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Research Article

Ethnobotanical Survey and Traditional Knowledge of Ayurvedic Plants for Gynecological Disorders in Jammu Region, J&K: Linking Folk Claims to Scientific Validation

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ABSTRACT

Background: The Jammu Division of Jammu & Kashmir, a transitional Himalayan zone encompassing subtropical plains, mid-hills and temperate forests, harbours a rich reservoir of ethnomedicinal knowledge that local Vaidyas, Hakims, Gujjar and Bakerwal communities, and elderly rural women have traditionally applied to gynecological complaints. While this folk knowledge is widely practiced, it has rarely been systematically documented alongside laboratory-based validation.

Objective: This study aimed to (i) document, through a structured ethnobotanical survey, the traditional knowledge of Ayurvedic medicinal plants used for gynecological disorders in the Jammu region, and (ii) link these folk claims to scientific validation through phytochemical and antioxidant profiling of the identified species.

Methods: Semi-structured interviews and questionnaire-based field surveys were conducted with traditional healers, herbal practitioners, and knowledgeable villagers across representative districts of Jammu Division (Jammu, Kathua, Udhampur, Reasi, Rajouri, Poonch and Doda), documenting local names, plant parts used, modes of preparation, dosage, and the specific gynecological indications treated. Twelve Ayurvedic medicinal plants identified through this survey and cross-verified among multiple informants were authenticated, collected, and sequentially extracted with hexane, ethyl acetate, methanol and water. Qualitative phytochemical screening, quantitative estimation of total phenolic (TPC), flavonoid (TFC), alkaloid (TAC) and saponin (TSC) content, and antioxidant assays (DPPH, FRAP) were performed, followed by correlation, regression and principal component analysis (PCA).

Results: Informants consistently reported the use of these twelve species for dysmenorrhea, menorrhagia, leucorrhea, infertility, menstrual irregularities, vaginal infections, postpartum weakness, hormonal imbalance and uterine inflammation. Methanolic extracts gave the highest yields (mean 10.7%) and the greatest phenolic, flavonoid and alkaloid recovery, while aqueous extracts were richest in saponins and tannins, mirroring traditional decoction-based preparation. Vitex negundo, Cinnamomum zeylanicum and Punica granatum showed the highest phenolic/flavonoid content and antioxidant capacity (DPPH IC_{50} 45-52 μg/mL; FRAP 458-490 μmol Fe^{2+}/g), Asparagus racemosus and Foeniculum vulgare were saponin-dominant, and Berberis lyceum and Cissampelos pareira were alkaloid-dominant. Antioxidant activity correlated strongly with TPC ($r = 0.91–0.93$, $p < 0.01$). PCA and hierarchical clustering grouped the species into three chemotypic clusters that aligned closely with the folk-use categories reported during the survey (antioxidant/anti-inflammatory, fertility/adaptogenic, and uterotonic/hormonal regulatory).

Conclusion: The close correspondence between informant-reported indications and species-specific phytochemical/antioxidant signatures demonstrates that the ethnomedicinal knowledge of Jammu Division is not anecdotal but chemically coherent. The findings provide a scientific rationale for prioritizing these plants for standardization, quality control and further pharmacological and clinical validation, while underscoring the need to conserve both the plant resource and the associated traditional knowledge.

Keywords: Ethnobotany, Traditional Knowledge, Ayurvedic Medicinal Plants, Gynecological Disorders, Jammu and Kashmir, Phytochemical Validation, Antioxidant Activity.

INTRODUCTION

Medicinal plants have historically formed the backbone of women's reproductive healthcare across the Indian subcontinent, with Ayurveda, Unani and regional folk traditions offering an extensive, largely oral, pharmacopoeia for managing menstrual, fertility-related and gynecological disorders [1,2]. In the Jammu Division of the Union Territory of Jammu & Kashmir, an ecologically diverse transition zone stretching from subtropical plains to temperate and sub-alpine Himalayan tracts, this knowledge continues to be actively practiced by traditional healers (Vaidyas and Hakims), Gujjar and Bakarwal pastoral communities, and elderly rural women, even as it remains poorly documented in the peer-reviewed literature [3]. Ethnobotanical surveys elsewhere in the Western Himalayas have shown that such traditional knowledge is often internally consistent across informants and geographically widespread, yet only a small fraction of the plants so identified have been subjected to systematic phytochemical or pharmacological scrutiny. This creates a critical gap: folk claims regarding efficacy in dysmenorrhea, menorrhagia, leucorrhea, infertility and related conditions persist as cultural practice without corroborating biochemical evidence, limiting both their integration into formal healthcare and their potential for standardization as nutraceuticals or phytopharmaceuticals [3-5].

The present study addresses this gap by combining a field-based ethnobotanical survey with laboratory phytochemical and antioxidant characterization of the medicinal plants so identified. The specific objectives were to: (i) document, through informant interviews across representative districts of Jammu Division, the local names, plant parts used, preparation methods and gynecological indications of traditionally used Ayurvedic herbs; (ii) authenticate and phytochemically screen the identified species; (iii) quantify their phenolic, flavonoid, alkaloid and saponin contents and antioxidant capacities; and (iv) statistically evaluate whether the resulting chemical signatures correspond to the folk reported therapeutic categories, thereby linking traditional claims to scientific validation.

MATERIALS AND METHODS

Study Area

The study was conducted across the districts of Jammu, Kathua, Udhampur, Reasi, Rajouri, Poonch and Doda, which together constitute the Jammu Division (approximately 32°17′-33°13′ N, 74°19′-75°20′ E). The region spans subtropical plains, mid-hill zones, temperate forests and sub-alpine tracts (elevation range approximately 300-3,000 m), with mean temperatures of 18-31 °C, relative humidity of 45-80%, annual rainfall of 1,100-1,400 mm, and soil pH of 6.5-7.5. This ecological heterogeneity supports a rich medicinal flora and a correspondingly diverse body of ethnomedicinal knowledge among resident communities.

Ethnobotanical Survey

A field-based ethnobotanical survey was undertaken to document traditional knowledge of medicinal plants used for female reproductive and gynecological disorders. Districts and villages were purposively selected on the basis of medicinal plant diversity, availability of ethnomedicinal knowledge, presence of traditional healers, ecological representativeness, and accessibility for repeated visits.

Information was elicited from traditional healers (Vaidyas and Hakims), elderly villagers, members of tribal (Gujjar and Bakarwal) communities, herbal practitioners, and local women recognized as custodians of traditional medicinal knowledge. Data were collected using semi-structured interviews, structured questionnaires and informal group discussions during repeated field visits, conducted in Dogri, Gojri, Pahari and Hindi as appropriate to the informant. For each plant, the following information was systematically recorded: local (vernacular) name; plant part used; mode of preparation (e.g., decoction, infusion, paste); method and route of administration; dosage pattern; duration of treatment; the specific gynecological disorder(s) treated; and any combination with other herbal ingredients. Reported ailments spanned dysmenorrhea, menorrhagia, leucorrhea, infertility, menstrual irregularities, vaginal infections, postpartum weakness, hormonal imbalance, uterine inflammation and lactation-related disorders. Ethnomedicinal claims were cross-verified across multiple independent informants to ensure consistency and reliability before a species was retained for further study.

Selection, Collection and Authentication of Plant Species

Twelve medicinal plant species were selected for detailed investigation on the basis of frequency of traditional use for gynecological disorders, local availability, literature support, taxonomic authenticity and sufficiency of plant material. Multiple specimens of each species were collected between March and August, during pre-flowering and flowering stages, from the localities identified during the survey (Table 1). All specimens were authenticated by botanical experts using standard regional floras, taxonomic keys, and morphological and microscopic characters, with Ayurvedic identity confirmed by the Department of Ayurveda and further cross-verification against herbarium specimens at the Botanical Survey of India (Northern Regional Centre, Dehradun). Voucher specimens were prepared, labelled and preserved for future reference. Cleaned samples were shade dried (25–30 °C, 10–15 days), powdered (60-mesh sieve) and stored in airtight, amber coloured containers under moisture-free, low-light conditions.

Extraction and Phytochemical Analysis

Powdered plant material was sequentially extracted with solvents of increasing polarity n-hexane, ethyl acetate, methanol and water to achieve polarity-based metabolite fractionation. Qualitative screening for alkaloids, flavonoids, saponins, tannins/phenolics, terpenoids/steroids and glycosides was performed using standard colorimetric and precipitation tests. Quantitative estimation of total phenolic content (TPC, as mg gallic acid equivalents/g dry extract), total flavonoid content (TFC, as mg quercetin equivalents/ g), total alkaloid content (TAC, % w/w) and total saponin content (TSC, as mg diosgenin equivalents/g) was carried out spectrophotometrically, with all values expressed as mean ± SD (n = 3).

Antioxidant Activity and Statistical Analysis

Antioxidant capacity of methanolic extracts (the solvent yielding the highest phytochemical recovery) was evaluated using the DPPH radical scavenging assay (expressed as IC_{50}, μg/mL, relative to ascorbic acid) and the Ferric Reducing Antioxidant Power (FRAP) assay (μmol Fe^{2+}/g extract). Data were analysed using one-way ANOVA, Pearson's correlation, multiple linear regression, and principal component and hierarchical cluster analyses (Ward's method, Euclidean distance) to relate phytochemical parameters to antioxidant outcomes and to test the coherence of chemotypic groupings with the ethnobotanically reported use-categories. Statistical significance was set at $p < 0.05$.

RESULTS

Ethnobotanical Profile of the Studied Plants

The survey identified a consistent core of twelve Ayurvedic medicinal plants used across the surveyed districts for gynecological complaints, spanning ten botanical families (Table 1). Roots, bark, leaves, aerial parts, seeds and fruit/peel were all represented as the plant part employed, and reported indications ranged from uterine toning and menstrual regulation to fertility enhancement, antimicrobial use against leucorrhea, and relief of menstrual cramps.

Table 1. Ethnobotanical Profile of Medicinal Plants used for Gynecological Disorders in Jammu Division

Botanical Name	Family	Local Name	Part Used	District(s) of Collection	Traditional Gynecological Use
Cissampelos pareira L.	Menispermaceae	Patha	Root	Jammu (Bhalwal, Akhnoor)	Uterine tonic; menstrual regulator
Punica granatum L.	Lythraceae	Daanim/Anar	Peel/ Fruit rind	Jammu & Kathua	Menorrhagia; uterine inflammation
Berberis lyceum Royle	Berberidaceae	Kashmal	Root bark	Rajouri & Poonch	Leucorrhea; infections
Artemisia vulgaris L.	Asteraceae	Nagdona	Aerial parts	Poonch	Emmenagogue
Vitex negundo L.	Lamiaceae	Nirgundi/ Sambhalu	Leaves	Udhampur	PMS relief; hormonal balance
Cymbopogon citratus (DC.) Stapf	Poaceae	Gandhatrina/ Lemongrass	Leaves	Jammu	Antispasmodic
Mentha longifolia L.	Lamiaceae	Jungli Pudina	Leaves	Udhampur & Reasi	Dysmenorrhea

Asparagus racemosus Willd.	Liliaceae	Shatavari	Roots	Udhampur & Doda	Fertility enhancer
Ageratum conyzoides L.	Asteraceae	Neeli Booti/ Goat Weed	Whole plant	Doda	Vaginal infections
Trachyspermum ammi (L.) Sprague	Apiaceae	Ajwain	Seeds	Jammu	Menstrual cramps
Cinnamomum zeylanicum Blume	Lauraceae	Dalchini	Bark	Jammu	Uterine stimulant
Foeniculum vulgare Mill.	Apiaceae	Saunf	Seeds	Kathua & Jammu	Menstrual regulator

Survey data further indicated that informants typically prepared these plants as aqueous decoctions or infusions, occasionally combined with other herbal ingredients, administered orally over a period ranging from a few days to several weeks depending on the condition treated. Cross-verification across multiple informants confirmed consistent reporting of indications for all twelve species.

Extraction Yields

Sequential extraction showed a consistent solvent-dependent trend across all twelve species, with mean yields following the order methanol (10.7%) > aqueous (6.4%) > ethyl acetate (3.7%) > hexane (2.1%) (One-way ANOVA, $p < 0.01$). Vitex negundo, Cissampelos pareira and Cinnamomum zeylanicum gave the highest overall total yields (>23%).

Table 2. Extraction Yield (%) of Studied Plant Species across Solvents

Plant Species	Hexane (%)	Ethyl Acetate (%)	Methanol (%)	Aqueous (%)	Total Yield (%)
Cissampelos pareira	2.8	4.2	10.4	5.6	23.0
Punica granatum	1.5	3.1	11.2	6.8	22.6
Berberis lyceum	2.2	3.9	9.7	7.1	22.9
Artemisia vulgaris	1.9	4.4	10.9	5.4	22.6
Vitex negundo	3.0	4.0	11.6	6.2	24.8
Cymbopogon citratus	1.8	3.6	9.5	5.8	20.7
Mentha longifolia	2.6	3.8	10.7	6.5	23.6
Asparagus racemosus	1.4	3.5	10.9	6.7	22.5
Ageratum conyzoides	2.1	4.1	9.8	5.9	21.9
Trachyspermum ammi	2.9	3.3	10.5	5.6	22.3
Cinnamomum zeylanicum	1.5	3.0	11.9	7.4	23.8
Foeniculum vulgare	1.7	2.8	10.4	7.6	22.5

Qualitative Phytochemical Screening

Qualitative screening confirmed the presence of alkaloids, flavonoids, saponins, tannins/ phenolics, terpenoids/steroids and glycosides across all species, in patterns that broadly matched their folk-use categories (Table 3). Hierarchical clustering of the qualitative data grouped species into a polyphenol-rich cluster (Punica granatum, Cinnamomum zeylanicum, Vitex negundo), an alkaloid/terpenoid-dominant cluster (Cissampelos pareira, Berberis lyceum, Artemisia vulgaris), and a saponin-dominant adaptogenic cluster (Asparagus racemosus, Foeniculum vulgare, Mentha longifolia).

Table 3. Qualitative Phytochemical Distribution and Phytochemical Richness Index (PRI)

Plant Species	Alkaloids	Flavonoids	Saponins	Tannins/ Phenolics	Terpenoids/ Steroids	Glycosides	PRI
Cissampelos pareira	+++	++	+	++	++	++	8.5
Punica granatum	+	+++	+	+++	+	+	9.0
Berberis lyceum	+++	+	+	++	+	+	8.0

Artemisia vulgaris	+	++	+	+	+++	+	8.2
Vitex negundo	++	+++	++	++	++	+	9.4
Cymbopogon citratus	+	++	+	++	+++	+	8.8
Mentha longifolia	+	+++	+	++	++	+	9.1
Asparagus racemosus	+	+	+++	++	++	++	9.3
Ageratum conyzoides	++	++	+	+	+	+	7.8
Trachyspermum ammi	+	+++	+	+	++	+	8.5
Cinnamomum zeylanicum	+	++	+	+++	++	+	9.2
Foeniculum vulgare	+	++	++	++	++	++	9.0

Legend: +++ strong presence; ++ moderate presence; + mild presence. PRI = average sum of positive reactions per compound class (out of 10).

Quantitative Phytochemical Content

Total phenolic content (TPC) ranged from 58.7 mg GAE/g (Ageratum conyzoides) to 91.7 mg GAE/g (Vitex negundo), with an overall mean of 72.8 ± 3.1 mg GAE/g. Total flavonoid content (TFC) ranged from 46.5 to 79.1 mg QE/g (mean 63.4 ± 2.4 mg QE/g) and correlated strongly with TPC ($r = 0.94$, $p < 0.01$). Total alkaloid content (TAC) was highest in Berberis lyceum (4.28%) and Cissampelos pareira (3.92%), while total saponin content (TSC) was highest in Asparagus racemosus (31.4 mg diosgenin eq./g) and Foeniculum vulgare (26.5 mg/g) (Table 4).

Table 4. Quantitative Phytochemical Content of Studied Plant Species (Mean ± SD, N = 3)

Plant Species	**TPC (mg GAE/ g)**	**TFC (mg QE/ g)**	**TAC (% w/ w)**	**TSC (mg DE/ g)**	**Dominant Compound Class**
Cissampelos pareira	62.4 ± 1.8	49.3 ± 1.4	3.92 ± 0.15	22.3 ± 0.9	Alkaloids
Punica granatum	87.5 ± 2.5	71.4 ± 2.2	1.64 ± 0.10	18.5 ± 0.8	Phenolics
Berberis lyceum	71.2 ± 1.9	59.9 ± 1.7	4.28 ± 0.19	15.6 ± 0.7	Alkaloids
Artemisia vulgaris	64.1 ± 1.7	62.4 ± 1.9	2.31 ± 0.12	14.8 ± 0.6	Terpenoids
Vitex negundo	91.7 ± 2.4	79.1 ± 2.1	1.95 ± 0.11	25.7 ± 1.0	Flavonoids
Cymbopogon citratus	60.9 ± 1.8	56.3 ± 1.8	1.34 ± 0.09	16.4 ± 0.7	Terpenoids
Mentha longifolia	73.6 ± 2.1	65.7 ± 2.0	1.72 ± 0.10	19.1 ± 0.8	Flavonoids
Asparagus racemosus	68.5 ± 2.3	58.2 ± 1.6	0.85 ± 0.07	31.4 ± 1.2	Saponins
Ageratum conyzoides	58.7 ± 1.5	46.5 ± 1.3	2.85 ± 0.14	17.2 ± 0.7	Alkaloids
Trachyspermum ammi	65.9 ± 2.0	63.5 ± 1.9	1.43 ± 0.09	20.6 ± 0.8	Flavonoids
Cinnamomum zeylanicum	89.4 ± 2.7	74.2 ± 2.3	1.27 ± 0.08	18.9 ± 0.9	Phenolics
Foeniculum vulgare	69.2 ± 1.8	67.1 ± 2.0	0.98 ± 0.06	26.5 ± 1.0	Saponins

Antioxidant Activity

DPPH radical scavenging and FRAP assays showed close agreement, with Vitex negundo (IC_{50} 45.2 μg/mL; FRAP 489.6 μmol Fe^{2+}/g), Cinnamomum zeylanicum (IC_{50} 49.6 μg/mL;

FRAP 469.2 μmol Fe^{2+}/g) and Punica granatum (IC_{50} 51.8 μg/mL; FRAP 457.9 μmol Fe^{2+}/g) showing the strongest antioxidant capacity, and Ageratum conyzoides and Cymbopogon citratus the weakest (IC_{50} > 80 μg/mL) (Table 5). Antioxidant activity correlated strongly with TPC ($r = 0.91$ with DPPH, $r = 0.93$ with FRAP; $p < 0.01$) and TFC ($r = 0.89$ and 0.86, respectively), confirming phenolics and flavonoids as the principal determinants of antioxidant potency.

Table 5. Antioxidant Activity of Studied Plant Species (Methanolic Extracts)

Plant Species	DPPH IC_{50} (μg/ mL)	Relative Potency (% Ascorbic Acid)	FRAP (μmol Fe^{2+}/ g)	Rank
Vitex negundo	45.2	132.1	489.6	1
Cinnamomum zeylanicum	49.6	128.6	469.2	2
Punica granatum	51.8	123.0	457.9	3
Mentha longifolia	59.2	104.7	402.7	4
Foeniculum vulgare	60.3	101.3	383.9	5
Trachyspermum ammi	65.0	94.5	377.6	6
Berberis lyceum	67.4	96.2	374.5	7
Asparagus racemosus	70.8	90.0	353.5	8
Cissampelos pareira	72.5	88.0	321.4	9
Artemisia vulgaris	78.2	83.2	298.7	10
Cymbopogon citratus	81.3	79.8	272.8	11
Ageratum conyzoides	85.1	77.5	260.4	12

Correlation, PCA and Chemotypic Clustering

Principal component analysis reduced the six phytochemical/antioxidant variables (TPC, TFC, TAC, TSC, DPPH, FRAP) to two components explaining 81.6% of total variance (PC1 = 63.0%, PC2 = 18.6%). PC1 was defined by high loadings of TPC, TFC, and DPPH and FRAP (polyphenolic-antioxidant axis), while PC2 reflected saponin–alkaloid variation. Multiple linear regression showed that TPC, TFC and TSC together explained 94% of the variance in antioxidant activity ($R^2 = 0.94$, $p < 0.01$). Hierarchical cluster analysis (Ward's method) corroborated the PCA groupings and yielded four clusters: (i) polyphenol-rich - Vitex negundo, Cinnamomum zeylanicum, Punica granatum, Mentha longifolia; (ii) saponin-rich - Asparagus racemosus, Foeniculum vulgare; (iii) alkaloid/terpenoid-dominant - Berberis lyceum, Cissampelos pareira, Artemisia vulgaris; and (iv) lower phytochemical diversity - Cymbopogon citratus, Ageratum conyzoides, Trachyspermum ammi. Notably, these statistically derived clusters correspond closely to the folk-use categories recorded during the ethnobotanical survey (antioxidant/anti-inflammatory; fertility-enhancing/adaptogenic; and uterotonic/hormonal-regulatory), providing an independent, data-driven confirmation of the coherence of local traditional classification.

DISCUSSION

LINKING FOLK CLAIMS TO SCIENTIFIC VALIDATION

A central aim of this study was to test whether the gynecological indications reported by traditional healers and community informants in Jammu Division are reflected in the underlying phytochemistry of the plants concerned. The results provide consistent support for this correspondence (Table 6). Cissampelos pareira, folk-classified as a uterine tonic and menstrual regulator, was alkaloid-dominant (3.92% TAC), consistent with reports that isoquinoline alkaloids such as cissampeline influence uterine smooth-muscle tone [6-8]. Berberis lyceum, traditionally used for leucorrhea and infections, likewise showed the highest alkaloid content (4.28%), in line with the antimicrobial and estrogen-receptor modulating activity documented for berberine. Vitex negundo, reported for PMS relief and hormonal balance, was the most flavonoid-rich and antioxidant-potent species (TFC 79.1 mg QE/g; DPPH IC_{50} 45.2 μg/mL), consistent with the phytoestrogenic and anti-inflammatory actions attributed to its flavonoid constituents [9, 10]. Punica granatum and Cinnamomum zeylanicum, both used traditionally for menorrhagia and uterine inflammation, were the most phenolic-rich species, supporting a mechanistic role for polyphenol-mediated antioxidant and cytoprotective action in endometrial tissue [11-13]. Asparagus racemosus and Foeniculum vulgare, folkdesignated fertility enhancers and menstrual regulators, were the most saponin-rich species, consistent with steroidal saponins (e.g., shatavarins) acting through hypothalamic–pituitary–gonadal axis modulation.

Table 6. Correspondence between Folk Claims and Phytochemical/Mechanistic Evidence

Plant Species	Folk-Reported Use	Dominant Phytochemical Class	Proposed Mechanistic Basis
Cissampelos pareira	Uterine tonic; menstrual regulator	Alkaloids	Uterotonic/smoothmuscle modulation
Berberis lyceum	Leucorrhea; infections	Alkaloids	Antimicrobial; hormonal modulation
Vitex negundo	PMS relief; hormonal balance	Flavonoids	Phytoestrogenic; antiinflammatory
Punica granatum	Menorrhagia; uterine inflammation	Phenolics/Tannins	Antioxidant; cytoprotective
Cinnamomum zeylanicum	Uterine stimulant	Phenolics	Antioxidant; antimicrobial
Asparagus racemosus	Fertility enhancer	Saponins	Steroidal/adaptogenic, endocrine axis
Foeniculum vulgare	Menstrual regulator	Saponins	Adaptogenic; galactagogue
Mentha longifolia	Dysmenorrhea	Flavonoids	Anti-inflammatory; antispasmodic
Trachyspermum ammi	Menstrual cramps	Flavonoids/volatile phenolics	Spasmolytic; antioxidant
Artemisia vulgaris	Emmenagogue	Terpenoids	Uterotonic; volatile-oil mediated
Cymbopogon citratus	Antispasmodic	Terpenoids	Smooth-muscle relaxant; antimicrobial
Ageratum conyzoides	Vaginal infections	Alkaloids/mild phenolics	Antimicrobial

This species-by-species congruence between reported use and chemical signature indicates that the ethnomedicinal knowledge documented in Jammu Division is not merely anecdotal but reflects an empirically grounded, if informally transmitted, understanding of plant bioactivity. The correlation and PCA results (Section 3.6) reinforce this at a multivariate level, showing that phytochemical clustering recapitulates folk-use categorization independently of any prior assumption [14,15]. Environmental and geographical factors also appear to shape this knowledge system. Species from higher-altitude, temperate localities (Berberis lyceum, Artemisia vulgaris) were alkaloid/terpenoid-rich, while plains and mid-hill species exposed to greater UV and thermal stress (Vitex negundo, Punica granatum) accumulated higher phenolic loads, suggesting that regional chemotypic variation may itself have shaped, over generations, the localized specificity of folk indications across different parts of the Jammu Division [12,16].

These findings carry practical significance. They support prioritizing Vitex negundo, Cinnamomum zeylanicum, Punica granatum and Asparagus racemosus for further standardization, quality control and pharmacological/clinical validation as candidate phytotherapeutics for gynecological disorders. They also underscore the value of documenting traditional knowledge before it is lost, given that such knowledge, once cross-verified, can meaningfully guide the selection of species for bioprospecting [6,10]. At the same time, several limitations should be noted: the survey was restricted to twelve species prioritized by frequency of traditional use, in vitro assays cannot substitute for in-vivo or clinical efficacy data, and larger, more geographically stratified informant samples with formal quantitative ethnobotanical indices (e.g., use-value, informant consensus factor) would further strengthen future replications of this approach [12-14].

CONCLUSION

This study combined a structured ethnobotanical survey with phytochemical and antioxidant profiling to examine whether traditional gynecological uses of twelve Ayurvedic medicinal plants in Jammu Division, J&K, are chemically coherent. The survey documented consistent, cross-verified traditional knowledge linking specific plants to specific reproductive and gynecological indications. Laboratory analysis showed that phytochemical dominance patterns alkaloid-rich (Cissampelos pareira, Berberis lyceum), flavonoid/phenolic-rich (Vitex negundo, Punica granatum, Cinnamomum zeylanicum), and saponin-rich (Asparagus racemosus, Foeniculum vulgare) correspond closely to the folk-reported therapeutic roles of these species, and that antioxidant capacity is strongly predicted by phenolic and flavonoid content ($R^2 = 0.94$). These results demonstrate that the traditional ethnomedicinal knowledge of the Jammu region is empirically grounded and provide a scientific basis for prioritizing candidate species for standardization, conservation, and further pharmacological and clinical investigation, thereby strengthening the bridge between folk claims and modern scientific validation.

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REFERENCES

1. Akhtar, S., Dar, M. U., Jan, R., & Mir, R. A. (2025). Phytochemical and pharmacological evaluation of Himalayan medicinal plants used in women's reproductive health. Journal of Ethnopharmacology, 320, 117203.
2. Attri, K., Sidhu, H. K., Sharma, N., Dogra, R., Singh, A., Singh, J., & Singh, A. (2024). Bioactive phytochemical assessment of traditional medicinal plants from Jammu Division: A scientific investigation of their therapeutic potential in women's reproductive health disorders. Frontiers in Health Informatics, 13(8), 7318–7327.
3. Attri, K., Sidhu, H. K., Sharma, N., Dogra, R., Singh, A., & Singh, J. (2025). Comprehensive in vitro phytochemical characterization of Ayurvedic medicinal plants from Jammu Division, J&K, India: Elucidating their pharmacological relevance in gynaecological disease management. International Journal of Environmental Sciences, 11(24s).
4. Bhatia, H., Sharma, Y. P., Manhas, R. K., & Kumar, K. (2015). Ethnomedicinal plants used by the villagers of district Udhampur, J&K, India. Journal of Ethnopharmacology, 163, 179–191.
5. Anwar, S., Singh, D., & Goyal, R. (2020). Phytochemical and pharmacological evaluation of Vitex negundo Linn. Pharmaceutical Biology, 58(1), 563–575.
6. Alok, S., Jain, S. K., Verma, A., Kumar, M., Mahor, A., & Sabharwal, M. (2013). Plant profile, phytochemistry and pharmacology of Asparagus racemosus (Shatavari): A review. Asian Pacific Journal of Tropical Disease, 3(3), 242–251.
7. Ahmad, A., Khan, A., & Ali, M. (2021). Antioxidant potential of Punica granatum extracts in reproductive oxidative stress. Journal of Food Biochemistry, 45(2), e13620.
8. Ali, H., Khan, M., & Akram, M. (2021). Uterotonic and analgesic effects of Trachyspermum ammi in reproductive disorders. BMC Complementary Medicine and Therapies, 21(1), 230.
9. Arif, S., Rahman, K., & Ahmad, I. (2021). Berberine-mediated regulation of estrogen receptors in reproductive health. Molecules, 26(8), 2201.
10. Bhardwaj, R., & Kaushik, P. (2022). Altitudinal variation in phytochemical composition of Himalayan herbs. Plant Physiology Reports, 27(2), 298–314.
11. Bhat, A. A., Mir, R. A., & Qazi, H. A. (2020). Solvent-dependent extraction efficiency of polyphenolic antioxidants in Himalayan medicinal plants. Indian Journal of Natural Products and Resources, 11(4), 215–223.
12. Agarwal, A., Gupta, S., & Sharma, R. (2020). Oxidative stress and its role in female infertility and reproductive disorders. Reproductive Biology and Endocrinology, 18(1), 80–99.
13. Bajpai, V. K., Rahman, A., & Kang, S. C. (2022). Role of polyphenols in modulation of oxidative stress and hormonal balance in endometriosis. Reproductive Sciences, 29(3), 673–689.
14. Bansal, S., Jaiswal, P., & Tripathi, R. (2023). Iridoid glycosides from Vitex negundo: Phytoestrogenic and antioxidant mechanisms. Frontiers in Pharmacology, 14, 1123178.

15. Ahmed, A., Das, P., & Singh, D. (2022). Synergistic pharmacology of Ayurvedic polyherbal formulations: Insights from systems biology. Frontiers in Pharmacology, 13, 985412.
16. Azwanida, N. N. (2015). A review on the extraction methods used in medicinal plant studies. Asian Journal of Pharmaceutical and Clinical Research, 8(1), 6–10.