Ethnoecological knowledge and conservation status of plant resources in the Himalayan Dry Temperate Forests of Kashmir, India

Mehnaz Aijaz, Rayees Afzal Mir and Eyram Hamid

Correspondence

Mehnaz Aijaz[1]*, Rayees Afzal Mir[1] and Eyram Hamid[1]

[1]School of Life Science, Glocal University Saharanpur-247121 (U.P), India

*Correspondence Author: mehnaza955@gmail.com

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Research

Abstract

Background: Indigenous population has a great deal to offer in the analysis and mitigation of current environmental challenges with their ethnoecological knowledge and experience. Himalayan forests are especially vulnerable to these impacts; hence it is critical that indigenous knowledge be documented at the regional level in order to contribute to forest conservation and restoration.

Methods: The aim of the research was to investigate the ethnoecological knowledge on the wild plant species utilized by the forest fringe populations in the Himalayan dry temperate forest of the Kashmir Himalayas. Ethnobotanical data were collected through semi-structured questionnaire was used to conduct one-on-one interviews and group discussions with selected informants. To measure the significance of species Use value (UV) was used.

Results: A total of 87 plant species from 52 families belonging to different families were reported. Asteraceae, Lamiaceae, Rosaceae and Polygonaceae were the dominant families. The most often utilized plant portion was the roots were the most commonly plant preparation was powder. Gastrointestinal and dermatological disease categories, followed by respiratory and musculoskeletal disease categories were treated by highest number of plant species. The highest UV was reported for *Artemisia absinthium* (0.73), *Aconitum heterophyllum* (0.71), *Arnebia benthamii* (0.69), *Rheum webbianum* (0.70), while as the lowest UV was reported for *Cannabis sativa* (0.17). A total number 17% of species were reported to be exotic while as the remaining 83% of species are native to Asia or the Himalayas.

Conclusions: According to our findings, indigenous ethnoecological knowledge is of emblematic importance in understanding the links between culture and forest diversity, and it has the potential to considerably contribute to forest conservation. This could happen if biocultural conservation efforts to preserve natural ecosystems are integrated with traditional management of local natural resources.

Keywords: Ethno-medicine, Traditional health care, Medicinal plants, Indigenous communities.

Background

Knowledge about forest plants is particularly valuable for small-scale societies that rely heavily on their environment for their livelihoods and are therefore vulnerable to abrupt environmental changes (Diaz *et al.* 2019). Forest resources provide crucial nature's contributions to highland communities, but also to lower land inhabitants (Haq *et al.* 2024). Ethnoecological knowledge is closely related to forestry resources, ethnic identity, and social cohesion. Furthermore, ethnoecological knowledge may be viewed and experienced differently among social groups, as cultures have created distinct cultural and epistemological frameworks for understanding and interacting with the world (Haq *et al.* 2023). Despite their essential contributions, mountain areas are particularly vulnerable due to the combination of direct (e.g., extreme weather events, including a steady increase in precipitation) and indirect (like landslides) environmental crises (Haq *et al.* 2020; Gillani *et al.* 2024). To maintain ecological, economic, and environmental sustainability, it is important to investigate indigenous knowledge (Khoja *et al.* 2024). The utilization of forest resources is crucial to ascertaining the impact of human activities on the ecosystem and formulating effective conservation plans (Haq *et al.* 2023). The community's traditional ecological knowledge (TEK), resource availability, season, and socioeconomic level all influence the harvested methods used during the collection of forest products (Jabeen *et al.* 2024).

Understanding the complex relationships between biological diversity and ethnicity, cultural memory, ecological knowledge, and social values of local and indigenous groups is based on biocultural heritage (Waheed *et al.* 2023a; Haq *et al.* 2023a). Acknowledging the importance of biocultural legacy, it is apparent that nearby people possess priceless traditional knowledge that can support efforts to restore forests as well as social and environmental sustainability (Haq *et al.* 2023b). Indeed, ethnoecological knowledge constitutes a safety net during pandemic by providing alternative sources of food that contribute to enhancing daily diet diversification (Golden *et al.* 2011). Nevertheless, as knowledge differs across and within ethnic groups, gender and age (Porcher *et al.* 2022), it is also important to explore differences in the knowledge held by different sub-groups of the population, as knowledge diversity can contribute to the resilience of the knowledge system (Díaz-Reviriego *et al.* 2016).

Ethnobotanical knowledge, which is mostly possessed by rural populations or practiced in communal contexts, has sadly received little attention despite its importance in advancing forest conservation and restoration as well as social and environmental sustainability (Haq *et al.* 2024). On the other hand, the status of the wild medicinal plant population is decreasing mostly because of overexploitation, habitat degradation, and invasive species (Chen *et al.* 2016; Kunwar *et al.* 2016; Howes *et al.* 2020). Forest resources are under threat from increased resource extraction, habitat degradation and extensive deforestation (Haq *et al.* 2023a). Thus, before these resources are irretrievably lost, it is imperative to swiftly develop appropriate management techniques and feasible programs. The more ethnoecological knowledge is distributed within a population, the more likely it is able to deal with disturbances (Blanco & Carrière 2016).

The forest resources are essential to the people living near the forests in their daily lives. In all developing nations, it is important to implement rigorous and systematic data collection systems for better forest utilization and conservation (Waheed *et al.* 2023). For traditional and indigenous knowledge to be preserved and restored, different ethnic groups must use their ethnoecological expertise to contribute to the conservation of these forest resources (Khoja *et al.* 2022; Haq *et al.* 2024). While biodiversity and corresponding ecological knowledge of Himalayan plant resources have been extensively studied, but ethnoecological knowledge in the Himalayan Dry Temperate Forests has received less attention (Quesada et *al.* 2009).Our primary purpose was (1) to document the forest species used by the indigenous people of the study area. (2) To investigate the ecological characteristics such as life form, growth form, and nativity of the reported forest species. (3) To investigate the traditional use i.e., medicine and food of the forest plant by local communities? Finally, evaluate the conservation of status the documented plant species. By addressing the above questions, we will be able to bridge the information gap on forest plants in the Himalayan Dry Temperate Forests, which will aid in the conservation and restoration of local plant diversity, as well as the preservation of indigenous knowledge.

Materials and Methods

Study area

The current study was conducted in the district Ganderbal of the Union Territory of Jammu and Kashmir. The area is located in Kashmir Province's hilly region, between 34°7' and 34°28' North latitude and 74°42' to 75°26' East longitude. A total of seven villages namely Balthal, Kangan, Hardo-panzin, Nuner, Shalbug, Yarmuqam, and Sonamarg were selected for data collection (Figure 1). Studies sites were chosen based on the presence of various ethnic groups, including Gujjars, Bakarwals, Pahari, and Kashmiri. In their daily lives, all of these ethnic groups make use of a diverse range of therapeutic herbs. The

research region is distinguished by a mountainous topography with an average elevation of 1115 meters. The area is distinguished by dense forests dominated by conifers tree species (*Pinus wallichiana*) and falls under the Himalayan Dry-Temperate Forest type (Haq *et al.* 2020). Numerous ethnic groups call it home, including the Kashmiri community which is primarily found in the main valleys and the Gujjars and Phari, who live in the low to high-altitude regions of Ganderbal (Haq *et al.* 2023).

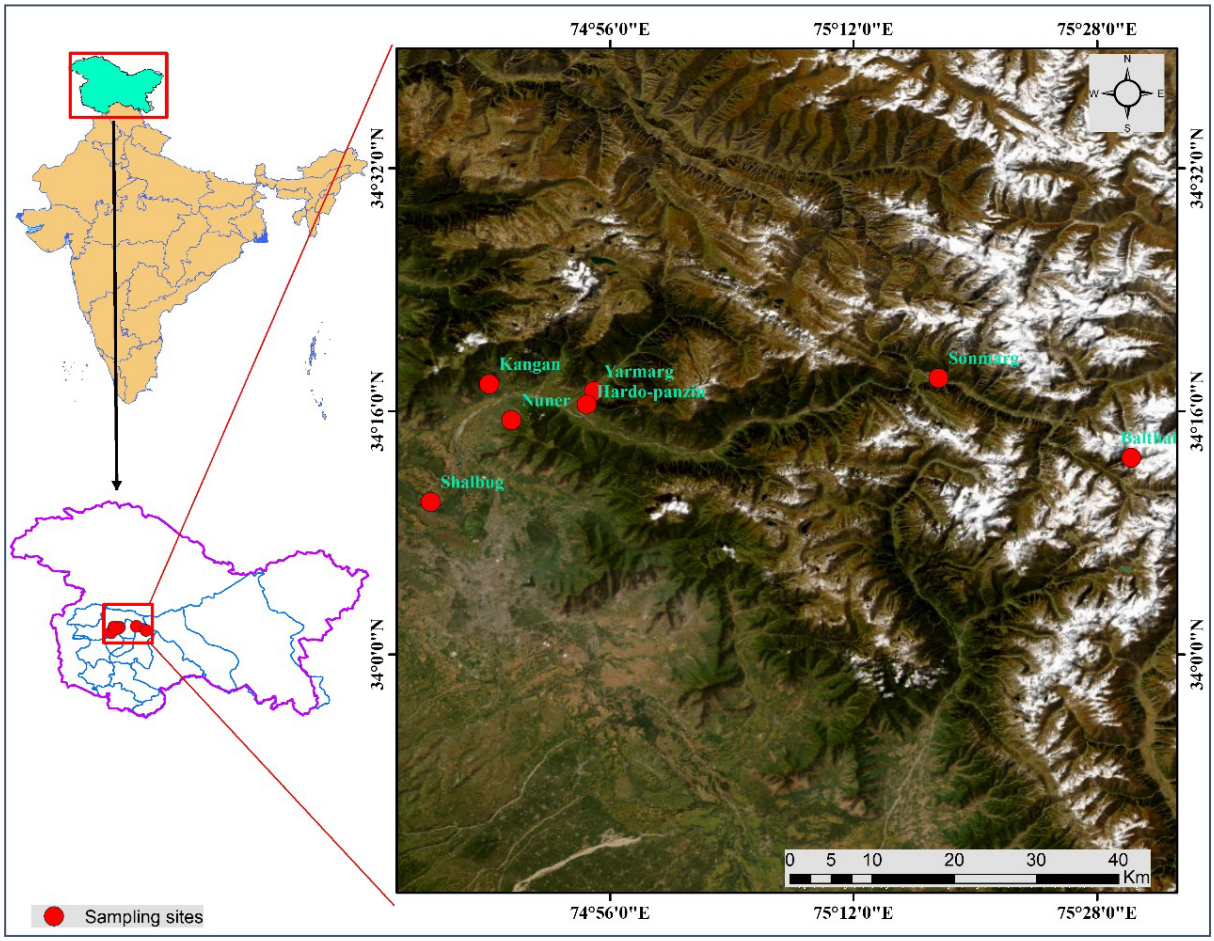

Figure 1. Map of the study area showing studied sites.

Data collection

In order to gather medicinally significant plants and the associated traditional knowledge, extensive surveys were carried out within the study region between March 2019 and August 2021. Semi-structured interviews were employed in conjunction with group discussions as a means of simple stratified sampling (Waheed *et al.*2022). According to (Haq *et al.* 2024a), snowball sampling method was used to select informants. Information was gathered by group discussions (N-13) and open-ended and closed-ended semi-structured interviews (N-45) (Haq *et al.* 2023c). A questionnaire was developed in order to collect data about the traditional ethnobotanical uses of plant taxa. In order to guarantee precise data gathering, we hired a translator to help us communicate with the people living in the chosen villages, which are mostly home to the Gujjar, Phari and Kashmiri communities. We verified the gathered data by cross-referencing it with pertinent literature sources (Forman and Bridson 1989; Khoja *et al.* 2022a; Haq *et al.* 2023). Verbal prior informed consent was obtained from all the informants before conducting the interviews. Additionally, for each indigenous community, we selected an individual who was well-respected and knowledgeable about the traditions and norms of their respective community to guide us during the field surveys. To gather information regarding the traditional ethnobotanical uses of plant resources, including medicines, and their significance, a questionnaire was created. Furthermore, the focus of interviews and discussions was the ethnobotanical applications of local plant resources, including food, medicine, fuelwood, fodder, flavorings, and harvesting season information. The questions during the interview were: (1) Participants were asked about their demography details which include age, gender, ethnic group, occupation, etc. (2) What are the benefits you get from the forest? (3) Common name of the plants used? (4) Name commonly used medicinal plants? (5) Which plant part is used as medicinal plants? (6) How you prepare these medicinal plants? (7) What are the other uses of these medicinal plants? Before beginning any

interview, verbal informed agreement was sought, and the International Society of Ethnobiology (ISE) Code of Ethics (2006, available at https://www.ethnobiology.net) was adhered to. In accordance with the terms of the Nagoya Protocol, participant ethnicity and language information are kept confidential, as agreed upon by local participants. During our field studies, we collected detailed data on each plant specimen, including relevant taxonomic information. To identify the plants, we referred to taxonomic literature (https://eforaindia.bsi.gov.in/eFlora/eFloraHomePage.action). We updated the nomenclature using the Plants of the World Online (POWO) taxonomic database (https://powo.science.kew.org).

Data Analysis

A Principal Component Analysis (PCA) was conducted to visualise the utilization of provisioning services and plant components. The function of fact was extra and used to illustrate the PCA biplot, contribution plot, and even values corresponding to the variance described by each principal component. To show the relation between medicinal preparation, plant part used and plant preparations of plant species, a chord diagram was prepared in Origin Pro software (version 9.95) (Haq *et al.* 2023d).The Sorensen's similarity coefficient, based on presence/absence data, was used to identify significant differences among plant part used across different age groups (Sajad *et al.* 2021).The use value (UV) index was used to calculate the relative value of each medicinal plant species used by the local population. Plants that receive highest use reports have the highest use-value, while those that have received the least use reports have the lowest use-value.

Use Value (UV)

It is an index proposed by Philips and Gentry in 1993 to quantify the importance of species, UV is calculated according to the formula reported by (Albuquerque *et al.* 2006).

$$UV = Ui/N$$

Where Ui is the number of uses mentioned by each informant, and N is the total number of informants.

Results and Discussion

Demography of informants

A total of 112 respondents in all were chosen for interviews; because of cultural constraints, most of the informants were men 68 and 44 were women (Table 1). Women may be restricted to their houses due to cultural restrictions, which may account for the decreased proportion of female informants (Khoja *et al.* 2022b).To secure the cooperation of the local people, the study conducted several visits prior to documenting. We interviewed people of different ages, genders, and occupational categories using semi-structured questionnaires (Waheed *et al.* 2022a). Questions on species were posed to the participants, including details about the species' local name, parts used, methods/techniques utilized in the preparation, and application for curing that specific diseases treated. The majority of the study population (52.68%) had a formal education, and we discovered that those without a formal education knew less about ethnomedicine (47.32%). It was noted that the illiterate population had more knowledge of traditional medicine, which may be explained by the fact that educated participants are expected to have exposure to the developed world and mostly rely on current medications rather than alternative one. Herders (33.94%) made up the majority of those who held traditional knowledge followed by Cultivator/agricultural labourer (20.54%), traditional healers (17.86%), skilled/semi-skilled workers (13.04%), shopkeepers (8.93%), and government employees (5.36%). The majority of the time that herders spend in the forests with their cattle and without access to medical services explains why they had the greatest levels of traditional knowledge. Every informant in our research adhered to Islam.

Table 1. Demographic status of the respondents from the Himalayan Dry Temperate Forests of Kashmir, India.

Variable	Categories	Number of Persons	Percentage
Informant category	Traditional healer	20	17.86
	Other local participants	92	82.14
Gender	Male	68	60.71
	Female	44	39.29
Age group	20-40 years	19	16.96
	41-60 years	40	35.71
	61-90 years	53	47.32
Education Level	Illiterate	53	47.32
	Primary education	29	25.89
	Secondary education	19	16.96

	Higher education	11	9.82
Profession	Cultivator/agricultural laborer	23	20.54
	Govt. Employees	6	5.36
	Herders	38	33.94
	Shopkeepers	10	8.93
	Skilled/semi-skilled worker	15	13.4
	Traditional healers	20	17.86
Religion	Islam	112	100

Plant composition and distribution patterns

In the current investigation a total number of 87 species plants from 52 families were reported. Comparable to previous ethnobotanical studies carried out in other Himalayan regions, the number of plant species discovered in the research area is higher. For instance, 53 plant species were reported by (Barreda *et al.* 2015) from the Monpa tribe in the Eastern Himalayas; 67 plant species were reported by (Khoja *et al.* 2022a) from various ethnic groups in Kupwara, Kashmir Himalayas; 29 species were reported by (Asif *et al.* 2021) from various ethnic groups in a remote tehsil (Karnah); and 53 plants were reported by (Sher *et al.* 2020) from District Swat, Pakistan. The way a species is used greatly depends on the socioeconomic conditions in the area, and distribution patterns might vary from location to location. Families' contributions to different usage categories differed widely. The fact that several groups use forest resources shows how important these species are to the survival of the local community. The research revealed a notable dependence on a range of forest resources for medicinal applications.

Species family relationship of documented forest plants

In the current study family Asteraceae was found to have the most plant species (N-10), followed by Lamiaceae (N-9), Rosaceae (N-4), Polygonaceae (N-3), Araceae, Apiaceae, Asparagaceae, Boraginaceae, Berberidaceae, Caryophyaceae, Euphorbiaceae, Geraniaceae, Gentianaceae, Pinaceae, Plantaginaceae, and Malvaceae (2 species each), while as (N-36) are the monotypic plant families (Figure 2). Members of Asteraceae can adapt to arid and dry settings with ease because of their broad range of ecological amplitudes. The plants of family Asteraceae are used to treat a range of ailments. Numerous forest areas showed the dominance of Asteraceae, especially in open habitat environments (Khoja *et al.* 2022a). According to a number of studies (Waheed *et al.* 2023c: Mohammad *et al.* 2021; Awan *et al.* 2021) the Asteraceae was also the most significant family in the regions surrounding the Himalayan regions of Pakistan and Kashmir. Similarly, Asteraceae was noted by (Tenzin *et al.* 2017) as the dominant family in the Bhutanese Highlands of Gasa District.

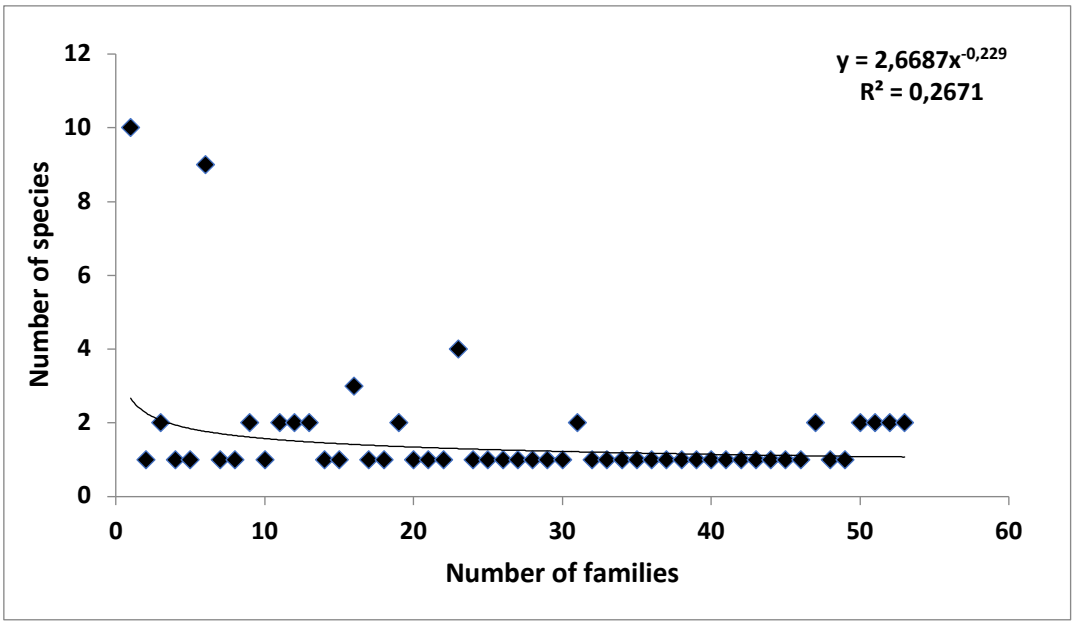

Figure 2. Species family relationship of the documented forest plants in the Himalayan Dry Temperate Forests of Kashmir, India.

Life form

Herbs accounted for the greatest number of plant species (N-69, 80%), with trees (N-8, 9), shrubs (N-6, 7), ferns (N-2, 3), and fungus (N-1, 1) following (Table 2). Herbs are abundant in nature and are particularly common in natural forests, along roadsides, and in-home gardens. The study demonstrates that medicinal plants have a significant role in the health care of populations living near forest areas, particularly during the winter when access to the area is restricted for prolonged periods of time. Most extremely valuable plant species were collected at high altitudes, primarily in herbaceous form, and were used for medicinal purposes. In addition, herbaceous species account for the majority of plant diversity in the Himalayan region's forests. It could be another reason that the majority of species identified for ethnobotanical usage came from the herb life form. Herbs are used because they contain a high concentration of bioactive chemicals (Waheed *et al.* 2023d, 2023b) and because they have a more potent medicinal impact than other plant forms (Adnan *et al.* 2014). Similar results were reported by (Haq *et al.* 2024; Khoja *et al.* 2024; Waheed *et al.* 2023; Bhat *et al.* 2021) from their study area.

Plant part used

The study's findings indicate that the most often used plant parts for medicinal purposes are roots (N-36, 34%), followed by leaves (N-23, 24%), whole plants (N-16,17%), seeds and fruits (N-5, 5% each), resin (N-4, 4%), whole frond and stem (N-2, 2% each), bark, bulb, twigs, fruiting body and flowers (N-1, 1% each) (Figure. 3). Maximum number of responders believes that to obtain the extracts in the form of powder, decoction and infusion from wild medicinal herbs is easy as compared to shrubs and trees. For therapeutic purposes, plant roots are often used or exchanged for goods by native pastoralists, herbalists, those involved in the herbal medicine trade, and people belonging to various ethnic groups. This tendency emphasizes how important the medicinal qualities of these plant-based ingredients are in conventional medical procedures. However, it is important to discourage the overharvesting of underground parts or entire plants particularly for vulnerable species, as this practice can lead to their eradication and decline in the wild (Haq *et al.* 2023a). The results of this study are in line with the research conducted by (Aziz *et al.* 2018: Bhat *et al*. 2021). When using medication given for a specific condition, people used to take the guidance of traditional Hakims or local healers. As per the findings of (Waheed *et al.* 2022b, 2023; Haq *et al.* 2023d), the prevalent methods for extracting active substances in main regions of the world include grinding, boiling, and smashing. According to (Aziz *et al.* 2021) roots are known for having a high concentration of bioactive compounds.

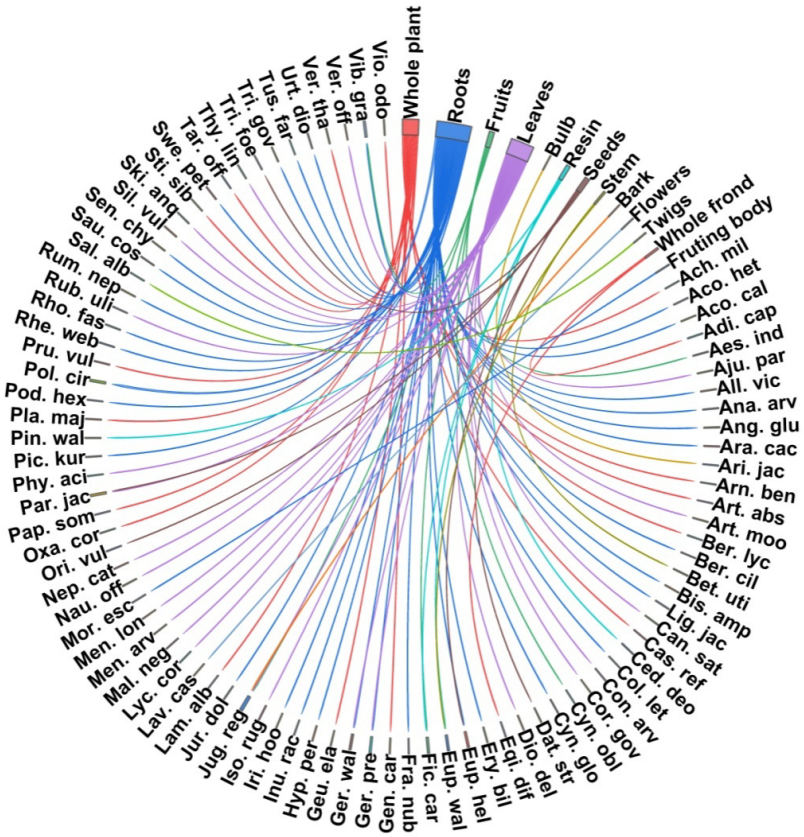

Figure 3. Species distribution according to plant part used in Himalayan Dry Temperate Forests of Kashmir, India. The direction of the lines shows which species are associated with which types of habitat and the thickness of each bar shows the number of species in each habitat category. The complete name of the species is shown in Table 2.

Relationship between age of informants and plant part used

A total of 112 participants (44 women, 68 men) participated in semi-structured interviews for the current investigation, they are distributed into three age groups I.e. younger age group (20-40 years), middle age (41-60 years) and older aged group (61-90 years). In the current study old age group used most of the plant species. The dendrogram showed two distinctly separated clusters based on the degree of intensity of plant part usage by different age groups, in which old aged formed one cluster and while as younger and middle aged formed second cluster (figure 4). The reason behind the younger generation has shown less plant part usage is because in the study area that modernizations, including improved and increased road connectivity and improvements of rural infrastructure, has contributed a lot to the decrease of traditional knowledge. This implies that the rural population is more connected to forest resources as compared to the urban population, elderly were the major caretakers of traditional knowledge, and if a structure is not put in place to ensure apprenticeship, the knowledge gap between the elderly and the young generation becomes a serious concern. In the current study, the link between locals and forest resources demonstrates the depth of indigenous knowledge on the various facets of plants used in the corridor. People's reliance on forest resources ranges from commonly utilized eating plants and medication to highly preferred fermentable plants.

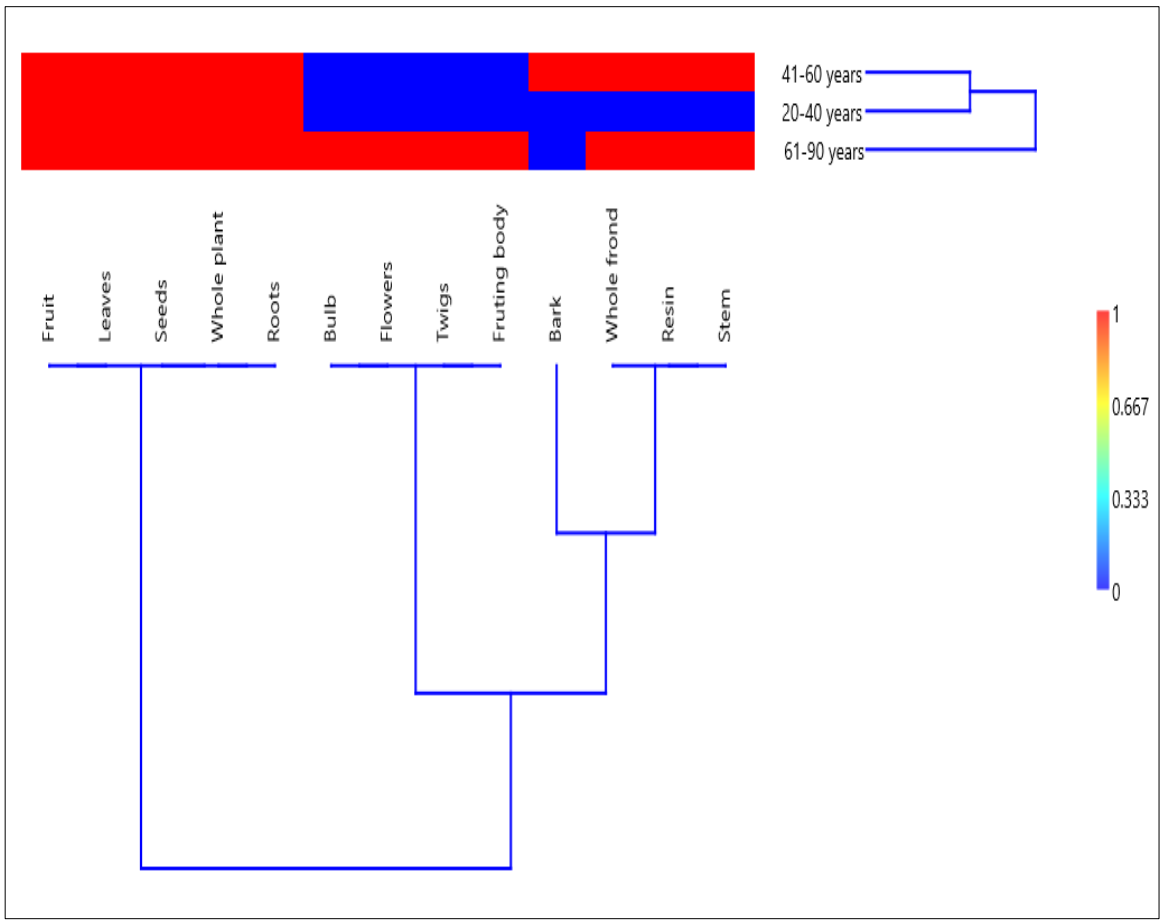

Figure 4. Heat map showing clustering dendrogram based on plant part used across different age groups.

Plant preparations

In the current study most number of plant taxa were used in powder form (N-30, 36%) following decoction (N-15, 18%), raw and paste (N-11, 13% each), infusion (N-9, 11%), herbal tea (N-6, 7%), cooked (N-2, 2%) were the most common ways that the plants described by the respondents were used (Figure 5).The majority of plant species are harvested in the autumn and the people who live in forests are aware of the best times to collect different plant species as well as their methods and frequency of collection, depending on what is available. The collected plants parts were dried, crushed into powder is the most common technique used by the informants in the study area. Plant taxa prepared in the form of powder is stored in cotton clothes or airtight glass bottles, in order to use them in harsh winter and is also preserved for longer period of time. In other regions of the world, powder and decoction are the commonly used techniques for preparing medicinal herbs (Rokaya *et al.* 2010; Uprety *et al.* 2010). According to ethnobotanical studies, decoction is the most popular way of preparing

herbal treatments; it involves extracting the remedies using water and other liquids, such as olive oil and honey (Altaf *et al.* 2018). The primary method of administration for more than half of herbal treatments is oral ingestion.

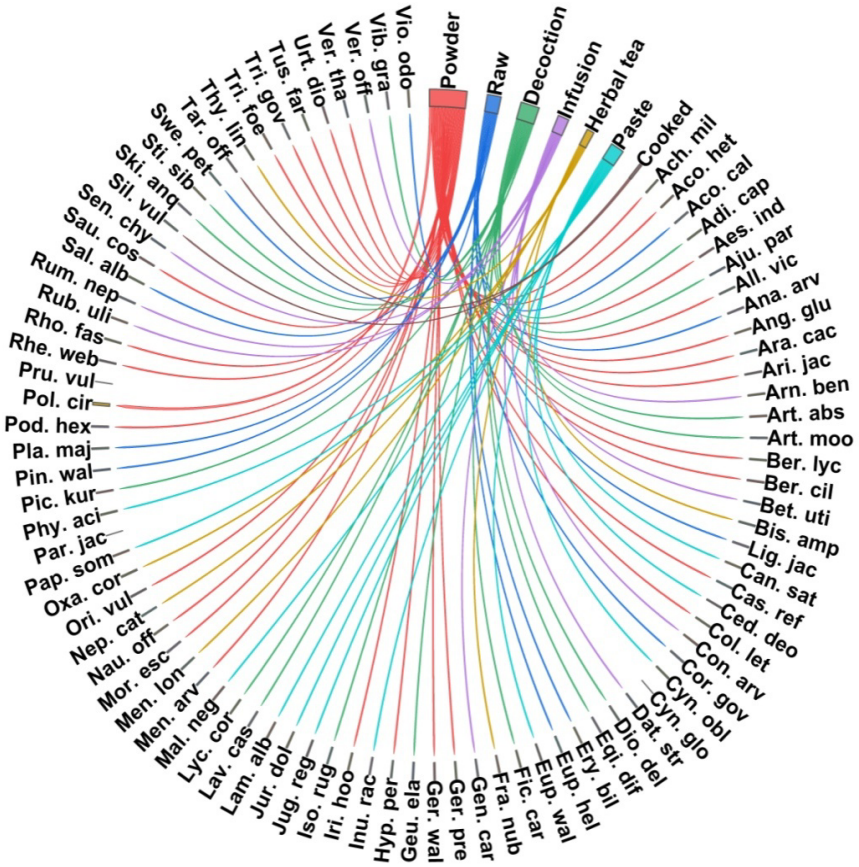

Figure 5. Species distribution according to the medicinal preparations in the Himalayan Dry Temperate Forests of Kashmir, India. The direction of the lines shows which species are associated with which types of medicinal preparations and the thickness of each bar shows the number of species in each habitat category. The complete name of the species is shown in Table 2.

Ailments addressed

Plants were used to treat 41 different ailments. Of these, the majority of species (N-46, 34%) were used to treat gastrointestinal, followed by dermatological (N-17, 23%) and musculoskeletal (N-13, 9%) (Figure. 6, Table 2). The reason behind the widespread occurrence of gastrointestinal disorders in the region is as a result of poor sanitation, starvation, and a shortage of clean water. The dermatological disorders may arise due to unhygienic living conditions, UV exposure, sharing rooms with family members and contaminated food. While as the musculoskeletal disorders may rise due to heavy work, common injuries that occur in the fields and poor rest. The respiratory disorders mostly cough and cold may arise due to harsh winter conditions like snowfall and frosting, increased moisture in higher altitudes and sudden variations in weather. It is noteworthy that elevated dosages of therapeutic plants might occasionally result in severe side effects, for this reason, consumption of these therapeutic herbs at home requires caution. Similar results were obtained by researchers from different ethnic groups in Pakistan (Tariq *et al.* 2015), Northern Nigeria (Rahman 2021), Pakistan (Wali *et al.* 2021), and the Northern Himalaya (Farooq *et al.* 2019). Plants are widely used in medicine for the treatment of digestive diseases (Simsek *et al.* 2004).

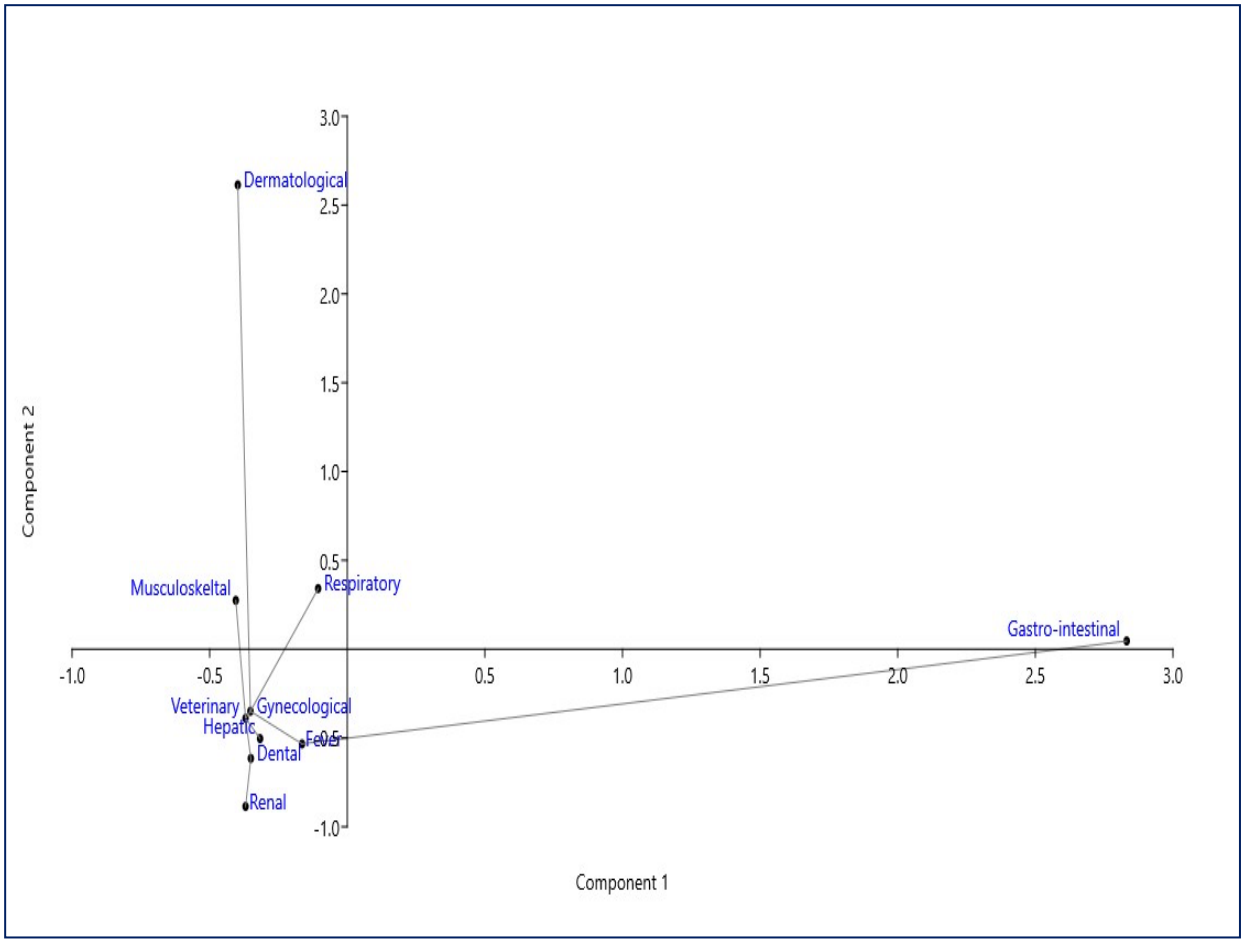

Figure 6. Principal Component Analysis (PCA) illustrating the relationship the disease categories in the Himalayan Dry Temperate Forests of Kashmir, India.

Ethnoecological usage

The majority of plant species were used for medicinal purpose (53%) followed by food (22%), firewood (10%) fodder (9%), herbal tea (4%), and timber and black magic (1% each) (Table 2). This shows the importance of medicinal plant resources in all facets of life for those who reside in remote areas, particularly when it comes to meeting the basic needs for food, shelter, livelihoods and healthcare. Some of the commonly used wild leafy vegetables growing around populated areas are *Allium victorials, Nasturtium officinales, Prunella vulgaris, Rumex nepalensis*, *Rheum webbianum*, *Silene vulgaris*, herbal tea is made from *Bistorta amplexicaulis*, *Bergenia ciliata, Betula utilis, Fragaria nubicola*, *Geranium wallichianum, Geranium pratense*, and *Hypericum perforatum*. Some of the plants having religious uses like those that were used in religious gatherings were *Jurinea dolomiaea* and *Podophyllum hexandrum*. Several other studies also reported similar results from other Himalayan regions like (Haq *et al.* 2020a) from District Reasi, Northwestern Himalaya, (Khoja *et al.* 2024; Haq *et al.* 2023c) from Kashmir Himalayas. Due to its accessibility, low cost, perceived adverse effects, ease of use, and expanding significance of medicinal plants were frequently prefer in traditional medicine (Haq *et al.* 2024).

Use Value (UV)

The species examined in this study had UV indices ranging from 0.20 to 0.65 (Table 2). *Artemisia absinthium* (0.73) *Arnebia benthamii* (0.69), *Rheum webbianum* (0.70), *Aconitum heterophyllum* (0.71), *Artemisia moorcroftiana* (0.67) and *Ficus carica* (0.68), and had the greatest UV indexes, while *Cannabis sativa* (0.17) had the lowest UV indexes (Figure 7). The computation of use value can provide insight into the utilization of a species. Because they are thought to be natural remedies with fewer side effects, species with greater UV levels are typically well-known and favored (Ojha *et al.* 2020). According to (Farooq *et al.* 2019), the medicinal plants in the study area with high UV levels were generally well-known in the area. The main phytochemicals reported from these species are lactones and terpenoids, which include trans-thujone, terpinene, 1,4-terpeniol, myrcene, bornyl acetate, cadinene camphene, trans-sabinyl acetate, guaiazulene, chamazulene, camphor, and linalool were reported in *Artemisia absinthium* (Haq *et al.* 2022b). *Aconitum heterophyllum* is useful in treating a variety of gastrointestinal disorders since its roots contain flavonoids and diterpene alkaloids (Khoja *et al.*2023).

Table 2. List of medicinal plant species used by the indigenous tribes in the temperate forests of Kashmir Himalayas.

Botanical name/ Family	Common name	Part used	Preparation	Application	Disease treated	Ethno-ecological usage	Use reports	Use value	Nativity
Achillea millefolium L. Asteraceae (Ach. mil)	Pahalgasseh	Whole plant	Dried roots are crushed into powder	The mixture is used both externally as well as orally depending upon the condition.	Toothache, diuretic, jaundice.	Aerial part is used as fodder	32	0.28	Native
Aconitum heterophyllum Wall. ex. Royle Ranunculaceae (Aco. het)	Patris	Roots	Roots are dried are crushed into powder	The mixture is taken orally at least twice usually early in the morning.	Abdominal pain, intestinal worms.	--------	80	0.71	Native
Acorus calamus L. Araceae (Aco. cal)	Vai gander	Roots	Dried roots are eaten raw	The mixture is taken orally usually early in the morning for 2-4 days.	Stomachache, abdominal pain, and diarrhea	--------	71	0.63	Native
Adinatum capillus-veneris L. Pteridaceae (Adi. cap)	Gev-theer	Whole frond	Whole plant is crushed along with water to make decoction	The mixture is taken orally for 5 days.	Cough, jaundice, stomachache.	Rachis is used as toothpick	43	0.38	Native
Aesculus indica (Wall.ex. Cambess.) Hook. Sapindaceae (Aes. ind)	Handoon	Fruit	Fruits are crushed into powder	The mixture is applied externally at least for 3 days.	Dandruff.	Leaves are used as fodder, whole plant is used as firewood	59	0.52	Exotic
Ajuga parviflora Benth. Lamiaceae (Aju. par)	Jain adam	Leaves	Leaves are crushed along with water to make decoction	The mixture is taken early in the morning for at least 3 days.	Stomachache, diuretic.	Aerial part is used as fodder	61	0.54	Native
Allium victorials L. Amaryllidaceae (All. vic)	Jungle rohan	Roots	Dried roots are crushed into powder	The mixture is taken orally for 2 days.	Joint pain.	Tinder leaves are cooked as vegetable	49	0.43	Native
Anagallis arvensis L. Primulaceae (Ana. arv)	Danddawa	Roots	Raw roots are used	Dried root is applied externally.	Toothache.	Aerial part is used as fodder	44	0.39	Native

Angelica glauca Edgew. Apiaceae (Ang. gla)	Chour	Roots	Dried roots are crushed into powder	The mixture is taken orally usually 3 or 4 times.	Stomachache, bloat.	Roots are used as flavorings agent	71	0.63	Native
Aralia cachemirica Decne Araliaceae (Ara. cac)	Khoree	Roots	Dried roots are grinded into powder	The mixture is taken orally twice a day.	Joint pain.	---------	35	0.31	Native
Arisaema jacquemontii Blume Araceae (Ari. jac)	Hapatgogaj	Bulb	Dried bulb is crushed into powder & mixed with sugar	The mixture is taken orally at bedtime.	Helminthic infestation.	Bulb are used to make pickles	44	0.39	Native
Arnebia benthamii (Wall. ex. G. Don) Boraginaceae (Arn. ben)	Kahzaban	Whole plant	Leaves are boiled in water to make infusion	The mixture is taken orally	Enhances lactation, cough &cold.	Leaves are used to make herbal tea	78	0.69	Native
Artemisia absinthium L. Asteraceae (Art. abs)	Tethwan	Areal part	Areal part is sun dried and crushed with water to make decoction	The mixture is taken orally mostly during morning time.	Abdominal pain, intestinal worms, indigestion.	----------	82	0.73	Native
Artemisia moorcroftiana Wall. ex DC. Asteraceae (Art. moo)	Jungliteathwan	Leaves	Dried leaves are boiled in the water to make decoction	The mixture is taken orally early in the morning for 1-3 days	Acidity.	----------	76	0.67	Native
Berberis lycium Royle Berberidaceae (Ber. lyc)	Kawdach	Whole plant	Whole shrub is crushed into powder	The mixture is taken orally.	Cholera, respiratory disorders.	Fruits are eaten fresh, whole plant is used as firewood	37	0.33	Native
Bergenia ciliata (Haw.) Sternb. Saxifragaceae (Ber. cil)	Zakhmihayat	Roots	Roots are crushed into powder	The mixture is taken orally as well as externally.	Joint pain, wounds, liver diseases & asthma.	Roots are used to make herbal tea	33	0.29	Native
Betula utilis D.Don Betulaceae (Bet. uti)	Burz	Wood	Dried Wood is used to make glass	The water is taken orally.	Asthma.	Whole plant is used as firewood	36	0.32	Native
Bistorta amplexicaulis (D.Don) Greene Polygonaceae (Bis. amp)	Masloom	Roots	Dried roots are used to make tea	The mixture is taken orally for 3-5 days usually twice a day.	Hay fever, whitening of tongue & stomachache.	Roots are used to make herbal tea	44	0.39	Native

Cannabis sativa L. Cannabinaceae (Can. sat)	Bhang	Leaves	Dried leaf powder is mixed with oil to make paste	The mixture is applied externally.	Earache, Skin diseases.	---------	20	0.17	Exotic
Cascuta reflexa Roxb. Cuscutaceae (Cas. ref)	Kukli port	Whole plant	Whole herb is crushed into powder	The mixture is applied externally usually for 2-3 days.	Wounds, swelling of testicles, hair fall.	---------	24	0.21	Native
Cedrus deodara (Roxb.) G.Don Pinaceae (Ced. deo)	Deodar	Resin	Dried wood is kept in the utensil and around it fire is given to extract the oil	The mixture is applied externally special care is taken while applying it should not be licked by cattle which may lead to death.	Lice killing, foot& mouth disease.	Whole plant is used as firewood and timber	48	0.42	Native
Colchicum luteum Baker Colchicaceae (Col. lut)	Virkumpoash	Roots	Dried roots are crushed into powder. Water is added to the obtained powder	Mixture is taken orally early in the morning.	Constipation.	----------	39	0.34	Native
Convolvulus arvensis L. Convolvulaceae (Con. arv)	Threed	Leaves	Leaves are soaked in water overnight to make infusion	The mixture is taken orally	Constipation.	Aerial part is used as fodder	51	0.45	Native
Corydalis govianiana Wall. Fumariaceae (Cor. gov)	Sang herbi	Leaves	Leaves are crushed into paste	The mixture is taken orally.	Respiratory disorders, whooping cough, asthma.	Aerial part is used as fodder	42	0.37	Native
Cyndonia oblonga Mill. Rosaceae (Cyn. obl)	Bomb choat	Fruit	Fruit is taken raw	Fruits are taken orally mostly in winters.	Constipation.	Fruits are eaten fresh, whole plant is used as firewood	60	0.53	Exotic

Cynoglossum glochidiatum Wall. ex Benth. Boraginaceae (Cyn. glo)	Nil tooth	Roots	Roots are crushed into paste	The mixture is applied externally.	Skin diseases.	Aerial part is used as fodder	30	0.26	Native
Datura stramonium L. Solanaceae (Dat. str)	Datur	Seeds	Dried seeds are crushed, and infusion is made	The mixture is taken orally with water.	Asthma, diarrhea, and anti-inflammatory	---------	58	0.51	Exotic
Dioscorea deltoidea Wall. ex. Kunth Dioscoreaceae (Dio. del)	Krech	Leaves	Decoction is made from the leaves.	The mixture is taken orally for 3 days.	Urinary tract infections.	---------	56	0.5	Native
Equistem diffusum D.Don Equisetiaceae (Equ. dif)	Gandamgud	Whole frond	Whole frond is crushed along with water to make decoction	The mixture is taken orally empty stomach.	Kidney stones, stomachache	Rachis is used to clean teeth	47	0.41	Native
Eryngium billardieri Delar. Apiaceae (Ery. bil)	Dawamool	Roots	Dried roots are eaten raw	Roots are taken orally especially in the morning.	Jaundice, diuretic.	Aerial part is used as fodder	44	0.39	Native
Euphorbia helioscopa L. Euphorbiaceae (Eup. hel)	Gueursochal	Seeds Roots resin	Dried seeds and roots are eaten raw Resin is applied topically	The mixture is taken orally.	Ring worm	----------	28	0.25	Exotic
Euphorbia wallichii Hook. F Euphorbiaceae (Eup. wal)	Guri-dud	Stem, resin&seeds	Stem extract & Seeds are crushed along with piper to make paste	The mixture is applied externally as well as orally.	Skin diseases, cholera.	----------	24	0.21	Exotic
Ficus carica L. Moraceae (Fic. car)	Anjeer	Fruit, stem &resin	Fruits are boiled and resin is applied topically	The mixture is applied externally as well as orally.	Skin diseases, throat infection, cough.	Fruits are eaten fresh	77	0.68	Exotic
Fragaria nubicola Lindl. ex Lacaita Rosaceae (Fra. nub)	Ringrish	Roots	Dried roots are used to make tea	The mixture is taken orally usually twice or thrice a day.	Fever, tonsillitis, joint pain.	Fruits are eaten fresh; roots are used to make herbal tea	40	0.35	Native
Gentiana carinata (D.Don) Griseb Gentianaceae (Gen. car)	Pangri	Whole plant	Whole plant is boiled in the water to make infusion	The mixture is taken orally early in the morning.	Abdominal pain.	--------	51	0.45	Native

Geranium pratensis L. Geraniaceae (Ger. pra)	Ratanjote	Roots & Leaves	Dried roots are crushed into powder	The mixture is taken orally twice a day for 2-4 days.	Joint pain, diarrhea.	Roots are used to make herbal tea	46	0.41	Native
Geranium wallichianum Oliv. Geraniaceae (Ger. wal)	Ratanjote	Roots & Leaves	Roots are dried under shade & are crushed into powder	The mixture is taken orally twice a day for 2-4 days.	Joint pain, general weakness, acidity.	Roots are used to make herbal tea	42	0.37	Native
Geum elatum Wall. ex G. Don Rosaceae (Geu. ela)	Shah buti	Whole plant	Whole plant is grinded and made into decoction	The mixture is taken orally for 2-3 days.	Constipation Helminthic infestation	Aerial part is used as fodder	33	0.29	Native
Hypericum perforatum L. Hypericaceae (Hyp. per)	Chai kul	Roots	Dried roots are crushed into powder	The mixture is taken orally usually early in the morning.	Diarrhea.	Aerial part is used as fodder, roots are used to make herbal tea	55	0.49	Native
Inula racemosa Hook.F. Asteraceae (Inu. rac)	Poshkar	Roots	Dried roots are powdered and mixed with cow milk	The mixture is taken orally.	Bronchial asthma, Anthelmintic in children, antiseptic, and diuretic.	Aerial part is used as fodder	42	0.37	Native
Iris hookeriana Foster Iridaceae (Iri. hoo)	Mazarmundh	Roots	The roots are dried & crushed into powder	The mixture is taken orally.	Swelling in throat	---------	37	0.33	Native
Isodon rugosus (Wall. ex Bentha) Lamiaceae (Iso. rug)	Shulekhat	Leaves	Dried leaves are boiled in water	The mixture is applied orally as well as externally.	Foot fever, stomachache, and diarrhea.	Whole plant is used as firewood	49	0.43	Native
Juglans regia L. Juglandaceae (jug. reg)	Doon	Fruit / leaves and bark	Young fruits & leaves are crushed into paste	The mixture is applied externally.	Foot and mouth diseases of cattle,rheumatism and toothache.	Fruits are eaten fresh	59	0.52	Native
Jurinea dolomiaea Boiss, Asteraceae (Jur. dol)	Doop/ gogle doup	Roots	Dried roots are crushed into powder and mixed with mustard oil	The mixture is applied externally for 2 days.	Skin diseases and wound healing.	Roots are used against black magic	75	0.66	Native
Lamium alba L. Lamiaceae (Lam. alb)	Zakhmedawa	Whole plant	Whole plant is crushed to make paste	The mixture is applied externally.	Wound healing.	Aerial part is used as fodder	47	0.41	Native

Lavatera cashmeriana Camb. Malvaceae (Lav. cas)	Jungle souchal	Flowers	Flowers are used to make decoction	The mixture is taken orally twice a day.	Cough & cold.	Flowers are used to make jam	54	0.48	Native
Ligularia jacquemontiana (Badecne.) Asteraceae (Lig. Jac)	Hapatkuth	Roots	Dried roots are taken as raw	Dried roots are taken orally early in the morning.	Intestinal worms & Abdominal pain	Aerial part is used as fodder	52	0.46	Native
Lychnis coronaria Desr. Caryophyaceae (Lyc. cor)	Chock dawa	Leaves	Leaves are boiled in water	Leaves are applied externally for 2-3 days.	Burns.	---------	31	0.27	Native
Malva neglecta Wallr. Malvaceae (Mal. neg)	Souchal	Leaves	Leaves are crushed to make small balls	The mixture is given orally twice a day.	Constipation, stomach cramps.	Aerial part is used as fodder	58	0.51	Native
Mentha arvensis L. Lamiaceae (Men. arv)	Pudine	Leaves	Leaves are crushed into powder	The mixture is taken orally twice a day.	Asthma, cough &cold, diarrhea.	Leaves are used as salad	62	0.55	Native
Mentha longifolia (L.) Lamiaceae (Men. lon)	Guddpudine	Leaves	Dried leaves are used to make tea	The mixture is taken orally twice a day.	Abdominal pain, tonsillitis.	--------	55	0.49	Exotic
Morchella esculenta Fr. Morchellaceae (Mor. esc)	Kanighitch	Fruiting body	Fruiting body is dried in open sun & crushed into powder	The mixture is applied orally as well as externally.	Wound healing & cough.	Fruiting body is cooked as vegetable	67	0.59	Native
Nasturtium officinale W.T.Aiton Brassicaceae (Nas. off)	Nag souchal	Leaves	Dried leaves are crushed into powder	The mixture is taken orally for 2-3 days.	Mumps & stomach cramps.	Tinder leaves are cooked as vegetable	30	0.26	Native
Nepeta cataria L. Lamiaceae (Nep. cat)	Gandsoi	Leaves	Leaves are used to make herbal tea	The mixture is taken orally.	Colic, urine disorders, skin infection.	Aerial part is used as fodder	39	0.34	Native
Origanum vulgare L. Lamiaceae (Ori. vul)	Baber	Seeds	Seeds are sundried & crushed into fine powder	The mixture is taken orally usually for 4 days.	Dry throat & diuretic	seeds are as flavorings agent	49	0.43	Exotic
Oxalis corniculata L. Oxalidaceae (Oxa. cor)	Tsok-tsen	Whole plant	Whole plant is dried & is used to make tea	The mixture is taken orally.	Diarrhea, abdominal pain, tonic.	Aerial part is eaten fresh	22	0.19	Exotic

Papaver somniferum L. Papaveraceae (Pap. som)	Kashkash	Whole plant	Whole plant is crushed into powder and is taken along with salt and water	Taken orally for 2 days.	Diarrhea.	Seeds are used as flavorings agent	58	0.51	Exotic
Parrotiopsis jacquemontiana (Decne) Rehder Hamamelidaceae (Par. jac)	Posh, Pohu	Stem and leaves	Leaves are crushed and oil is extracted from the stem	The mixture is applied externally.	Antimicrobial.	Whole plant is used as firewood	33	0.29	Native
Phytolacca acinosa Roxb. Phytolaccaceae (Phy. aci)	Hapat brand/ brand	Leaves	Leaves are crushed into paste	The mixture is applied externally.	Foot and mouth disease.	Tinder leaves are cooked as vegetable	41	0.36	Native
Picrorhiza kurroa Royale ex. Benth Plantaginaceae (Pic. kur)	Kod	Roots	Dried roots are grinded into powder & boiled in water to make infusion	The mixture is taken orally.	Abdominal pain	--------	45	0.4	Native
Pinus wallichiana A. B.Jacks. Pinaceae (Pin. wal)	Kayur	Resin	Resin collected from tree is used raw	The mixture is applied externally.	Wound healing & skin problems.	Whole plant is used as firewood and timber	59	0.52	Native
Plantago major L. Plantaginaceae (Pla. maj)	Bead gul	Whole plant	Dried roots are eaten raw	Dried roots are eaten Orally mostly in the morning.	Abdominal bloating, dysentery.	Aerial part is used as fodder	40	0.35	Native
Podophyllum hexandrum (Royle) T.S Ying Berberidaceae (Pod. hex)	Wanwagun	Roots	Dried roots are crushed into powder	The mixture is taken orally for 2 days.	Diarrhea, constipation.	Fruits are eaten fresh	52	0.46	Native
Polygonatum cirrhifolium (Wall.) Royle Asparagaceae (Pol. cir)	Salapmesri	Roots	Dried roots are crushed into powder	The mixture is taken orally for 2-5 days.	Albuminuria.	Roots are eaten as fresh	37	0.33	Native
Polygonatum verticillatum (L.) All. Asparagaceae (Pol. ver)	Salamesri	Roots	Dried roots are crushed into powder	The mixture is taken orally for 2-5 days.	Albuminuria.	Roots are eaten fresh	48	0.42	Native

Prunella vulgaris L. Lamiaceae (Pru. vul)	Kalwauth	Whole plant	Whole plant is boiled in water	The mixture is taken orally as well as externally for 3 days.	Foot fever, constipation, sore throat.	Tinder leaves are cooked as vegetable	53	0.47	Native
Rheum webbianum Royle Polygonaceae (Rhe. web)	Pambchalan	Roots	Roots are sundried & grinded into powder	The mixture is taken orally as well as externally.	Joint pain, wound healing, skin burns.	Tinder leaves are cooked as vegetable	79	0.7	Native
Rhodoila fastigiata (Hk. f. et Thoms.) Crassulaceae (Rho. fas)	Hisbe di jaldi	Roots	Roots are dried in shade & crushed into powder	The mixture is taken orally thrice a day.	Diarrhea.	----------	27	0.24	Native
Rubus ulmifolius Schott. Rosaceae (Rub. fas)	Gounch	Leaves	Green leaves are soaked into water to make infusion	The mixture is taken orally.	Digestive problems.	Fruits are eaten fresh, whole plant is used as firewood	65	0.58	Exotic
Rumex nepalensis Spreng. Polygonaceae (Rum. nep)	Abij	Roots	Dried roots are semi crushed and boiled in water.	The mixture is applied externally.	Arthritis and rheumatic pain, Skin scars.	Tinder leaves are cooked as vegetable	61	0.54	Native
Salix alba L. Salicaceae (Sal. alb)	Bot-vir	Twigs	Fresh twigs are used	Chewed	Stomachache	Aerial part is used as fodder, whole plant is used as firewood	39	0.34	Exotic
Saussurea costa (Falc.) Lipsch. Asteraceae (Sau. cos)	Kouth	Roots	Roots are crushed into fine powder	The mixture is taken orally twice a day special care is taken after eating this boiled water is taken for 3 days.	Joint problems	Tinder leaves are cooked as vegetable	67	0.59	Native
Senecio chrysanthemoides DC. Asteraceae (Sen. chr)	Boug	Roots	Roots are crushed along with water to make infusion	The mixture is taken orally.	Fever, kidney diseases.	Aerial part is used as fodder	34	0.3	Native

Silene vulgaris (Moench) Garcke Caryophyllaceae (Sil. vul)	Watkram	Leaves	Leaves are cooked as vegetable	Taken orally.	Indigestion.	Tinder leaves are cooked as vegetable	54	0.48	Native
Skimmia anquetillia N.P. Taylor & Airy Shaw Rutaceae (Ski. anq)	Nair pan	Leaves	Dried leaves are boiled in water to make decoction	The mixture is taken orally.	Digestive problems.	Whole plant is used as firewood	37	0.33	Native
Stipa sibirica L. Poaceae (Sti. sib)	Guddgass	Whole plant	Areal part is boiled in water	The mixture is applied externally.	Mastitis.	----------	51	0.45	Native
Swertia petiolata Royle. ex D. Don Gentianaceae (Swe. pet)	Moomrum	Roots	Roots are taken raw	Dried roots are taken orally.	Abdominal pain.	Aerial part is used as fodder	46	0.41	Native
Taraxicum officinale (L.) Weber ex F.H. Wigg Asteraceae (Tar. off)	Handh	Whole plant	Whole plant especially leaves are cooked as vegetable	The vegetable is taken orally along with rice.	Stomach cramps.	Tinder leaves are cooked as vegetable	70	0.62	Native
Thymus linearis Benth Lamiaceae (Thy. lin)	Javind	Leaves	Tea made from the dried leaves is taken against stomachache & stomach cramps.	The mixture is taken orally early in the morning.	Stomachache, stomach cramps.	----------	42	0.37	Native
Trigonella foenum-graecum L. Fabaceae (Tri. foe)	Meath	Seeds	Dried seeds are crushed into fine powder	The mixture is applied externally.	Factures.	Seeds are used as flavorings agent	55	0.49	Exotic
Trillium govanianum Wall. ex D.Don Melanthiaceae (Tri. gov)	Trupatri	Roots	Roots are dried in shade & grinded into powder	The mixture is used both externally as well as orally.	Boils, intestinal worms	Tinder leaves are cooked as vegetable, roots are used against black magic	36	0.32	Native
Tussilago farfara L. Asteraceae (Tus. far)	Wattpan	Roots	Dried roots are crushed into powder	The mixture is given orally twice a day.	Abdominal pain.	--------	50	0.44	Native
Urtica dioica L. Urtiaceae (Urt. dio)	Soi	Roots	Roots are sun dried & crushed into powder	The mixture is taken orally for at least a week	Rheumatism, urine infection.	Tinder leaves are cooked as vegetable	40	0.35	Native

Verbascum thapsus L. Scrophulariaceae (Ver. tha)	SarfeMakai	Areal part	Areal part is crushed into powder	The mixture is applied externally as well as given orally.	Bloat, burns.	Whole plant is used as firewood	53	0.47	Native
Verbena officinalis L. Verbenaceae (Ver. off)	Hatmool	Leaves	Green leaves are soaked in water to make infusion	The mixture is taken orally.	Indigestion	Aerial part is used as fodder	48	0.42	Native
Viburnum grandiflorum Wall. ex DC Viburnaceae (Vib. gra)	Kilmish	Fruits& roots	Fruits are eaten raw while roots are boiled in water upon cooling it's taken against cough & stomachache.	The mixture is taken orally.	Cough & stomachache.	Fruits are eaten fresh, whole plant is used as firewood	32	0.28	Native
Viola odorata L. Violaceae (Vio. odo)	Banafsha	Whole plant	Whole plant is used raw	The mixture is taken orally twice a day.	Cough & cold & foot fever.	Tinder leaves are cooked as vegetable	55	0.49	Exotic

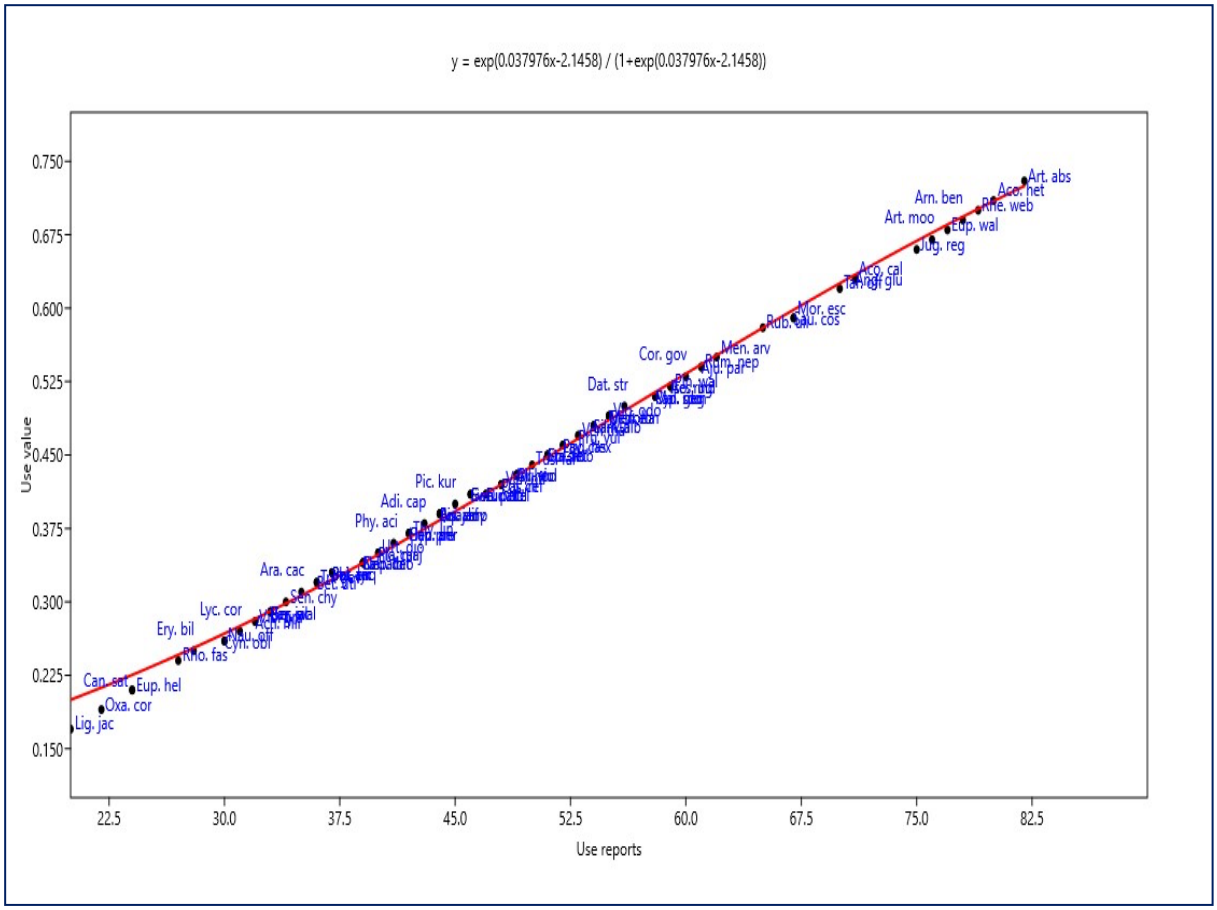

Figure 7. Relationship between use value (UV) and frequency of citation (FC). The full plant names are presented in Table 2.

Nativity status of medicinal plants

Our results showed that 17% of plant species were considered alien, suggesting that a significant number of non-native plants have made their way into the remote and inhospitable Himalaya region. We found that a significant number of exotic species were found in disturbed forest habitats, such as roadsides, including *Aesculus indica, Cannabis sativa, Datura stramonium, Euphorbia helioscopa, Mentha longifolia, Rubus ulmifolius*, and *Viola odorata*. Based on these findings, we suggest that tunnels, not roads, are the best indicators of connectivity in fragile mountain ecosystems. Reducing the factors that endanger biodiversity is necessary to maintain ecosystems and its inhabitants.

Conservation status

Plant taxa are categorized under both the International Union for Conservation of Nature's (IUCN) Red List and the Convention on International Trade in Endangered Species of Wild Fauna and Flora's (CITES) Appendix II (Table 3). In this study, a total of thirteen plant taxa are reported in IUCN Red List and four plant taxa by the CITES (Table 3). Seventy-three percent of the informants stated that unsustainable harvesting, particularly early collecting to meet commercial demand, was the main cause of the fall in wildlife populations. *Aconitum heterophyllum, Angelica glauca, Arnebia benthamii, Inula racemosa, Saussurea costa*, and *Trillium govanianum* are a few plant taxa that fall into this group. The destruction of habitat, especially deforestation and habitat fragmentation was the second major factor contributing to decrease in the wild population of medicinal plants. In addition, overexploitation, a rise in harvesters, indiscriminate gathering, unmanaged deforestation, and habitat destruction pose threats to the Kashmir Himalayas. Various biological properties of plants, such as habitat specificity, growth rate, species variety, population size, reproductive system, and range of distribution, all have a significant impact on their availability (Wagh & Jain 2013; Chen et al. 2016). Due to their importance to the plant life cycle, excessive harvesting of roots, leaves, and tubers should be avoided. Because of their great diversity, protecting medicinal plants also means protecting plant biodiversity (Hamilton 2004). As a result, the decisions and plans should be made appropriately. To boost the number of these endangered species in the study area, we advise giving human assistance in natural regeneration efforts top priority. Lastly, in light of impending climate change, management might be directed by the knowledge currently available about risks to the forest flora.

Table 3. Medicinal plants included in International Union for Conservation of Nature (IUCN) and International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Botanical name	IUCN status	CITES
Aconitum heterophyllum Wall. ex. Royle	Endangered	Appendix II
Acorus calamus L.	Vulnerable	
Allium victorials L.	Endangered	
Angelica glauca Edgew.	Endangered	
Arnebia benthamii (Wall. ex. G. Don)	Endangered	
Betula utilis D.Don	Vulnerable	
Colchicum luteum Baker		Appendix II
Dioscorea deltoidea Wall. ex. Kunth		Appendix II
Inula racemosa Hook. F.	Critically endangered	
Jurinea dolomiaea Boiss.	Endangered	
Picrorhiza kurroa Royale ex. Benth	Endangered	
Podophyllum hexandrum (Royle) T.S Ying	Endangered	
Rheum webbianum Royle	Vulnerable	
Saussurea costa (Falc.) Lipsch.	Critically endangered	Appendix II
Trillium govanianum Wall. ex D.Don	Endangered	

Conclusion

The plant taxa in the temperate forests of Kashmir Himalayas are gathered by the locals for therapeutic uses in order to meet their basic medical needs. The wild plant species that are taken from these forests provide a low-cost and effective means of treating a range of ailments. In the current study a total number of 87 plant species from 52 families, are used to treat a variety of disorders. Urgent action is required to encourage the transmission of traditional knowledge. In order to maintain functioning ecosystems and the health of its inhabitants, it is necessary to reduce the factors that endanger biodiversity. Forest management strategies need to ensure that prospective threats (such as forest fragmentation and the invasion of exotic species) are dealt with before they become issues. The genders did not affect medicinal plants' knowledge, but age had a significant correlation. Most of the informants agreed that medicinal plants are under pressure due to overharvesting and lack of proper forest management practices. The number of medicinal plants reported from the study area indicates that the people in the study area possess rich traditional knowledge, and the vegetation of the temperate forests of Kashmir Himalayas constitutes rich diversity of medicinal plants. Overall, our study shows that local and indigenous forest knowledge and practices offer valuable insights and also a few possible solutions for addressing contemporary conservation and ecological challenges. Integrating these traditional perspectives with scientific knowledge can lead to more comprehensive and effective strategies for forest conservation and ecological transition.

Declarations

Author contributions: M.A. designed and supervised the entire study, M.A, conducted field surveys and collected data. M.A. R.A.M. and E.H. contributed in data arrangement, presentation and analysis. M.A. and E.H. played role in statistical interpretation of data and also wrote the first draft of the manuscript along with M.A., Later R.A.M. incorporated scientific input revised the manuscript.

Ethics approval and consent to participate: The ethical guidelines for the survey of rural and indigenous communities provided by International Society of Ethnobiology (available online: www.ethnobiology.net/whatwe-do/coreprograms/iseethics-program/code-of-ethics) were carefully followed. Prior to interviews, formal verbal consent (regarding data collection and publication) of each participant was taken. The PRA (Participatory rural appraisal) approach mentioned in the Kyoto Protocol (2017) was applied with the consent of the informant.

Consent for publication: Not applicable. Availability of data and materials: All data generated or analyzed during this study are included in this published article.

Availability of data and materials: The authors have no relevant financial or non-financial interests to disclose. **Funding:** No funding has been received for the study. Authors utilized their own resources for the completion of the study.

Competing interests: Not applicable

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