**EXPLORING THE MEDICINAL WEALTH OF NELUMBO NUCIFERA GAERTN: A REVIEW ON ITS TRADITIONAL USES AND SCIENTIFIC PERSPECTIVES**

**Abstract**

**Introduction:**
*Nelumbo nucifera* Gaertn., commonly known as the sacred lotus, holds significant value in various traditional medicine systems such as Ayurveda, Traditional Chinese Medicine, and other ethnomedical practices. Different parts of the plant—including leaves, flowers, seeds, and rhizomes—have been traditionally utilized to address a range of health conditions, including hemorrhagic disorders, digestive disturbances, metabolic dysfunctions, and neurological ailments. **Methods:** This review synthesizes classical knowledge from traditional systems of medicine with contemporary scientific literature. An extensive search was conducted across major biomedical databases to compile data on the phytochemical composition, pharmacological activities, formulations, and therapeutic applications of *N. nucifera*. **Results:**Phytochemical analyses have revealed that *N. nucifera* is rich in bioactive constituents such as alkaloids, flavonoids, glycosides, polyphenols, and essential micronutrients. These compounds exhibit diverse pharmacological activities, including antioxidant, anti-inflammatory, hepatoprotective, antidiabetic, neuroprotective, and cardioprotective effects. Several in vitro and in vivo studies support these activities, and a variety of formulations derived from different parts of the plant are being explored for therapeutic use. **Discussion:**While traditional use and experimental studies highlight the broad therapeutic potential of *N. nucifera*, gaps remain in clinical evidence and standardization protocols. Most current data are limited to preclinical models, with insufficient human trials to establish efficacy, safety, dosage, and long-term effects. **Conclusion:***Nelumbo nucifera* demonstrates substantial therapeutic promise, supported by both traditional knowledge and pharmacological research. However, further clinical studies, standardization of active compounds, and safety assessments are necessary to validate its integration into modern healthcare systems. Expanded scientific investigation will be essential to realize its full potential as a complementary or alternative medicinal agent.

**Keywords**- Nelumbo nucifera; Sacred lotus; Traditional medicine; Phytochemistry; Pharmacological activities; *Ayurveda*; Antioxidant; Anti-inflammatory; Ethnopharmacology; Herbal therapeutics

**INTRODUCTION**

*Nelumbo nucifera* Gaertn., commonly known as the Sacred Lotus, is an important medicinal and symbolic plant belonging to the family Nymphaeaceae. It is a perennial aquatic herb characterized by large, circular leaves and showy pink or white flowers, thriving in freshwater ecosystems. In classical Ayurvedic texts, this plant holds significant therapeutic and cultural relevance. It is referred to by numerous Sanskrit names such as *Kamal*, *Padma*, *Nalin*, *Aravinda*, *Mahotapala*, *Sahasrapatra*, *Kusheśaya*, *Pankeruha*, *Saras*, and *Rajeev*, reflecting its physical attributes and mythological symbolism in Indian tradition [1].

The plant has a wide range of regional names across the Indian subcontinent. In Hindi, it is known as *Kamal* or *Puraana*; in Bengali, it is referred to as *Padma*; in Malayalam and Gujarati, it is also called *Kamal*; in *Tamil*, it is termed *Tamrae*; in *Telugu*, it is known as *Ara Tamara*; and in *Kannada*, it is referred to as *Pumposha*. In Arabic, it is occasionally mentioned as *Katilunhala* [2]. These vernacular names demonstrate its widespread recognition and usage in various traditional health systems and cultural practices.

Numerous synonyms for *Nelumbo nucifera* appear in classical Ayurvedic literature, highlighting its revered status. These include *Nalini*, *Kamolini*, *Pundarika*, *Saarasa*, *Tamrasa*, *Shatapatra*, *Saroruha*, *Ambuja*, *Pankaj*, *Kairava*, *Shrigandha*, *Shivapushpa*, *Putakini*, *Padmavati*, *Pathoruha*, *Pushkara*, *Variruha*, *Salilaja*, and *Suryavallabha*, among many others. Each of these names symbolizes specific aspects of the plant—its habitat (aquatic origin), appearance (many-petaled, pink/white), or spiritual connotations (purity, divinity) [3].

In the Ayurvedic pharmacological classification, *Nelumbo nucifera* has been described in different Ganas (herbal groups). According to *Chakradatta*, it is included under *Mutravirechaneeya Gana*, which groups herbs with diuretic and urinary cleansing properties [4]. In Sushruta Samhita, it finds mention under the *Uttaphaladi Gana*, while Acharya Vagbhata categorizes it under *Mutraviranjaniya Dravyas*, which are known to cleanse and improve the colour of urine [5].

The extensive nomenclature and classification of *Nelumbo nucifera* in classical literature and regional dialects reflect not only its therapeutic significance but also its cultural and spiritual value across diverse traditions. This rich heritage, combined with modern phytopharmacological research, underscores its continued relevance in integrative medicine.

**AIMS AND OBJECTIVES**

**Aim**

To comprehensively explore the medicinal significance of *Nelumbo nucifera* Gaertn. by reviewing its traditional Ayurvedic applications and correlating them with modern scientific findings related to its phytochemistry and pharmacological activities.

**Objectives**

1. To document and analyse the classical references related to *Nelumbo nucifera* from traditional Ayurvedic texts and Nighantus, focusing on its synonyms, pharmacological actions (*karma*), and therapeutic indications.
2. To compile regional and vernacular nomenclature of the plant across different Indian languages, emphasizing its widespread cultural and medicinal relevance.
3. To review the phytochemical constituents, present in various parts of the plant (flowers, leaves, seeds, rhizomes, etc.) and their bioactive properties.
4. To examine the pharmacological activities of *Nelumbo nucifera* as reported in experimental, preclinical, and clinical studies, including antioxidant, anti-inflammatory, antidiabetic, cardioprotective, and neuroprotective effects.
5. To bridge traditional Ayurvedic knowledge with contemporary scientific evidence to support the integrative use of *Nelumbo nucifera* in modern medicine.
6. To identify gaps in existing literature and propose directions for future research regarding the standardization, safety profiling, and clinical applications of the plant.

**MATERIALS AND METHODS**

This review was conducted using a comprehensive and systematic approach to collect, analyze, and interpret information on the traditional uses and scientific findings related to *Nelumbo nucifera* Gaertn. The primary objective was to consolidate knowledge from classical Ayurvedic literature along with contemporary research, including phytochemical, pharmacological, and therapeutic studies.

**Literature Sources**

Information was gathered from classical Ayurvedic texts such as *Charaka Samhita*, *Sushruta Samhita*, *Ashtanga Hridaya*, *Bhavaprakasha Nighantu*, and *Dravyaguna Vijnana*. Additionally, relevant commentaries and translated works were referred to for traditional therapeutic applications and nomenclature.

Modern scientific data were collected from multiple sources including:

* Peer-reviewed journals indexed in PubMed, ScienceDirect, Scopus, and Google Scholar
* National and international research repositories (e.g., AYUSH Research Portal, ResearchGate)
* Books and monographs on medicinal plants, Ayurvedic pharmacology, and ethnobotany

Keywords used for database searches included: "*Nelumbo nucifera*", "Sacred Lotus", "Ayurveda", "pharmacological activity", "traditional uses", "lotus phytochemistry", and "Nymphaeaceae".

**Inclusion Criteria**

* Articles and texts that provided information on any part of *Nelumbo nucifera* (flowers, seeds, leaves, roots, rhizomes)
* Studies detailing phytochemical analysis, traditional uses, pharmacological properties, or clinical relevance
* Publications in English and Sanskrit with authentic and citable sources

**Exclusion Criteria**

* Articles lacking scientific validation or citation
* Studies not related directly to *Nelumbo nucifera*
* Non-peer-reviewed or anecdotal reports without reproducible data

**Data Extraction and Synthesis**

The collected data were categorized based on the following parameters:

1. Botanical identity and traditional nomenclature
2. Phytochemical constituents of different plant parts
3. *Ayurvedic* Pharmacodynamic Profile from Classical *Nighantus*
4. Therapeutic actions as per Ayurveda
5. Experimental pharmacological activities
6. Documented clinical and ethnomedicinal uses

Information was critically analyzed, compared across sources, and synthesized into thematic sections to provide a holistic view of *Nelumbo nucifera* from both traditional and scientific standpoints. Priority was given to studies with reproducible results and clear methodology.

1. **Botanical identity and traditional nomenclature**

*Nelumbo nucifera* Gaertn. is a perennial aquatic herb characterized by its large floating leaves and prominent red or pink flowers. The plant thrives in freshwater bodies such as lakes, ponds, and slow-moving streams throughout India. It grows from thick rhizomes rooted in the mud and sends up long stalks bearing the emblematic lotus blooms, which are not only botanically significant but also hold spiritual importance in various cultural traditions [6].

1. **Phytochemical constituents of different plant parts**

*Nelumbo nucifera* contains a rich array of bioactive secondary metabolites, primarily alkaloids, flavonoids, phenolic acids, terpenoids, polysaccharides, tannins, steroids, and essential oils. Alkaloids such as nuciferine, neferine, liensinine, isoliensinine, coclaurine, norcoclaurine, and roemerine have been isolated from seeds, leaves, flowers, and embryos. Major flavonoids include quercetin, kaempferol, luteolin, apigenin, isorhamnetin, syringetin, and myricetin, along with numerous O‑ and C‑glycosides (e.g., orientin, vitexin, isovitexin) that occur mainly in leaves, flowers, seed embryos, and rhizomes. Phenolic acids such as caffeic, chlorogenic, gallic, ferulic, and sinapic acids also contribute to its antioxidant properties. These compounds have been identified and quantified using advanced chromatographic and spectral techniques. These compounds are known for their antioxidant, anti-inflammatory, and neuromodulatory effects, and they contribute to the plant’s diverse pharmacological actions [7,8].

In Ayurvedic practice, the whole plant (*Panchanga*) is considered medicinally valuable. Common formulations include Churna (powder) administered in doses of 3 to 6 grams, and *Mulaswarasa* (expressed root juice) given in quantities of 10 to 20 ml, depending on the condition being treated and the patient's constitution [9].

**Table 1: Phytochemical Constituents of *Nelumbo nucifera* by Plant Part**

|  |  |  |
| --- | --- | --- |
| **Plant Part** | **Key Phytochemicals** | **Major Pharmacological Activities** |
| **Flowers** | Robinin (Flavonoid glycoside) | Antioxidant, Anti-inflammatory |
| **Leaves** | Nuciferine, Asimilobine, Liirnidine (Alkaloids) | Neuroprotective, Sedative, Anti-obesity |
| **Roots** | Isoliensinine, Neferine, Armepavine (Isoquinoline alkaloids) | Antioxidant, Cardioprotective, Hepatoprotective |
| **Seeds** | Romerin, Nornuciferine, Neferine | Antioxidant, Anti-diabetic, Neuromodulatory |
| **Whole Plant (Panchanga)** | Combination of all above constituents | Holistic, Multi-system therapeutic action |

1. **Therapeutic actions as per Ayurveda**

*Nelumbo nucifera* is credited with numerous therapeutic properties according to classical Ayurvedic texts. It is considered *Dahaprashamana* (relieves burning sensations), *Varinya* (enhances complexion), *Medhya* (promotes intellect), *Chhardi-Nigrahana* (anti-emetic), *Trishna-Nigrahana* (quenches excessive thirst), *Sthambhana* (astringent), Hridya (cardiotonic), *Sonitsthapana* (hemostatic), and *Prajasthapana* (supports fertility). It is also classified under *Mutravirechaniya* (diuretic), *Twakdoshahara* (beneficial in skin disorders), *Jwaraghna* (antipyretic), *Balya* (strength-promoting), *Vishaghna* (antitoxic), and *Raktavikaraghna* (blood purifier) [10,11].

The herb is traditionally indicated in a broad range of conditions, including burning sensation (*Daha*), ulcers and wounds (*Vrana*), cognitive weakness (*Mastika Daurbalya*), vomiting (*Vamana*), thirst (*Trishna*), diarrhea (*Atisara*), dysentery (*Pravahika*), cardiac diseases (*Hridaya Roga*), bleeding disorders (*Raktapitta, Raktasthambhana*), threatened miscarriage (*Garbhasrava*), urinary disorders (*Mutrakrichchhra*), skin conditions (*Varnya Vikara, Charma Vikara*), fevers (*Jwara*), toxic states (Visha), boils and blisters (*Vishphota*), vertigo (*Bhrama*), and heat exhaustion (*Santapa*) [12].

Traditional practices across various *Ayurvedic* treatises document specific uses of *Nelumbo nucifera*. The roots are chewed in cases of intestinal worm infestation [13]. Stamens, when ground with rice water and mixed with sugar candy juice, are administered in paediatric diarrhoea (*Balatisara*) [14]. The tender leaves, taken along with sugar, are believed to be effective in rectal prolapse [15]. A combination of the bark of pomegranate (*Dadima*) and lotus (*Kamal*), prepared with rice water, is traditionally used in the management of fever-associated diarrhoea (*Jwaraatisara*), as mentioned in *Bhavaprakasha Nighantu* [16].

1. **Ayurvedic Pharmacodynamic Profile from Classical Nighantus**

The Ayurvedic pharmacodynamic characteristics of Nelumbo nucifera Gaertn. have been documented across several classical Nighantus, highlighting its multifaceted therapeutic potential. According to Priya Nighantu (P.N.), the plant exhibits ***Kashaya* (astringent), *Madhura* (sweet),** and ***Tikta* (bitter)** Rasa, possesses a ***Sheeta* (cold) *Virya, Madhura Vipaka***, and exhibits ***Laghu* (light),*****Snigdha* (unctuous),** and ***Picchila* (slimy)** Guna. These qualities collectively enable it to pacify ***Kapha* and *Pitta doshas,*** making it beneficial in inflammatory and bleeding disorders [17]. In Raja Nighantu (R.N.), it is noted to have ***Madhura Rasa*** and ***Sheeta Virya***, and is specifically classified as a ***Raktapitta-nashaka***, which indicates its utility in managing hemorrhagic conditions and Pitta-related imbalances [18]. Sodal Nighantu (S.N.) describes it similarly with ***Kashaya, Madhura***, ***Rasa,*** further supporting its role as a ***Kapha-Pitta Shamaka*** [19]. The Dhanvantari Nighantu (D.N.) emphasizes its ***Sheeta Virya*** and ***Ruksha* (dry)** Guna, adding to its ability to reduce both Kapha and Pitta doshas effectively [20]. Bhavaprakasha Nighantu (B.P.N.) attributes ***Madhura* and *Lavana Rasa, Sheeta Virya,*** and ***Guru* (heavy)** and ***Ruksha Guna,*** indicating its action as a ***Pitta-Rakta Nashaka*** and ***Kaphahara***, suitable for conditions like burning sensations, skin disorders, and bleeding diatheses [21]. In Kaiyadeva Nighantu (K.N.), it is described as having ***Tikta, Kashaya, and Madhura Rasa, Sheeta Virya, Katu Vipaka***, along with ***Laghu*** and ***Grahi Guna***. These properties make it absorbent and cooling, aiding in diarrhea, dysentery, and inflammatory conditions, while also being noted for its ***Vatakaraka*** and ***Kapha-Pitta* balancing** actions [22]. According to Madanapala Nighantu (M.P.N.), the plant is characterized by a ***Sheeta Virya*** and ***Guru Guna,*** classifying it as ***Pitta-Kapha Hara*** and a ***Raktadosha Hara***, reinforcing its efficacy in purifying blood and managing heat-related disorders [23]. Lastly, Nighantu Adarsha (N.A.) reiterates its ***Tikta, Kashaya,* and *Madhura Rasa, Sheeta Virya,*** and ***Katu Vipaka***, identifying it as a potent ***Kapha-Pitta Hara*** agent, suitable for a wide spectrum of Pitta and Kapha-dominant conditions [24].

The consistency of these attributes across multiple classical texts supports the broad therapeutic applicability of Nelumbo nucifera in traditional practice, particularly for disorders involving inflammation, bleeding, excess heat, and mucosal imbalance.

**Table 2: Pharmacodynamic Attributes of *Nelumbo nucifera* According to Ayurvedic Nighantus**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***S.No.*** | ***Nighantu (Ayurvedic Text)*** | ***Rasa (Taste)*** | ***Virya (Potency)*** | ***Vipaka (Post-digestive Effect)*** | ***Guna (Qualities)*** | ***Doshaghnata (Dosha-Alleviating Action)*** |
| ***1*** | *Priya Nighantu (P.N.)* | *Kashaya, Madhura, Tikta* | *Sheeta* | *Madhura* | *Laghu, Snigdha, Picchila* | *Kaphapittashamaka* |
| ***2*** | *Raja Nighantu (R.N.)* | *Madhura* | *Sheeta* | *—* | *—* | *Raktapittanashaka* |
| ***3*** | *Sodhal Nighantu (S.N.)* | *Kashaya, Madhura, Sheeta* | *—* | *—* | *—* | *Kaphapittashamaka* |
| ***4*** | *Dhanvantari Nighantu (D.N.)* | *—* | *Sheeta* | *—* | *Ruksha* | *Kaphapittashamaka* |
| ***5*** | *Bhavaprakasha Nighantu (B.P.N.)* | *Madhura, Lavana* | *Sheeta* | *—* | *Guru, Ruksha* | *Pittaraktanashaka, Kaphanashaka* |
| ***6*** | *Kaiyadeva Nighantu (K.N.)* | *Tikta, Kashaya, Madhura* | *Sheeta* | *Katu* | *Laghu, Grahi* | *Vatakaraka, Kaphapittanashaka* |
| ***7*** | *Madanapala Nighantu (M.P.N.)* | *—* | *Sheeta* | *—* | *Guru* | *Pittakaphahara, Raktadoshahara* |
| ***8*** | *Nighantu Adarsha (N.A.)* | *Tikta, Kashaya, Madhura* | *Sheeta* | *Katu* | *—* | *Kaphapittahara* |

**5. Experimental Pharmacological Activities**

*Nelumbo nucifera* Gaertn. has demonstrated a wide array of pharmacological activities in experimental models, reinforcing its traditional applications through modern scientific validation.

Antimicrobial activity of *N. nucifera* flowers was evaluated using hydroethanolic extracts in an in vitro setting, where the extract exhibited significant antibacterial activity. Zones of inhibition were observed against *Escherichia coli* (14 mm), *Bacillus subtilis* (13 mm), and *Staphylococcus aureus* (11 mm), with moderate inhibition noted for *Pseudomonas aeruginosa* (8 mm) and *Klebsiella pneumoniae* (10 mm). Notably, the extract was found to be more effective against Gram-negative bacteria, challenging earlier assumptions that plant extracts typically favor Gram-positive strains. These results were benchmarked against chloramphenicol (30 µg/ml), a standard antibiotic used for comparison [25].

In terms of antiviral potential, ethanol extracts of *N. nucifera* seeds have shown inhibitory effects on Herpes Simplex Virus-1 (HSV-1). At a concentration of 100 mg/ml, the extract demonstrated an IC50 of 50 mg/ml. A specific subfraction known as NNFR (Nelumbo Nucifera Fractionated Residue) was found to suppress HSV-1 replication in HeLa cells by 85.9% at 50 mg/ml. Mechanistically, NNFR appears to downregulate the synthesis and transcription of immediate early viral proteins such as ICP0 and ICP4, thereby inhibiting downstream viral replication. This suggests that *N. nucifera* possesses promising antiviral properties, particularly in cases resistant to standard antivirals like acyclovir [26].

Antipyretic effects were observed in yeast-induced pyrexia models in rats, where ethanol extracts of *N. nucifera* stalks, administered at 200 and 400 mg/kg, significantly reduced elevated body temperatures. The effect was dose-dependent and comparable to standard antipyretic drugs such as paracetamol. The extract also exhibited a normalizing influence on basal body temperature in afebrile rats, confirming its antipyretic potential [27].

The plant also exhibits strong antioxidant activity. Methanolic extracts of *N. nucifera* leaves were tested against hydrogen peroxide-induced oxidative stress in Caco-2 cells. The extract, at concentrations ranging from 0.1–0.3 mg/ml, provided dose-dependent protection against reactive oxygen species (ROS)-induced cytotoxicity. Additionally, it showed inhibition of plasmid DNA oxidation and haemoglobin-induced linoleic acid peroxidation, confirming its free radical scavenging capability [28].

The hepatoprotective effects of *N. nucifera* were validated in a rat model of carbon tetrachloride (CCl₄)-induced liver toxicity. Leaf extracts administered at doses of 300 and 500 mg/kg significantly reversed hepatic damage, comparable to the protective effects of silymarin (100 mg/kg), a standard hepatoprotective agent. Biochemical markers such as ALT, AST, and histopathological changes confirmed the extract’s liver-protective role [29].

In studies assessing immunomodulatory activity, *N. nucifera* rhizome extract was tested in vivo using models that evaluated total and differential leukocyte count (TLC and DLC), neutrophil adhesion, phagocytic index, nitroblue tetrazolium (NBT) reduction, and delayed-type hypersensitivity (DTH) responses. Animals treated with doses of 100 and 300 mg/kg of rhizome extract showed increased TLC and lymphocyte percentages, with a concurrent decrease in neutrophils. Moreover, the DTH reaction was significantly enhanced, and neutrophil adhesion to nylon fibers improved (63.22% and 62.91% respectively), indicating heightened immune responsiveness. These findings suggest that *N. nucifera* enhances host immunity by modulating both cellular and innate immune parameters [30].

**6. Documented Clinical and Ethnomedicinal Uses**

Nelumbo nucifera Gaertn., commonly known as the sacred lotus, has been extensively used in various traditional medicine systems, including Ayurveda, Unani, Siddha, and folk medicine, for centuries. Classical Ayurvedic texts describe its application in conditions such as Raktapitta (bleeding disorders), Atisara (diarrhea), Trishna (excessive thirst), Jwara (fever), Hridaya roga (cardiac ailments), Vishavikara (toxic conditions), and Garbhasrava (threatened abortion) due to its *Sheeta virya* (cooling potency), *Madhura and Kashaya rasa*, and *Pitta-Kapha shamaka* properties [31]. Different parts of the plant — rhizomes, seeds, flowers, stamens, and leaves — are utilized for specific indications. For example, lotus seeds (Padma beeja) are regarded as medhya (brain tonics) and vrishya (aphrodisiac), while lotus stamens are traditionally used in dysentery and diarrhea, especially in children [32].

Ethnomedicinally, tribal and rural communities across India and Southeast Asia use the rhizomes as anti-diarrheal, anthelmintic, and nutritive agents, and also for treating leucorrhea, skin diseases, and urinary disorders. In Andhra Pradesh and parts of Odisha, tender leaves are crushed and mixed with sugar to manage rectal prolapse in children. The stalk juice is traditionally used in hyperacidity and burning sensation [33]. The flowers are also consumed to alleviate menorrhagia, while the seed powder is given with honey in general debility and semen disorders. Some formulations also include lotus flower paste as a topical application for burns and skin eruptions [34].

Recent clinical observations and integrative medicine practices have supported several of these claims. Preliminary clinical data suggest that lotus seed extracts may have anti-diabetic effects by modulating blood glucose levels and enhancing insulin sensitivity. In Unani medicine, it is prescribed as a cardioprotective, astringent, and anti-inflammatory agent in compound formulations [35]. Moreover, the plant is used in modern naturopathic therapies for its antioxidant, detoxifying, and calming effects, especially in stress-related disorders and metabolic syndromes. These documented uses from diverse sources validate *Nelumbo nucifera* as a holistic medicinal plant with applications in both preventive and therapeutic domains.

**DISCUSSION**

Nelumbo nucifera Gaertn., commonly referred to as the sacred lotus, holds a unique position in traditional medicine systems, particularly *Ayurveda*, due to its broad therapeutic spectrum and symbolic significance. Ancient *Ayurvedic* texts have extensively documented the medicinal use of its various parts—flowers, seeds, leaves, roots, and rhizomes—under the classification of *Panchanga*, attributing to it properties such as *Sheeta* *Virya* (cool potency), *Kashaya, Madhura*, and *Tikta Rasa,* and *Kapha-Pitta Hara* actions [36]. The pharmacodynamic descriptions across classical texts such as *Bhavaprakasha, Raja Nighantu,* and *Kaiyadeva Nighantu* consistently highlight its efficacy in conditions involving *Raktapitta* (bleeding disorders), *Jwara* (fever), *Trishna* (excessive thirst), *Atisara* (diarrhoea), and *Vishavikara* (toxic conditions) [37].

From a modern pharmacological standpoint, Nelumbo nucifera exhibits a diverse range of bioactivities supported by experimental and preclinical studies. Its various phytoconstituents—especially alkaloids such as Nuciferine, Neferine, and Isoliensinine—have shown potent antioxidant, anti-inflammatory, neuroprotective, hepatoprotective, and antidiabetic effects [38,39]. The flower extracts demonstrated antimicrobial activity against both Gram-positive and Gram-negative bacteria, while seed and leaf extracts exhibited significant antiviral and antioxidant effects in vitro [40]. These findings are congruent with the plant’s traditional usage in treating infections, fevers, and chronic inflammatory conditions [41].

Moreover, Nelumbo nucifera’s immunomodulatory activity, as observed in animal models, supports its application in enhancing host immunity—an area of growing interest, especially in integrative and preventive healthcare [42]. Clinical observations and ethnobotanical records also reveal the use of its different parts in managing gynaecological conditions, cardiac ailments, urinary tract disorders, and paediatric gastrointestinal diseases [43]. Such evidence reinforces its position not only in traditional practices but also in potential modern formulations aimed at holistic management of chronic and lifestyle disorders.

However, despite its long-standing traditional usage and promising experimental evidence, Nelumbo nucifera remains underexplored in terms of large-scale clinical validation. There is a need for standardized extract preparation, pharmacokinetic profiling, dose optimization, and toxicity studies to ensure its safe and evidence-based integration into mainstream medicine [44]. Furthermore, its potential for phytopharmaceutical drug development deserves deeper investigation through advanced molecular and pharmacological approaches [45].

**CONCLUSION**

Nelumbo nucifera represents a bridge between ancient wisdom and modern science. Its extensive traditional use, coupled with emerging pharmacological data, highlights its relevance as a multipurpose medicinal plant. A multidisciplinary approach combining classical Ayurvedic insights with contemporary research methodologies could pave the way for its therapeutic mainstreaming, especially in chronic, degenerative, and metabolic health conditions.

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, manuscript.

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