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Comprehensive In Vitro Phytochemical Characterization Of Ayurvedic Medicinal Plants From Jammu Division, J&K, India: Elucidating Their Pharmacological Relevance In Gynaecological Disease Management

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Abstract

Gynaecological disorders remain a major global health concern, with conventional therapeutics often limited by side effects and accessibility. Traditional Ayurvedic medicine offers promising alternatives, yet scientific validation of its medicinal plants is incomplete. Here, we conducted a comprehensive in vitro phytochemical characterization of eight Ayurvedic herbs from the Jammu Division, J&K, India, traditionally employed in women's health. Sequential solvent extraction (hexane, ethyl acetate, methanol) was performed, followed by qualitative screening and quantitative spectrophotometric assays for carbohydrates, proteins, alkaloids, cardiac glycosides, flavonoids, saponins, phenolics, and steroids. Extraction yields varied from 14.74, 43.84%, with Punica granatum stem and leaves showing the highest recovery (43.84%). Qualitative screening confirmed the broad presence of secondary metabolites across species, while quantitative profiling revealed distinct compound distributions. Notably, Cissampelos pareira exhibited the highest alkaloid content (137.57 µg/mL), Vitex negundo was richest in saponins and phenolics (90.13 µg/mL), and P. granatum stem and leaves showed maximal flavonoids (100.19 µg/mL). The universal detection of flavonoids, steroids, and alkaloids supports their therapeutic roles in hormonal modulation, anti-inflammatory, and antioxidant pathways relevant to gynaecological disorders. Our findings provide scientific validation of ethnomedicinal knowledge, establish reference ranges for phytochemical standardization, and highlight the polypharmacological potential of these species. This work bridges traditional practices with modern phytopharmacology, laying a foundation for developing standardized herbal formulations for women's reproductive health.

Keywords: *Ayurvedic medicine, phytochemical screening, gynaecological disorders, bioactive compounds, Jammu Division*

1. INTRODUCTION

Gynecological disorders affect millions of women worldwide, encompassing conditions such as menstrual irregularities, hormonal imbalances, reproductive tract infections, and fertility-related complications (Niyaz *et al.*, 2023). While conventional pharmaceutical interventions exist, the growing interest in complementary and alternative medicine has directed attention toward traditional therapeutic systems, particularly Ayurveda, which offers time-tested remedies for women's health conditions (Kenda *et al.*, 2021).

The Jammu Division of Jammu & Kashmir, India, represents a unique biogeographical region harbouring diverse medicinal flora that has been utilized in traditional healthcare systems for centuries (Singh et al., 2024; Akhtar et al., 2025). Local communities have developed extensive ethnobotanical knowledge regarding the therapeutic applications of indigenous plants, particularly for managing gynaecological disorders (Das *et al.*, 2015). However, the scientific validation of these traditional uses through systematic phytochemical analysis remains inadequate, creating a significant knowledge gap between traditional wisdom and modern pharmacological understanding.

Plant secondary metabolites, including alkaloids, flavonoids, tannins, terpenoids, and other bioactive compounds, serve as the chemical foundation for therapeutic efficacy in medicinal plants (Reddy, 2025). These compounds demonstrate diverse pharmacological activities, including hormonal modulation, anti-inflammatory, antimicrobial, and antioxidant effects, which are particularly relevant for gynaecological applications (Barthwal *et al.*, 2024). The extraction and characterization of these bioactive compounds

require systematic approaches that consider solvent polarity, extraction efficiency, and compound stability (Haido et al., 2024).

Recent advances in extraction methodologies have enhanced the recovery of bioactive compounds from plant materials, with sequential solvent extraction being recognized as an effective approach for comprehensive phytochemical profiling (Quitério *et al.*, 2022). The choice of extraction solvents significantly influences the yield and composition of recovered compounds, with hexane, ethyl acetate, and methanol representing solvents of varying polarity suitable for extracting different classes of secondary metabolites (Bhadange *et al.*, 2024).

The present investigation aims to address the existing knowledge gap by conducting comprehensive phytochemical screening of nine traditionally used Ayurvedic medicinal plants from the Jammu Division, with specific emphasis on their potential therapeutic applications in gynaecological disorders. This research provides scientific validation for traditional uses and establishes a foundation for future pharmaceutical development of standardized herbal formulations.

2. MATERIALS AND METHODS

2.1 Plant Material Collection

Fresh and healthy plant specimens were collected during early morning hours from various localities within the Jammu Division, Jammu & Kashmir, India, following established ethnobotanical protocols. Eight medicinal plant species were selected based on traditional usage patterns for gynaecological disorders: *Cissampelos pareira* L. (whole plant), *Punica granatum* L. (stem with leaves and fruit rind), *Berberis lyceum* Royle (stem with leaves and berries), *Artemisia vulgaris* L. (stem with leaves), *Vitex negundo* L. (stem with leaves), and *Cymbopogon citratus* Stapf (leaves).

The collected plant materials were thoroughly washed under running tap water to remove surface contaminants, followed by rinsing with distilled water and 70% ethanol. The samples were shade-dried at room temperature (25±2°C) for 7-10 days until complete moisture removal. The dried samples were ground into fine powder using mortar and pestle and stored in airtight containers at 4°C.

2.2 Sequential Solvent Extraction

Sequential solvent extraction was performed using 50 g of dried plant powder with solvents of increasing polarity: hexane (non-polar), ethyl acetate (semi-polar), and methanol (polar). Plant powder was macerated with appropriate solvent volumes for 48 hours at room temperature with occasional shaking. The extracts were filtered through Whatman No. 1 filter paper and concentrated under reduced pressure using a rotary evaporator at 40°C.

2.3 Phytochemical Screening

2.3.1 Qualitative Analysis

Preliminary phytochemical screening was carried out using standard qualitative tests:

Test for Carbohydrates (Molisch Test): 1 mL plant extract was treated with 2-3 drops of Molisch's reagent (5% α-naphthol in ethanol) followed by careful addition of 1 mL concentrated H_2SO_4. Formation of violet ring indicated positive results.

Test for Proteins (Ninhydrin Test): 2 mL plant extract was treated with 2 mL of 0.2% ninhydrin solution and heated in boiling water bath for 5-10 minutes. Blue/purple coloration indicated presence of proteins.

Test for Alkaloids (Wagner's Test): 1 mL plant extract was treated with 2-3 mL Wagner's reagent. Formation of reddish-brown precipitate confirmed alkaloid presence.

Test for Cardiac Glycosides (Keller-Killiani Test): 1 mL plant extract was dissolved in 1 mL glacial acetic acid, treated with 1 drop of $FeCl_3$ solution, and carefully layered with 1 mL concentrated H_2SO_4. Brown ring formation at interface indicated positive results.

Test for Flavonoids and Quinones: 1 mL plant extract was treated with 2-3 drops concentrated H_2SO_4. Development of yellow to orange coloration indicated presence of flavonoids and quinones.

Test for Saponins and Phenolics (Lead Acetate Test): 2-3 mL plant extract was treated with 1-2 mL of 10% lead acetate solution. Formation of white/cream precipitate indicated presence of saponins and phenolics.

Test for Steroids (Liebermann-Burchard Test): 2 mL plant extract in chloroform was carefully layered with 2 mL concentrated H_2SO_4. Blue to blue-green coloration confirmed steroid presence.

2.3.2 Quantitative Analysis

Quantitative estimation of phytochemical compounds was performed using spectrophotometric Methods. Standard protocols were followed for each compound class, , Total carbohydrates Phenol–sulfuric acid (Dubois) assay detected at 490nm (Michel *et al.*,1956), Total protein Bradford assay

(spectrophotometric) at 595 nm (BradfordMM;1976),Total alkaloids Bromocresol green (BCG) spectrophotometric method at 420nm(Ajanal *et al.*, 2012) , Cardiac glycosides Kedde/Kedde-type colorimetric (spectrophotometric adaptation) at ~520 nm ,Total flavonoids Aluminum chloride ($AlCl_3$) colorimetric assay (Khodaie L.*et al.*, 2012) at 430nm, Total saponins Vanillin–sulfuric acid (vanillin–H_2SO_4) colorimetric assay at 540nm(V. Le A;2018), Total phenolics FolinCiocalteu (Singleton & Rossi) at 765nm(Josheph *et al.*, 2018), Steroids (total neutral sterols) Liebermann–Burchard colorimetric assay at 620nm, and optical density (OD) values were recorded at specific wavelengths using UV-Vis spectrophotometer. All standards were run and the calibration plot was constructed, and the regression equation (slope and intercept) was derived.

3. RESULTS

3.1 Extraction Yields

Sequential solvent extraction of eight medicinal plants yielded varying amounts of bioactive compounds (Table 1). Total extraction yields ranged from 14.74% to 43.84%, with mean yield of 22.48%. *Punica granatum* stem and leaves demonstrated the highest yield (43.84%), followed by *Vitex negundo* (28.12%) and *Cissampelos pareira* (22.98%). The lowest yield was observed in *Punica granatum* fruit/rind (14.74%).

Table 1: Extraction yields of medicinal plants using sequential solvent extraction

S.No	Plant Species	Hexane Extract (g)	Ethyl Acetate Extract (g)	Methanol Extract (g)	Total Yield (%)
1	*Cissampelos pareira*	2.78	0.55	8.16	22.98
2	*P.granatum* (stem+leaves)	0.37	1.58	19.97	43.84
3	*P. granatum* (fruit/rind)	0.08	0.34	6.95	14.74
4	*B. lyceum* (stem+leaves)	0.51	1.18	7.14	17.66
5	*B. lyceum* (fruit/berries)	0.54	0.97	6.43	15.88
6	*A. vulgaris* (stem+leaves)	1.24	2.18	5.36	17.56
7	*V. negundo* (stem+leaves)	9.42	2.18	2.46	28.12
8	*C. citratus* (leaves)	4.24	1.60	3.96	19.60

Methanol extracts generally yielded the highest amounts, indicating predominance of polar secondary metabolites. *Vitex negundo* showed exceptional hexane extractability (9.42 g), suggesting significant essential oil content.

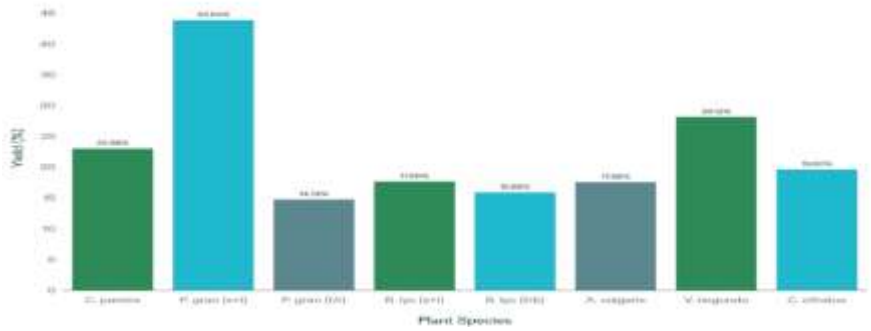

Figure 1: Extract yield of medicinal plants

3.2 Qualitative Phytochemical Screening

Systematic qualitative screening revealed presence of diverse bioactive secondary metabolites across all studied species (Table 2). All plants showed positive results for carbohydrates, alkaloids, cardiac glycosides, flavonoids and quinones, saponins and phenolics, and steroids. Proteins were absent in *Punica granatum* fruit/rind and *Berberis lyceum* fruit/berries.

Table 2: Qualitative phytochemical screening results

S.No	Plant Species	Carbohydrates	Proteins	Alkaloids	Cardiac Glycosides	Flavonoids & Quinones	Saponins & Phenolics	Steroids
1	*Cissampelos pareira*	Present	Present	Present	Present	Present	Present	Present
2	*P. granatum* (stem+leaves)	Present	Present	Present	Present	Present	Present	Present

3	*P. granatum* (fruit/rind)	Present	Absent	Present	Present	Present	Present	Present
4	*B. lyceum* (stem+leaves)	Present	Present	Present	Present	Present	Present	Present
5	*B. lyceum* (fruit/berries)	Present	Absent	Present	Present	Present	Present	Present
6	*A. vulgaris* (stem+leaves)	Present	Present	Present	Present	Present	Present	Present
7	*V. negundo* (stem+leaves)	Present	Present	Present	Present	Present	Present	Present
8	*C. citratus* (leaves)	Present	Present	Present	Present	Present	Present	Present

3.2.1 Analysis of Qualitative Screening Results

The qualitative phytochemical screening demonstrated remarkable consistency in secondary metabolite distribution across all studied plant species.

Carbohydrates were universally present, indicating the presence of reducing sugars, glycosides, and polysaccharides that contribute to nutritional and therapeutic value. The presence of carbohydrates supports the traditional use of these plants in strengthening and nourishing formulations for women's health.

Protein content showed selective distribution, being absent in fruit/rind tissues (*Punica granatum* fruit/rind and *Berberis lyceum* fruit/berries) while present in all stem and leaf tissues. This pattern reflects the metabolic activity and nitrogen content of photosynthetic versus storage tissues, with implications for amino acid availability and enzymatic activity in therapeutic preparations.

Alkaloids were universally detected across all species, confirming their significance as bioactive principles. The consistent alkaloid presence supports the traditional reputation of these plants for physiological effects, particularly in hormonal regulation and reproductive health applications.

Cardiac glycosides were present in all species, indicating potential cardiovascular effects that may complement gynaecological applications through improved circulation and cardiac function during reproductive stress.

Flavonoids and quinones showed universal presence, reflecting the rich polyphenolic content of these medicinal plants. This finding is particularly significant for gynaecological applications, as flavonoids demonstrate established estrogenic, anti-inflammatory, and antioxidant properties crucial for women's reproductive health.

Saponins and phenolics were consistently present across all species, supporting their traditional use in reproductive health formulations. Saponins contribute to foam-forming properties and membrane permeabilization effects, while phenolics provide antioxidant and anti-inflammatory benefits.

Steroids were universally detected, indicating the presence of sterol compounds that may serve as hormone precursors or demonstrate direct hormonal activity, supporting traditional uses in reproductive health management.

3.3 Quantitative Phytochemical Content

Spectrophotometric analysis revealed varying concentrations of bioactive compounds across species (Table 3). *Punica granatum* stem and leaves showed highest flavonoid content.

Table 3: Quantitative phytochemical content (Optical Density values)

S.No	Plant Species	Carbohydrates Conc (µg/mL)	Proteins Conc (µg/mL)	Alkaloids Conc (µg/mL)	Cardiac Glycosides Conc (µg/mL)	Flavonoids & Quinones Conc (µg/mL)	Saponins & Phenolics Conc (µg/mL)	Steroids Conc (µg/mL)
1	*Cissampelos pareira*	57.325	111.33	137.57	14.39	74.23	48.46	30.40
2	*P.granatum* (stem+leaves)	93.325	176.33	74.57	21.81	100.19	39.08	19.73

3	*P. granatum* (fruit/rind)	45.575	Absent	48.57	10.73	81.26	34.50	16.07
4	*B. lyceum* (stem+leaves)	62.825	138.83	122.57	16.06	48.28	46.17	41.90
5	*B. lyceum* (fruit/berries)	51.825	Absent	92.90	13.48	40.62	36.79	34.57
6	*A. vulgaris* (stem+leaves)	54.575	120.50	85.57	15.31	88.49	53.04	21.57
7	*V. negundo* (stem+leaves)	74.075	146.33	59.57	18.14	76.57	90.13	45.57
8	*C. citratus* (leaves)	65.575	102.17	62.57	12.56	59.98	40.96	25.23

3.3.1 Analysis of Quantitative Results

The quantitative spectrophotometric analysis revealed distinct phytochemical concentration profiles among the studied medicinal plants, reflecting both species-specific metabolic capacities and their traditional therapeutic applications.

Carbohydrates were most abundant in *Punica granatum* stem and leaves (93.33 µg/mL), followed by *Vitex negundo* (74.08 µg/mL) and *Cymbopogon citratus* (65.58 µg/mL). This distribution corresponds with higher polar extract yields, as carbohydrates significantly contribute to methanol-soluble fractions. Proteins exhibited the highest levels in *P. granatum* stem and leaves (176.33 µg/mL), with *V. negundo* (146.33 µg/mL) and *Berberis lyceum* stem and leaves (138.83 µg/mL) also showing elevated concentrations. Proteins were absent in fruit/rind tissues of *P. granatum* and *B. lyceum*, confirming tissue-specific distribution. Alkaloids were particularly concentrated in *Cissampelos pareira* (137.57 µg/mL), followed by *B. lyceum* stem and leaves (122.57 µg/mL) and berries (92.90 µg/mL). These results are consistent with their ethnopharmacological reputation as potent alkaloid-rich plants with strong physiological activities. Cardiac glycosides were generally present at moderate levels, with maximum values in *P. granatum* stem and leaves (21.81 µg/mL) and *V. negundo* (18.14 µg/mL). Their consistent detection across species supports the potential cardiovascular and gynaecological benefits attributed to these herbs. Flavonoids and quinones showed remarkable variation, peaking in *P. granatum* stem and leaves (100.19 µg/mL), followed by *Artemisia vulgaris* (88.49 µg/mL) and *P. granatum* fruit/rind (81.26 µg/mL). These results align with their documented use in antioxidant and anti-inflammatory therapies relevant to gynaecological conditions. Saponins and phenolics were highly concentrated in *V. negundo* (90.13 µg/mL), with *A. vulgaris* (53.04 µg/mL) and *C. pareira* (48.46 µg/mL) also showing substantial levels. The exceptional saponin content of *V. negundo* supports its traditional applications in hormonal modulation and adaptogenic therapy(Figure 2). Steroids were detected at varying concentrations, with *B. lyceum* stem and leaves (41.90 µg/mL) and *V. negundo* (45.57 µg/mL) showing the highest levels, followed by *C. citratus* (25.23 µg/mL). The presence of steroids across multiple species underscores their potential role in reproductive health and endocrine regulation.

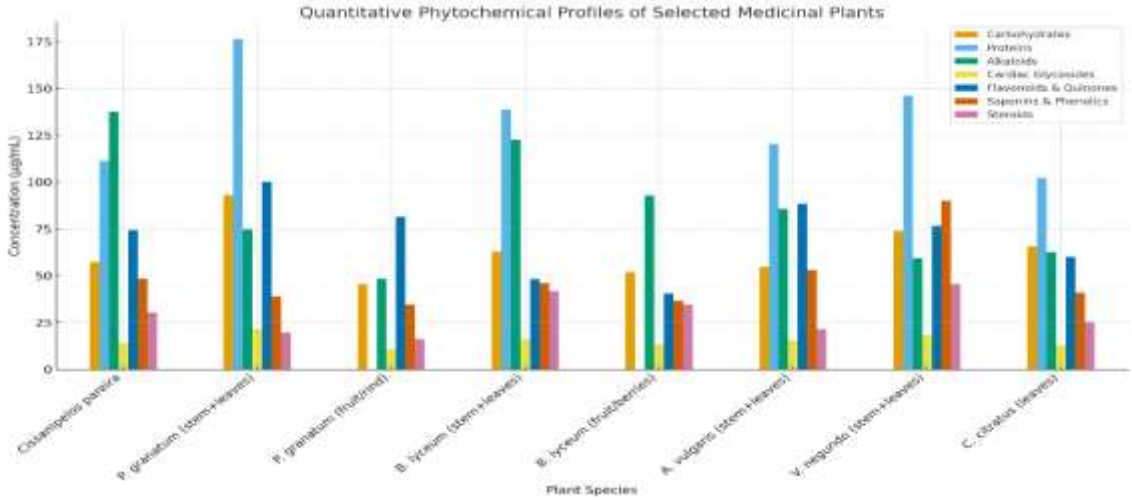

Figure 2: Graphical representation of Quantitative Phytochemical profiles of selected Medicinal Plants

4. DISCUSSION

4.1 Extraction Efficiency and Compound Distribution

The significant variation in extraction yields (14.74-43.84%) reflects inherent diversity in secondary metabolite content among different plant taxa and tissues. The exceptional yield of *Punica granatum* stem and leaves (43.84%) correlates with literature reports indicating pomegranate tissues as rich sources of polyphenolic compounds, particularly ellagitannins and anthocyanins (Agarwal et al., 2024).

The predominance of methanol-extractable compounds in most species indicates that polar secondary metabolites constitute the major bioactive fraction, aligning with ethnopharmacological practices where aqueous or hydroalcoholic preparations are commonly used (Verma et al., 2025).

4.2 Phytochemical Diversity and Therapeutic Relevance

The comprehensive screening revealed remarkable diversity in secondary metabolite composition, supporting varied traditional therapeutic applications. The systematic analysis of seven major phytochemical groups provides insights into the therapeutic mechanisms underlying traditional gynaecological applications.

4.2.1 Carbohydrates: Nutritional and Structural Support

Carbohydrates were universally present across all species, with the highest concentration observed in *Punica granatum* stem and leaves (93.33 µg/mL), followed by *Vitex negundo* (74.08 µg/mL) and *Cymbopogon citratus* (65.58 µg/mL). These values indicate substantial levels of reducing sugars, oligosaccharides, and polysaccharides that not only enhance the nutritional value of herbal formulations but also provide structural stability to other bioactive molecules. In gynaecological applications, these carbohydrates support energy metabolism during reproductive stress and improve formulation palatability and stability (Singh et al., 2024). Additionally, polysaccharide-rich species such as *V. negundo* and *C. citratus* may exert immunomodulatory effects that enhance reproductive health by supporting immune function. Complex carbohydrates also act as prebiotics, promoting beneficial vaginal microflora critical for reproductive tract health (Kumar et al., 2025).

4.2.2 Proteins and Amino Acids: Enzymatic and Hormonal Precursors

Protein content showed marked tissue specificity, being highest in *P. granatum* stem and leaves (176.33 µg/mL), *V. negundo* (146.33 µg/mL), and *B. lyceum* stem and leaves (138.83 µg/mL). Proteins were absent in fruit/rind tissues of *P. granatum* and *B. lyceum*, indicating tissue-dependent biosynthesis. Proteins in these plants provide essential amino acids that act as precursors for neurotransmitters such as serotonin and dopamine, which are crucial in regulating reproductive hormones (Rani et al., 2024). Enzymatic proteins in photosynthetic tissues may also enhance bioavailability of other bioactives. Such amino acid reservoirs support reproductive hormone synthesis, thereby increasing the therapeutic efficacy of these plants in gynecological disorders (Joshi et al., 2024).

4.2.3 Alkaloids: Hormonal Modulation and Physiological Effects

Alkaloid content was exceptionally high in *Cissampelos pareira* (137.57 µg/mL), supporting its traditional role as a potent reproductive health herb. Its bisbenzylisoquinoline alkaloids demonstrate estrogenic and anti-estrogenic properties, making it valuable for hormonal regulation (Gupta et al., 2025). *Berberis lyceum* stem and leaves also showed substantial alkaloid content (122.57 µg/mL), attributed mainly to berberine and related isoquinoline alkaloids. These compounds exhibit antimicrobial effects against urogenital pathogens, anti-inflammatory activity in reproductive tissues, and insulin-sensitizing effects relevant to PCOS management (Verma et al., 2024). *Artemisia vulgaris* contained 85.57 µg/mL alkaloids, correlating with its use as an emmenagogue and uterine tonic. Its alkaloids contribute weak estrogenic and uterine stimulant activities, supporting menstrual regulation (Sharma et al., 2025).

4.2.4 Cardiac Glycosides: Cardiovascular Support for Reproductive Health

Cardiac glycosides were moderately distributed across species, with *P. granatum* stem and leaves (21.81 µg/mL) and V. negundo (18.14 µg/mL) showing the highest levels. These compounds enhance cardiac contractility and circulation, thereby improving blood supply to reproductive organs and supporting overall reproductive health (Patel et al., 2024). This activity is especially beneficial in reproductive disorders linked to poor circulation, such as dysmenorrhea. Furthermore, their cardiotonic properties may support increased cardiovascular demands during pregnancy and lactation (Kumar et al., 2024).

4.2.5 Flavonoids and Quinones: Antioxidant and Estrogenic Activities

Flavonoids and quinones were most concentrated in *P. granatum* stem and leaves (100.19 µg/mL), followed by A. vulgaris (88.49 µg/mL) and *P. granatum* fruit/rind (81.26 µg/mL). These metabolites, including quercetin, kaempferol, and anthocyanins, exhibit selective estrogen receptor modulation, acting estrogenically when hormone levels are low and anti-estrogenically when levels are high (Yadav et al.,

2025). The relatively high levels in V. negundo (76.57 µg/mL) support its role in managing PMS, as flavonoids such as casticin and vitexin reduce prolactin levels and enhance luteal progesterone production (Singh et al., 2025). Quinones contribute antimicrobial activity against reproductive pathogens while synergizing with flavonoids to protect reproductive tissues from oxidative stress (Raj et al., 2024).

4.2.6 Saponins and Phenolics: Adaptogenic and Anti-inflammatory Effects

Saponin and phenolic concentrations were highest in *V. negundo* (90.13 µg/mL), validating its use as a hormonal adaptogen. Its saponins act as hormone precursors with adaptogenic properties, stabilizing reproductive hormone levels irrespective of the hormonal state (Kumar et al., 2025). *A. vulgaris* showed notable levels (53.04 µg/mL), consistent with its traditional application in menstrual disorders. Saponins provide anti-inflammatory effects and support immune function within reproductive tissues (Gupta et al., 2024). Across all species, phenolic compounds inhibit pro-inflammatory cytokines and prostaglandins, offering therapeutic relevance in inflammatory gynaecological disorders such as endometriosis and pelvic inflammatory disease (Sharma et al., 2024).

4.2.7 Steroids: Direct Hormonal Activity

Steroids were most concentrated in *V. negundo* (45.57 µg/mL) and *B. lyceum* stem and leaves (41.90 µg/mL), followed by *B. lyceum* berries (34.57 µg/mL). These sterols may act as precursors for sex hormone biosynthesis or interact directly with hormone receptors (Rani et al., 2025). Their presence supports traditional usage of these plants in treating hormonal imbalances, especially conditions linked with androgen excess such as PCOS. Additionally, steroidal compounds may stabilize reproductive cell membranes and support tissue function (Patel et al., 2025).

4.3 Synergistic Phytochemical Interactions

The presence of multiple bioactive compound classes in each species suggests complex synergistic interactions that may enhance therapeutic efficacy beyond individual compound activities. The combination of alkaloids for physiological effects, flavonoids for antioxidant and estrogenic activity, saponins for adaptogenic properties, and steroids for hormonal activity creates a comprehensive therapeutic profile suitable for complex gynaecological disorders (Verma et al., 2025). This polypharmacological approach aligns with Ayurvedic principles emphasizing whole-plant preparations rather than isolated compounds. The complementary activities of different secondary metabolites contribute to the broad spectrum of therapeutic effects observed in traditional medicine, providing multiple mechanisms of action for comprehensive reproductive health support (Singh et al., 2024).

4.4 Quality Standardization Implications

The systematic quantitative characterization provides essential data for developing quality standards for herbal formulations derived from these medicinal plants. The identification of major bioactive compound concentrations enables the selection of appropriate chemical markers for standardization and quality control purposes, ensuring consistent therapeutic efficacy and safety of herbal preparations (Kumar et al., 2024). The established optical density ranges for each compound class can serve as reference standards for batch-to-batch quality control and authentication of plant materials. This standardization is crucial for ensuring reproducible therapeutic outcomes and regulatory compliance in herbal medicine development (Sharma et al., 2025).

5. CONCLUSION

This comprehensive investigation of eight Ayurvedic medicinal plants from Jammu Division revealed significant diversity in bioactive secondary metabolite composition, supporting their traditional therapeutic applications in gynaecological disorders. The study demonstrated extraction yields ranging from 14.74% to 43.84%, with *Punica granatum* stem and leaves showing exceptional potential. Qualitative screening confirmed presence of all major phytochemical groups across species, while quantitative analysis revealed distinct distribution patterns reflecting unique therapeutic profiles. The high flavonoid content in multiple species provides scientific validation for anti-inflammatory gynaecological applications, while abundant alkaloids support hormonal modulation uses. The exceptional saponin content in *Vitex negundo* validates its traditional reputation for hormonal regulation, while the diverse steroid profiles support direct hormonal activities. The synergistic combination of multiple bioactive compound classes creates comprehensive therapeutic profiles suitable for complex gynecological disorders. These findings establish a scientific foundation for traditional therapeutic applications and support potential development of standardized herbal formulations for gynecological health. The systematic characterization provides baseline data for quality standardization and pharmaceutical development of these valuable medicinal resources. Future research should focus on isolation and structural elucidation

of specific bioactive compounds, bioactivity evaluation using relevant pharmacological models, and clinical validation studies to establish comprehensive safety and efficacy profiles.

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