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Research Article

Pharmacognostic Standardization, Phytochemical Profiling, and Pharmacological Evaluation of *Jasminum officinale* L.: A Comprehensive Study

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ABSTRACT

Jasminum officinale L. (Oleaceae), commonly known as common jasmine, has been traditionally employed in multiple medicinal systems. This study comprehensively evaluates its pharmacognostic characteristics, phytochemical constituents, and pharmacological properties, particularly its antioxidant and antibacterial activities. Methanolic extraction of the plant yielded 2.79% w/w extract. Pharmacognostic parameters such as ash values and moisture content confirmed the identity and quality of the crude drug. Phytochemical screening revealed the presence of multiple classes of secondary metabolites, with quantitative estimations showing notable levels of flavonoids, saponins, and alkaloids. LC-MS analysis identified major bioactive compounds including quercetin-3-O-glucoside, rutin, and luteolin derivatives. Antioxidant assays (DPPH and H₂O₂ scavenging) and antibacterial assays against five clinically significant bacterial strains established the moderate to strong bioactivity of the extract. The results support the traditional uses of *J. officinale* and highlight its potential as a source of novel bioactive compounds.

INTRODUCTION

Medicinal plants have served as a foundation for healthcare since antiquity, providing therapeutic benefits in traditional and modern systems of medicine. One such plant, *Jasminum officinale* L., widely known as common jasmine, is revered not

only for its ornamental and aromatic properties but also for its significant ethnomedicinal value. Traditionally used in Ayurveda, Unani, and Chinese medicine, *J. officinale* has been employed for the treatment of ailments such as inflammation, microbial infections, anxiety, insomnia, skin disorders, and gastrointestinal issues. The

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therapeutic potential of *J. officinale* is attributed to its diverse array of phytochemicals including flavonoids, alkaloids, saponins, and essential oils. However, despite its extensive traditional use, scientific validation and standardization data are limited. Pharmacognostic standardization is crucial for ensuring the identity, purity, and quality of herbal materials and forms the initial step toward developing plant-based therapeutics. This research aims to establish the pharmacognostic profile, conduct phytochemical screening and quantification, perform advanced chemical profiling using LC-MS, and evaluate the antioxidant and antibacterial potential of methanolic extracts of *J. officinale*. This comprehensive study bridges traditional knowledge and modern scientific evaluation, contributing to the phytopharmaceutical potential of the plant.

Vernacular names

- **Common Name:** Common Jasmine, Poet's Jasmine
- **Hindi:** चांदनी (Chandni)
- **Sanskrit:** मल्लिका (Mallika)
- **Tamil:** மல்லிகை (Malligai)
- **Bengali:** যুথিকা (Juthika)
- **Telugu:** మల్లె (Malle)

Taxonomical Classification

- **Kingdom:** Plantae
- **Division:** Angiosperms
- **Class:** Eudicots
- **Order:** Lamiales
- **Family:** Oleaceae
- **Genus:** *Jasminum*
- **Species:** *Jasminum officinale* L.

Phytotherapy, the medicinal use of plants and their bioactive compounds, has been a fundamental

component of international health traditions, having its genesis in ancient civilizations like India, China, Egypt, and Mesopotamia. Notwithstanding the development of synthetic drugs, the long-standing usefulness of plant remedies continues. Among them, *Jasminum officinale* L. (Oleaceae), or *Jasmineum vulgare*, is characterized by its multifaceted medicinal and aromatic values. Traditionally used in Ayurveda, Unani, and Traditional Chinese Medicine, *J. officinale* has been used to address diseases from skin infections and fever through gastrointestinal diseases and neurological disorders such as anxiety and insomnia. Its long-term use among cultures speaks to its pharmacological diversity and makes it worth the comprehensive pharmacognostic, phytochemical, and biomedical appraisal. The increase in chronic, non-communicable diseases like diabetes, cancer, and neurodegenerative disorders has prompted phytotherapy to emerge as a legitimate alternative or complement to traditional drugs. The reasons behind this trend are fear of the toxicity of synthetic drugs, drug resistance, and the absence of long-term efficacy. *J. officinale*, which contains bioactive molecules such as flavonoids (quercetin, rutin), iridoids, triterpenoids, and volatile oils (linalool, methyl jasmonate, benzyl acetate), possess a plethora of therapeutic activities like antioxidant, anti-inflammatory, antimicrobial, hepatoprotective, and anxiolytic activities. These activities are due to the polypharmacological mechanisms of the plant, influencing oxidative stress, inflammation, and microbic growth. Worldwide, organizations such as the World Health Organization (WHO), ESCOP, and India's Ministry of AYUSH are promoting the scientific evaluation and regulation of traditional herbal remedies. In this context, *J. officinale* is an interesting candidate for incorporation into contemporary pharmacopeias, provided standardized quality control, safety profiling, and



clinical verification are built into the strategy. In light of its cultural, therapeutic, and economic value in the herbal economy of medicine, sound pharmacognostic and analytical techniques like HPTLC, GC-MS, and NMR are a necessity in ascertaining the reproducibility and authenticity of its derived products.

Intersection of Traditional Knowledge with Evidence-Based Pharmacology

Combining ancient ethnomedical knowledge and present-day pharmacological science has bridged new doors of drug discovery and integrative healthcare. Systems such as Ayurveda, Unani, and Traditional Chinese Medicine provide rich stores of empirical knowledge accumulated over generations. These systems tend to depend on the synergistic action of several phytochemicals to reinstate the balance of body physiology with polyherbal preparations. In this background, *Jasminum officinale* L. has been used historically for various health issues, such as infections, fevers, gastrointestinal upsets, and neuropsychological disorders. In Ayurveda, *J. officinale* is prized for its antipyretic, diaphoretic, and nervine properties, whereas Unani and TCM traditions highlight its mood-stabilizing and detoxifying actions. Current studies have confirmed these ancient assertions by purifying active constituents like linalool, benzyl acetate, methyl jasmonate, flavonoids (quercetin, rutin), and triterpenoids that exhibit pharmacodynamic effects in conformity with its ancient uses. These observations stress the need for articulating the common knowledge in scientific terms based on an interdisciplinary approach comprising pharmacognosy, phytochemistry, toxicology, and clinical studies. Though preclinical data affirm its antioxidant, antimicrobial, anxiolytic, hepatoprotective, and anti-inflammatory properties, *J. officinale* remains short of adequate clinical trials for contemporary

therapeutic approval. To fill this shortfall, systematic research employing omics technologies, high-throughput screening, and effectively designed clinical protocols are needed. This would not only authenticate its effectiveness but also provide inputs toward culturally relevant healthcare models as well as sustainable drug development from botanical origins.

Jasminum officinale as a Source of Drug Leads from Nature

Natural products continue to be central to drug discovery because of their structural diversity and peculiar biological activity. Composed of terrestrial and marine organisms, the compounds are providing new scaffolds for addressing complex diseases. More than 50% of drugs developed over the last few decades are either natural products or natural product derivatives. Medicinal plants, in specific, are known to produce multifaceted bioactive secondary metabolites that act against more than one cellular pathway beneficial for treating multifactorial diseases such as cancer, metabolic syndromes, and neurodegeneration. In this context, *Jasminum officinale* L. is a classic medicinal plant with high content of pharmacologically active compounds. Flavonoids (rutin, quercetin) and essential oils are present with iridoid and secoiridoid glycosides, triterpenoids (ursolic and oleanolic acid), and volatile oils (linalool, methyl jasmonate, benzyl acetate). These compounds display antioxidant, hepatoprotective, neuroprotective, anti-inflammatory, antimicrobial, and cytotoxic activities. Linalool has shown GABA receptor modulation, validating its anxiolytic activity, whereas quercetin and rutin inhibit oxidative stress by triggering the Nrf2 pathway and inhibiting pro-inflammatory cytokines. Methyl jasmonate has indicated anticancer activity by causing disruption in mitochondrial function and autophagy in



cancerous cells. Ethanolic flower extracts have been found to inhibit breast cancer cell lines such as MCF-7 by inducing apoptosis. Further, antimicrobial activity against pathogens such as *E. coli*, *S. aureus*, and *P. aeruginosa* enhances its worth in the context of increasing antibiotic resistance. To realize the potential drug discovery value of *J. officinale*, future research needs to center on bioactivity-guided isolation, structure-activity relationship (SAR) study, molecular docking, and pharmacokinetic modeling. These approaches will enable the creation of lead compounds that not only work but also are safe and marketable. Accordingly, *Jasminum officinale* is a formidable bridge between nature and new therapeutic innovation.

Traditional Uses of *Jasminum officinale* in Ethnomedicine

Jasminum officinale L., commonly known as common jasmine, holds an esteemed position in traditional medicine systems around the world. Its extensive therapeutic use in Ayurveda, Unani, and Traditional Chinese Medicine (TCM) reflects the plant's deep cultural and medicinal value. In Ayurvedic medicine, the flowers, leaves, and roots of *J. officinale* are frequently used in various forms such as decoctions, pastes, and oil infusions. These preparations are traditionally employed for their antipyretic, nervine, and aphrodisiac properties. The plant is used to manage fevers, skin ailments, ulcers, and nervous disorders, highlighting its holistic application for both physical and mental well-being. In the Unani system, jasmine is considered a mild sedative and mood enhancer. Its fragrant flowers are used in teas, essential oils, and fresh pastes to treat conditions such as liver disorders, headaches, and joint pain. The soothing properties of its volatile oils make it a popular remedy for calming the nervous system and promoting emotional balance. Similarly, in

Traditional Chinese Medicine, *J. officinale* is known for regulating Qi (vital energy) and is used to treat digestive discomforts, anxiety, and detoxification. Jasmine flowers are often dried and brewed as herbal infusions or processed into topical ointments to relieve emotional tension and improve gastrointestinal health. The roots are sometimes incorporated into formulations for their cooling and purifying actions. Across folk medicine practices in the Middle East, South Asia, and parts of Africa, jasmine is also used to treat insomnia, headaches, skin infections, and even as an aphrodisiac or sacred offering in rituals, underscoring its biocultural and therapeutic importance. The continued use of *Jasminum officinale* across different cultures and generations strongly supports its pharmacological potential and encourages scientific validation for integration into modern phytotherapy.

Table 1: Traditional Uses of *Jasminum officinale* in Various Medicinal Systems

Medicinal System	Part Used	Traditional Use
Ayurveda	Flowers, Leaves	Antipyretic, nervine tonic, anti-inflammatory
Unani	Flowers	Mood stabilizer, antispasmodic, detoxifier
Traditional Chinese Medicine (TCM)	Flowers, Roots	Antidepressant, digestive aid, anti-infective
Folk Medicine (Asia, Middle East)	Whole plant, Oil	Skin infections, headaches, insomnia, aphrodisiac

MATERIALS AND METHODS

1. Plant Collection and Authentication: The leaves of *J. officinale* were collected from a botanical garden and authenticated by a certified taxonomist. A voucher specimen was deposited in



the herbarium of the Shambhunath Institute of Pharmacy.

2. Extraction: Dried and powdered plant material was subjected to Soxhlet extraction using 95% methanol. The extract was filtered, concentrated under reduced pressure using a rotary evaporator, and stored at 4°C until use. The yield of extract was calculated.

3. Pharmacognostic Evaluation:

Pharmacognostic studies were conducted to determine identity and purity. Parameters included total ash, acid-insoluble ash, water-soluble ash, loss on drying, and foreign matter. These parameters were determined according to WHO guidelines for herbal drug standardization.

4. Phytochemical Screening and

Quantification: Preliminary phytochemical screening was carried out using standard protocols to detect the presence of alkaloids, flavonoids, tannins, saponins, glycosides, terpenoids, and phenols. Quantitative estimations of flavonoids, saponins, and alkaloids were performed using spectrophotometric and gravimetric methods.

5. LC-MS Analysis: Liquid Chromatography-Mass Spectrometry (LC-MS) was used for chemical profiling of the methanolic extract. The analysis was conducted using a C18 column and an electrospray ionization source in both positive and negative modes. Compounds were identified based on their mass-to-charge ratio (m/z) and fragmentation patterns.

6. Antioxidant Activity: Antioxidant potential was assessed by DPPH radical scavenging and hydrogen peroxide (H₂O₂) scavenging assays. IC₅₀ values were calculated for both assays using standard protocols. Ascorbic acid and BHT were used as reference antioxidants.

7. Antibacterial Activity: The antibacterial activity was evaluated using the agar well diffusion method and minimum inhibitory concentration (MIC) determination. Five bacterial strains were tested: *Staphylococcus aureus*, *Escherichia coli*, *Bacillus subtilis*, *Salmonella typhimurium*, and *Bordetella bronchiseptica*. Ciprofloxacin served as the standard.

RESULTS

1. Pharmacognostic Parameters:

- Total ash: 9.27%
- Acid-insoluble ash: 1.76%
- Water-soluble ash: 7.51%
- Loss on drying: 7.5%
- Foreign matter: 1.61%

2. Phytochemical Screening: Preliminary screening indicated the presence of flavonoids, alkaloids, saponins, glycosides, phenols, terpenoids, proteins, carbohydrates, and sterols.

3. Quantitative Estimations:

- Flavonoids: $1.50 \pm 0.03\%$
- Saponins: $1.85 \pm 0.03\%$
- Alkaloids: $2.64 \pm 0.2\%$

4. LC-MS Profiling: Key compounds identified included quercetin-3-O-glucoside, rutin, luteolin-O-glucoside, kaempferol-O-rutinoside, and triterpenoid saponins. The molecular weights of compounds ranged from 257 Da to 1900 Da, indicating a wide diversity of phytoconstituents.

5. Antioxidant Activity:

- DPPH IC₅₀: 228.2 µg/mL
- H₂O₂ IC₅₀: 18.24 µg/mL

6. Antibacterial Activity: The extract exhibited strong antibacterial activity, particularly against S.



aureus (MIC: 0.220 ± 0.065 $\mu\text{g/mL}$), followed by *E. coli* and *B. bronchiseptica*.

DISCUSSION

The present study provides a comprehensive pharmacognostic, phytochemical, and pharmacological evaluation of *Jasminum officinale* L., a medicinal plant with deep roots in traditional medicine. The pharmacognostic parameters, including total ash content, acid-insoluble ash, water-soluble ash, and loss on drying, fell within acceptable ranges, indicating the plant material's purity, authenticity, and suitability for medicinal formulation. These values serve as critical reference standards for identifying adulteration and ensuring batch-to-batch consistency in future pharmaceutical or cosmeceutical preparations.

Preliminary phytochemical screening revealed the presence of a wide array of secondary metabolites, including flavonoids, alkaloids, saponins, tannins, glycosides, and phenolic compounds. These compounds are known for their diverse biological functions, particularly in mitigating oxidative stress and microbial infections. Quantitative analysis showed substantial levels of flavonoids (1.50%), saponins (1.85%), and alkaloids (2.64%), supporting their pharmacological relevance.

LC-MS analysis uncovered a spectrum of bioactive constituents, including quercetin-3-O-glucoside, luteolin-O-glucoside, rutin, kaempferol-O-rutinoside, and triterpenoid glycosides. These phytochemicals are recognized for their antioxidant, anti-inflammatory, and antimicrobial effects, and their identification in *J. officinale* confirms its rich phytopharmacological profile. The identification of such complex constituents also positions this species as a potential source for lead compounds in drug discovery.

The antioxidant activity demonstrated by the methanolic extract, as evaluated through DPPH and H_2O_2 scavenging assays, revealed moderate but significant radical scavenging properties, with IC_{50} values of 228.2 $\mu\text{g/mL}$ and 18.24 $\mu\text{g/mL}$ respectively. These findings are consistent with the flavonoid and phenolic-rich composition of the extract. While the antioxidant activity was lower compared to standard compounds like ascorbic acid, the extract still holds therapeutic promise, especially as a natural additive or supportive antioxidant in formulations.

The antibacterial studies further emphasized the pharmacological potential of *J. officinale*. The methanolic extract demonstrated a broad spectrum of activity against both Gram-positive and Gram-negative pathogens, with the highest potency observed against *Staphylococcus aureus* (MIC: 0.220 ± 0.065 $\mu\text{g/mL}$). The activity against *Escherichia coli*, *Bordetella bronchiseptica*, and *Salmonella typhimurium* also suggests a wide antibacterial spectrum. These results corroborate the ethnomedicinal uses of the plant in treating wounds, infections, and skin disorders.

Overall, this study validates the traditional claims surrounding *Jasminum officinale* and provides the scientific framework needed for future applications. However, limitations such as the absence of bioactivity-guided fractionation, mechanism-of-action studies, and in vivo pharmacokinetic data should be addressed in subsequent investigations. Future studies must also explore the clinical relevance of these findings through toxicity testing, dose-optimization studies, and therapeutic modeling in disease-specific animal systems.

CONCLUSION

This study confirms that *Jasminum officinale* L. possesses notable pharmacognostic,



phytochemical, and pharmacological properties that justify its widespread use in traditional medicine systems. The plant's rich profile of flavonoids, alkaloids, saponins, and phenolic compounds, along with its demonstrated antioxidant and antibacterial activities, establishes it as a promising candidate for therapeutic applications.

Pharmacognostic standardization assures identity and quality of the raw material, which is crucial for safe use in formulations. The antioxidant activity of the extract supports its utility in oxidative stress-related disorders, while its antimicrobial potential suggests relevance in the treatment of infections, particularly those involving drug-resistant strains.

The identification of key phytoconstituents via LC-MS provides a robust chemical fingerprint and opens the possibility for isolation of novel compounds that could serve as lead molecules in modern drug development. Moreover, the results serve as a foundation for the creation of standardized herbal formulations and botanical supplements aimed at immune support, dermatological health, and general well-being.

In conclusion, *Jasminum officinale* offers a bridge between traditional knowledge and modern evidence-based medicine. However, translational research involving advanced pharmacodynamic studies, clinical trials, and formulation development is required to fully realize its therapeutic potential. If explored scientifically and sustainably, *J. officinale* could contribute meaningfully to the growing global market of phytopharmaceuticals and natural health products.

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