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A Comprehensive Review of the Phytochemistry and Pharmacological Potential of *Urtica parviflora*: An Ethnomedicinal Perspective

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ABSTRACT

Urtica parviflora Roxb., commonly known as Himalayan nettle is a medicinal herb widely distributed in the Himalayan region and traditionally used for inflammatory conditions, metabolic disorders, wound healing and general health restoration. This review summarizes the current knowledge on its phytochemical constituents, pharmacological activities, traditional and ethnomedicinal uses, and toxicological profile. Evidence indicates promising antioxidant, anti-inflammatory, antimicrobial, nephroprotective, wound-healing and hepatoprotective activities. However, research remains largely limited to *in vitro* and *in vivo* experimental models with insufficient clinical trials and toxicological evaluations. The review highlights research gaps and future directions for developing standardized herbal formulations, safety validation and the clinical applications of *Urtica parviflora* as a potential therapeutic agent. A comprehensive literature survey was conducted to collect relevant information on *Urtica parviflora*. Published scientific data up to the year 2025 were retrieved from standard electronic databases such as ScienceDirect, Google Scholar, Scopus, PubMed and Web of Science. Relevant peer-reviewed research articles, review papers, books and ethnomedicinal reports published in the English language were screened. This updated comprehensive review includes 43 articles related to *Urtica parviflora* covering its traditional uses, phytochemistry and pharmacological potential. The current study highlights significant antioxidant, hypoglycaemic, cardioprotective and hepatoprotective activities of *Urtica parviflora* indicating that the plant may serve as a valuable source for future drug development. However, despite these promising findings comprehensive pharmacological studies and clinical trials are still needed to validate its therapeutic profile. Continued investigation will help clarify its therapeutic potential and support its integration into evidence-based medicine.

Keywords: *Urtica parviflora*, Himalayan medicinal herb, antioxidant, ethnomedicine, anti-nflammatory, pharmacological activity.

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INTRODUCTION

The genus *Urtica* belongs to the family Urticaceae and is classified under the Angiosperms. This genus comprises of 46 plant species.[1]The most significant species include *Urtica dioica* L. and *Urtica urens* L. which can reach up to 2m in height.[2] *Urtica parviflora* Roxb. belongs to the family Urticaceae. It is a bisexual, evergreen herb found in damp regions of evergreen forest.[3,4,5] (Figure 1) It occurs at an altitude of 1700-2800 m above sea level and is distributed in India and other South Asian countries.[6,7] This medicinal plant is known by various vernacular names such as shishoon in Kumaon and kandali in the Garhwal regions of Uttarakhand. The plant is rich in nutrients. The leaves of this herb possess of stinging trichomes that causes a burning and itching sensation upon dermal contact due to the presence of inflammatory mediators such as 5-hydroxytryptamine and histamine.[7,8] The tender (newly emerged) leaves of the herb are consumed as food in the Western Himalayan region. When cooked, they are palatable, nutritious and a rich source of nutrients mainly, αtocopherol and vitamin C. The herb has been conventionally utilized for various therapeutic applications. Its seed oil is edible and possesses therapeutic peoperties, and is used in the alleviation of sciatica, rheumatism and numerous skin disorders.[9] Ethnobotanically, this plant is utilized in the treatment of digestive, joint and liver ailments while the young leaves are used to treat goiter and associated pain.[10,11,12,13] Allergic disorders such as cough and cold are also treated using the leaves of this herb. It is utilised for hair cleansing and has been reported to treat hair loss. The fresh roots and leaves are used for the management of bone fractures and joint dislocation.[14] The presence of autacoids has also been confirmed in the leaves of this medicinal herb.[15,16] The young inflorescence of plant is traditionally used by local women as a cleansing and invigorating agent after childbirth.[17,18] Fibres of *Urtica parviflora* are utilized for biomedical applications.[5] Biodynamic preparations are also made from the leaves of Himalayan stinging nettle.[19] The inflorescences are traditionally employed as a post-parturition cleansing agent and for the treatment of dermatitis in the alpine regions of the eastern and central Himalayas.[20] The plant is considered an important medicinal species due to its diverse therapeutic uses.[3,7,8] Although this species appears promising for health care applications, limited well documented research is currently available. Therefore, the rationale of the present review is to critically evaluate and analyse the available scientific and traditional data related to *Urtica parviflora*. This review primarily focuses on pharmacognostic parameters and traditional uses to highlight its ethnopharmacological importance and pharmacological activities thereby supporting its therapeutic potential. This comprehensive review aims to connect modern scientific research and traditional knowledge as well as to encourage further experimental and clinical studies to explore its potential as a safe and effective natural therapeutic agent.



Fig. 1: *Urtica parviflora* Roxb. with its habitat

Methodology

Source and Search Strategy

A comprehensive literature survey was conducted to collect relevant information on *Urtica parviflora* published scientific data up to the year 2025 were retrieved from standard electronic databases such as PubMed, Google Scholar, ScienceDirect, Scopus, and Web of Science. Keywords used for the search included *Urtica parviflora*, Himalayan nettle, pharmacognosy, phytochemistry, pharmacology, and traditional uses. Relevant peer-reviewed research articles, review papers, books and ethnomedicinal reports published in the English language were screened.

Inclusion and Exclusion Criteria

The present review includes all available and relevant scientific literature on *Urtica parviflora* Roxb. published up to the year 2025. Studies related to its pharmacognostic, phytochemical, pharmacological, and traditional uses reported in peer-reviewed journals, books, and authenticated sources in the English language were considered. Publications related to other species of the genus *Urtica* without specific reference to *Urtica parviflora* Roxb. were excluded. Studies with insufficient scientific evidence, unclear methodology, duplicate data or those unrelated to the medicinal relevance of the plant were not included.

Geographical distribution

Urtica parviflora is mostly present in shady and moist areas at the altitude of 1700- 2800 m above sea level. This plant is present in India and its neighbouring nations. In India it is found in multiple states across the Himalayan and southern regions.[8]

Taxonomy[3,8]

Kingdom	Plantae
Subkingdom	Tracheobionta
Super division	Spermatophyta
Division	Angiospermae
Class	Dicotyledone
Subclass	Archichlamydeae
Order	Urticales
Family	Urticaceae
Genus	Urtica
Species	*Urtica parviflora* Roxb.

Common names of *Urtica parviflora*

*Urtica parviflora*is recognized by several vernacular names, including, English: Nettle, Sting Nettle, Himalayan Stinging Nettle; Hindi: Bichubuti; Nepalese: Ghariya Sisno; Bengali: Paharah Bichuti; Garhwali: Kandli; Kumaoni: Shishoon.[8]

Botanical description

Urtica parviflora is a perennial, monoecious herb attaining a height of 2-4 feet. It is commonly present in partially shaded and moist areas of evergreen forests.The herb is characterized by widely spreading, stoloniferous rhizomes forming a perennial rootstock. Leaves are dark green, coarsely serrate with prominent margins and distinct venation on the lower surface and bear stinging hairs. They are opposite, borne on wiry and erect stem.The stem is firm, hairy, sparsely branched and quadrangular. It ranges from 25–50 cm in height and green when young plants becoming purple to reddish with age. The plant has a grooved, hollow and wiry stem covered with stinging hairs. The entire plant bears erect, bristly glandular hairs containing acetylcholine, formic acid, 5-hydroxytryptamine and histamine. It blooms in mid-year, bearing small greenish to greenish-white flowers arranged in drooping clusters. Fruiting occurs between June to October. The fruits are broadly oval achenes, yellow-green in colour and a moderately flattened.[8,10,11,12,13] The morphological characters of various components of the plant *Urtica parviflora* are shown in Table 1.

Propagation

Urtica parviflora is often regarded as a weed due to its rapidly spreading perennial root system which is difficult to eradicate once established. The plant can be propagated through vegetative or seeds division. The seeds are minute and can be easily handled when mixed with sand. In early spring when the young plants reach a height of 3-4 inches, they should be transplanted to a herbal nursery, maintaining a spacing of approximately 20 cm and water as required during warm season. The best time for harvesting young leaves and shoots is from spring through September when the plants have reached a height of about 20 cm. Wear gloves during harvesting to avoid stings from the small hairs on leaves and stems. In young plants, only the top bud set should be harvested and removal of the terminal bud stimulates lateral growth, allowing continuous harvesting. Seed should be collected upon maturity while roots are typically harvested in autumn for use in herbal preparations.[19,8,26]

Microscopic description

Microscopic examination of the leaves of *Urtica parviflora*, as reported in previous studies, revealed distinct diagnostic features. The transverse section showed the presence of both epidermal layers with a thick cuticle. Anomocytic stomata were reported to be present on both surfaces. Beneath the epidermis, 5-6 layers of collenchyma were clearly visible, providing mechanical support to the leaf. The vascular system consisted of well-developed xylem and phloem arranged in vascular bundles. Calcium oxalate crystals in the form of prisms were also observed within the tissues.

Table 1: Morphology and distribution of *Urtica parviflora*

S. No.	Plant parts	Description	References
1.	Stem	Herbaceous, erect, often covered with stinging hairs	21,22
2.	Leaves	Opposite, simple, serrated margins, stinging hairs present	21,22,2
3.	Stipules	Present, variable in form, sometimes used for species identification	21,23
4.	Flowers	Small, greenish, unisexual, arranged in clusters; male and female flowers on separate plants	21
5.	Roots	Fibrous root system	21
6.	Stinging Hairs	Urtica type, needle-like trichomes injecting irritants (histamine, acetylcholine)	21,22
7.	Diagnostic Traits	Stinging hairs, opposite leaves, stipules, herbaceous habit	21,22,23
8.	Geographic Range	Himalayan region	6,24,25
9.	Altitudinal Range	400–3000 meters above sea level	6,24
10.	Habitat	Moist, partly shady areas, forest margins, disturbed sites	6,24,25
11.	Associated Flora	Grows with diverse Himalayan plant communities	24,25

Notably, the midrib region lacked palisade tissue[3,8]. Furthermore, powder microscopy of leaves as reported in earlier studies revealed the presence of unicellular trichomes, prism-shaped calcium oxalate crystals, elongated and uniform epidermal cells, and anomocytic stomata. These microscopic characteristics serve as reliable parameters for the identification and authentication of *Urtica parviflora* leaves.

Traditional and contemporary uses

Urtica parviflora has a been used traditionally for conditions like goitre, cough, allergies, and fevers. Its leaves are consumed as a nutritious food especially after cooking, which reduces the risk of stinging and irritation.[8,27] It has been reported to be used in ethnoveterinary medicine for treating infected wounds of livestock.[28] (Table 2)

Phytochemistry

Stinging nettle is a rich source of nutrition. Its typical composition includes protein (22%), lipids (4%), non-nitrogen extracts (37%), fiber (9–21%) and ash (19–29%). Depending on season and growing conditions (shade or sunlight), each gram of dry leaves contains approximately 4.8 mg of chlorophyll. Interestingly, plants grown in shaded conditions exhibit higher levels of carotenoids and chlorophyll. The fibres obtained from nettle stems are processed using a retting process similar to that used for linen and have historically been utilized for comparable purposes. Unlike cotton, nettles can be cultivated with minimal or no use of insecticides. This medicinal plant also contains various bioactive compounds, including autacoids, as well as amino acids such as tryptophan, tyrosine, serine, and aspartic acid, along with organic acids like malic acid. Additionally, it is rich in vitamins, including αtocopherol and vitamin C.[4,8,15] The chemical structure of the constituents present in *Urtica parviflora* are shown in Figure 2.

Pharmacological reports

Hepatoprotective action

The ethanolic extract of the leaves of *Urtica parviflora* was investigated for its hepatoprotective potential against carbon tetrachloride (CCl_4) induced hepatic injury in rats. The ethanolic extract when administered orally reduced elevated levels of alkaline phosphatase (ALP), aspartate aminotransaminase (AST), serum protein and total bilirubin. Histopathological examination of liver tissue further confirmed its hepatoprotective effects.[34,35,36,37]

Wound healing action

The methanolic leaf extract of this medicinal

Table 2: Ethnomedicinal uses of different parts of *Urtica parviflora*

Use Category	Ethnobotanical Application	Plant Part Used	Preparation / Mode of Use	Ref.
Endocrine Disorders	Treatment of goitre and associated pain	Young leaves	Applied directly/eaten as vegetable	3,8
	Relief from goitre or localized pain	Young twigs with stinging hairs	Applied externally	
Respiratory Disorders	Relief from cold and cough	Leaves	Eaten as vegetable	3,8
	Used to treat allergic disorders such as cold and cough	Leaves	Various traditional preparations	
Cardiovascular disease	Lowers or controls Blood pressure	Leaves	Leaves cooked with rice maize or finger millet flour and made to chapatti	29
Dermatological/ Wound Healing	Treatment of boils	Fresh leaf juice	Applied topically	3,4,8
Musculoskeletal Disorders	Treatment of fractures and bone dislocations	Fresh leaf juice	Applied to affected area	3,4,8
	Used for sprains and swelling (counter-irritant)	Branches with leaves	Applied externally	30,8
	Relief from rheumatic pain	Young leafy shoots	Consumed as vegetable	30,8
Febrile Conditions	Used as febrifuge	Whole plant decoction	Taken orally	4,8
	Treatment of fevers	Plant decoction	Taken orally	30,8
ENT Disorders	Relief from throat pain	Root juice	Applied / taken orally	30,8
Urogenital Disorders	Treatment of gonorrhoea	Root juice	Taken orally	30,8
Toxic / Envenomation Treatment	Treatment for dog bite	Root decoction	Taken orally	30,8
Veterinary Uses	Reducing inflammation in fractured or injured animals	Root (poultice)	Applied topically	30,8
Fiber / Industrial Uses	Production of cloth, fishing nets, ropes, and industrial materials	Stem fibers	Processed as fiber	31,8
Women's Health	Treatment of fever and post-partum illnesses	Plant	Traditional decoction	32,8
Gastrointestinal Disorders	Used in dysentery, Stomach ache	Leaves, Root	Decoction/extract	7,8,33
Liver Disorders	Treatment of liver ailments	Leaves	Decoction/extract	7,8
Hair Care	Preventing baldness	Leaf extract	Used as hair wash	8

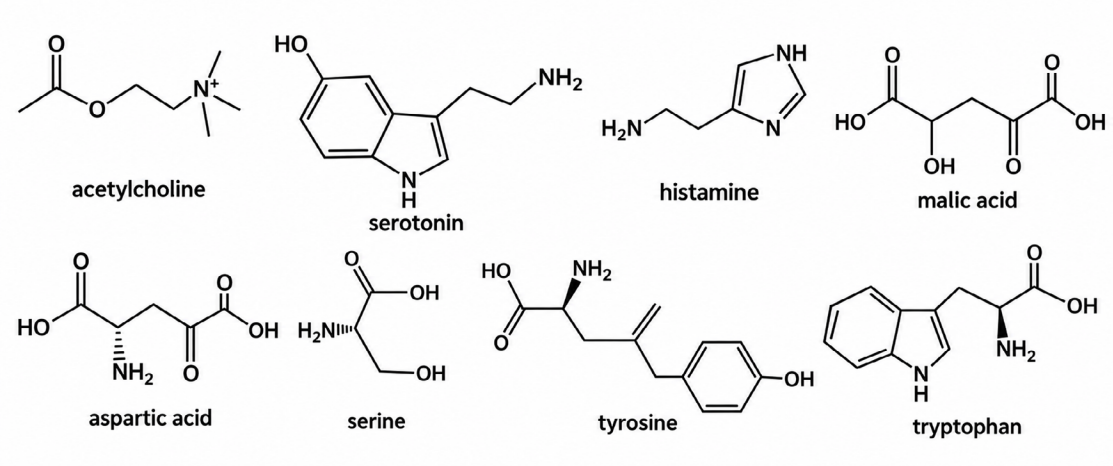


Fig. 2: Phytochemical constituents and their chemical structures

plant was evaluated for wound healing activity using various animal models including dead space, excision and incision wound models. An ointment containing 5%w/w methanolic extract of the plant was formulated as per the method described in the Indian Pharmacopoeia. The formulation was applied topically to the animal model at a dose of 300 mg/kg/day. Wound healing was assessed based on granulation tissue weight, wound contraction rate, breaking strength, epithelialization period and histopathological and hydroxyproline parameters. The extract demonstrated significant tissue regeneration activity in the treated group compared to the control.[4]

Anti-oxidant action

Various *in-vitro* assays, including DPPH radical scavenging, reducing power assay, and nitric oxide scavenging, were employed to evaluate the antioxidant potential of the hydro-methanolic extract of this medicinal herb. Ascorbic acid was used as a standard for comparison. The extract demonstrated the ability to mitigate cellular damage caused by reactive oxygen species.[7] The phytoconstituents present in the leaves exhibited significant antioxidant activity by scavenging free radicals and reducing oxidative stress. These bioactive compounds are likely responsible for the observed antioxidant effects. Overall, the extract of *Urtica parviflora* owing to its antioxidant potential, represents a valuable plant-derived source for combating oxidative stress.[7]

Cardio-protective action

The cardioprotective potential of the hydroethanolic extract of *Urtica parviflora* leaves was evaluated in a doxorubicin-induced cardiotoxicity animal model. The extract protected myocardial tissue by modulating oxidative stress markers. It also significantly reduced elevated levels of biochemical markers associated with cardiac and tissue damage. The hydroethanolic extract demonstrated a significant cardioprotective effect against doxorubicin-induced cardiotoxicity in Wistar rats.[38] Additionally, *Urtica parviflora* prevented isoproterenol-induced cardiotoxicity by enhancing endogenous antioxidant activity. The observed effects may be attributed to its antioxidant mechanisms and improvement in myocardial biomarkers.[30]

Nephroprotective action

An extract of *Urtica parviflora* showed significant nephroprotective potential against paracetamol (PCM)-induced nephrotoxicity in rat models. A decrease in the levels of serum creatinine and blood urea nitrogen (BUN) confirmed this pharmacological effect.[39]

Hypoglycemic action

The aqueous extract of the leaves of *Urtica parviflora* exhibits marked glucose-lowering effects, primarily through the inhibition of intestinal glucose absorption. The observed hypoglycaemic effect is likely attributed to the presence of various bioactive compounds including polyphenols.[40] The extract also effectively suppresses α-amylase and α-glucosidase activity *in-vitro* in a dose-dependent manner. The

Table 3: Reported pharmacological activities of Urtica parviflora

Pharmacological Properties	Experimental Model	Findings	Extract	Plant part	Dose/ Concentration	Ref.
Antidiabetic	*In vitro* enzyme inhibition assays	Extract showed significant, dos e dependent inhibition ofα-amylase and α- glucosidase enzymes; phenolic compounds were predominantly present	Ethanol	Whole plant	Alpha-amylase enzyme inhibition Maximum reduction was obtained at 84.53% and Minimum reduction was obtained at 28.34%. Alpha-glucosidase inhibition Maximum reduction was obtained at 84.17% and Minimum reduction was obtained at 32.84%.	26
	Alloxan-induced Type 2 diabetes in rats	Aqueous and chloroform extract also showed significant reduction in blood glucose levels compared to diabetic control	Petroleum Ether, Chloro form, Ethanol and Water	Leaves	250mg/kg	42
Cardioprotective	Isoproterenol-induced myocardial infarction in rats	Ethanolic extract reduced serum LDL, ALT, AST, ALP, and total cholesterol; increased antioxidant enzymes	Ethanol	Leaves	350 mg/kg and 500 mg/kg	30
Nephroprotective	Paracetamol-induced nephrotoxicity in rats	Extract reduced blood urea, BUN, creatinine, lipid peroxidation; improved antioxidant status and histology	Methanol and Water(4:1)	Leaves	250, 500 and 750 mg/kg	39
Antioxidant (*in vitro*)	DPPH scavenging assay,	High antioxidant activity, enhanced by fermentation; linked to increased phenolics and flavonoids	80% Ethanol	Leaves	0.1g/ml(5gm of leaves and volume made up to 50 ml with ethanol)	27
Anticancer (*in vitro*)	MDA-MB-231 (TNBC) cell line	Leaf and stem extracts showed significant anticancer activity and low toxicity to healthy cells	Ethanol, Chloroform ,Hexane	Leaves and Stems	-	41
Hepatoprotective	Carbon tetrachloride induced (CCL4) induced hepato-toxicity inrats	Ethanolic leaf extract showed potential hepatoprotective activity in rats	Ethanol	Leaves	250, 500 and 750 mg/kg	34

study demonstrated significant antihyperglycaemic activity thereby justifying the traditional use of this plant in the management of diabetes mellitus.[26]

Anticancer action

Extracts from *Urtica* species (*U. dioica* and *U. parviflora*) exhibited potential anticancer effects against the MDA-MB-231 (TNBC) cell line and demonstrated reduced cytotoxicity toward normal cell lines (HEK293T), suggesting their relative safety and therapeutic potential.[41] Hence, These findings may be valuable for the development of herbal, target-specific therapies for breast cancer. The pharmacological activities of the plant are summarized in Table 3.

Toxicology

Urtica parviflora, a stinging nettle species used in traditional medicine is recognized for its nutritional and therapeutic properties. However, its toxicological profile remains only partially characterized, with notable gaps in standardized dosing and comprehensive safety data. Preclinical studies in rats have shown that ethanolic and hydroethanolic extracts of *Urtica parviflora* at doses ranging from 200–750 mg/kg do not cause mortality or overt toxicity. Instead, these extracts demonstrate protective effects against induced myocardial and renal toxicity, as evidenced by improvements in biochemical and histopathological markers.[30,39] No organ damage or acute toxicity was observed at tested doses however, long-term and high-dose safety data remain limited. The plant possesses stiff stinging hairs containing serotonin and histamine which causes skin irritation, pain, and urticaria upon contact.[8,27] While these effects are typically mild and localized, severe allergic reactions may occur in sensitive individuals. Cooking or drying the plant neutralizes the stinging effect.[22] Standardized dosing guidelines for *Urtica. parviflora* are lacking in both traditional and experimental contexts. This limitation hampers safety evaluation and clinical translation as highlighted in broader reviews of ethno-medicinal plants.[43]Standardization is essential to ensure efficacy and minimize adverse effects.

Future Prospects

Urtica parviflora demonstrates significant potential as a source of bioactive compounds; however, its future applications depend on addressing key research and development limitations. Despite promising preclinical findings supporting its nephroprotective, cardioprotective, hepatoprotective and anticancer activities, there is a notable lack of clinical trials evaluating its efficacy and safety in humans. Most available data are derived from animal models and in vitro studies, and evidence supporting clinical efficacy remains limited. Existing reviews highlight the absence of comprehensive clinical and toxicological investigations and emphasize the need for well-designed clinical trials to validate its therapeutic potential. Standardization of this medicinal plant is essential to ensure safety, efficacy and reproducibility. Current studies highlight the importance of consistent extraction techniques and quantification of active phytoconstituents (viz. phenolics, flavonoids, and tannins) to achieve reliable outcomes. Although pharmacognostic evaluation and phytochemical profiling are critical, the lack of standardized extraction protocols remains a significant challenge. *Urtica parviflora* is also rich in nutrients, highlighting its potential as a nutraceutical agent. Its leaves are traditionally consumed as food, and processing methods such as fermentation/controlled drying may enhance antioxidant content supporting its application in functional foods and dietary supplements. Additionally, its use in animal nutrition further supports its nutraceutical value. Several studies have demonstrated that the antioxidant activity of *Urtica parviflora* is largely attributed to its high content of polyphenols, flavonoids, and tannins. This antioxidant potential is associated with protective effects in cardiovascular and renal models and processing techniques such as fermentation may further enhance these properties. Recent studies have identified novel phytoconstituents from *Urtica parviflora* with promising anticancer activity and favorable pharmacokinetic profiles, suggesting its potential in drug discovery. Overall, the broad pharmacological profile of this plant supports its candidacy for the development of new therapeutic agents.

Limitations

Most pharmacological studies on *Urtica parviflora* have been conducted using uncharacterized crude extracts making it difficult to reproduce results or identify the bioactive metabolites. Therefore, there is a need for phytochemical standardization and bioactivity-guided identification of active compounds.

Phytochemical research on *Urtica parviflora* has led to the isolation of a limited number of classes of plant metabolites. However, its extensive traditional use and demonstrated pharmacological activities indicate that considerable scope remains for further phytochemical exploration. Such studies may further expand its therapeutic potential.

CONCLUSION

Urtica parviflora is a medicinally important plant with a strong ethnomedicinal background which reflects its long-standing use in traditional healing practices. Its rich phytochemical profile provides a scientific basis for these traditional uses, revealing the presence of bioactive phytoconstituents with therapeutic potential. The current study highlights significant antioxidant, hypoglycaemic, cardioprotective and hepatoprotective activities indicating that the plant may serve as a valuable source for future drug development. However, despite these promising findings, comprehensive pharmacological studies and clinical trials are still required to validate its safety and efficacy. Continued investigation will help clarify its therapeutic potential and support its integration into evidence-based medicine.

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Ethical statement

Not applicable.

Conflict of interest

The authors declare that there is no conflict of interest.

Abbreviations

CCl4	:	Carbon tetra chloride
AST	:	Aspartate aminotransaminase
ALP	:	Alkaline phosphatase
GSH	:	Glutathione
MDA	:	Malondialdehyde
HDL	:	High-density Lipoprotein
LDL	:	Low-density Lipoprotein
CAT	:	Catalase
CPK	:	Creatine phosphokinase
LDH	:	Lactate dehydrogenase
BUN	:	Blood urea nitrogen
SOD	:	Superoxide dismutase
DPPH	:	2,2-Diphenyl-1picrylhydrazyl

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