



A REVIEW ON: MEDICINAL VALUE OF URTICA DIOICA

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ABSTRACT

Urtica dioica L. widely known as stinging nettle, is a perennial, herbaceous flowering plant from the Urticaceae family. All parts of the plant—including its roots, stems, leaves, and seeds—are edible. *Urtica dioica* is known to possess a wide range of therapeutic properties, including antimicrobial, anti-inflammatory, antioxidant, hepatoprotective, anticancer, antiallergic, and cardioprotective effects. The plant contains an abundance of phytonutrients and diverse bioactive compounds, including polyphenols and flavonoids. This review aims to highlight some of the potential medicinal benefits of the plant as documented in the literature.

KEYWORDS- *Urtica dioica*, anti-inflammatory, antidiabetic, traditional medicine

INTRODUCTION

Urtica dioica, the scientific name for stinging nettle, is a perennial herb that comes from the family Urticaceae. It is a plant that is found all over the world, especially in Europe, Africa, the Americas, and some areas of Asia, as it is capable of growing in a variety of settings and climates. *Urtica dioica* has been a source of nutrition and an ingredient in traditional medicine for a long time[1]. The herbs and plants have been preferred for treating diseases in traditional medicine because of their advantages like low side effects, cost-effectiveness, and natural composition[2].

Urtica dioica is a renowned ethnomedicinal plant widely utilised in Ayurveda, with its applications in Indian traditional folk medicine also being well-documented. The nettle plant was first referenced as a herbal medicine by Paracelsus and Matthioli[3]. It has been traditionally used as a natural remedy for various conditions, including diabetes, colitis, rhinitis, rheumatism, asthma, cardiovascular diseases, and neurodegenerative disorders, owing to its rich and diverse nutraceutical composition[4,5].

Traditionally, *Urtica dioica* has been utilised as a source of nutrition and traditional medicine, with every part of the plant used in various preparations such as teas, salads, ointments, soups, infusions, decoctions, and liquid extracts[6]. It comprises various chemical constituents, including carotenoids, coumarins, lignans, phenolic compounds, flavonoids, lectins, fatty acids, ceramides, steroids, and triterpenoids[7].

Classification

Kingdom- Plantae

Division-Magnoliophyta

Class- Magnoliopsida

Order- Urticales

Family- Urticaceae

Genus- *Urtica*

Species- *dioica*

Vernacular names- English- Stinging nettle, Hindi- Bichchu buti, kandali, Sanskrit- Vrschikali

Morphology

Urtica dioica is a perennial herb that lives more than two years. The stem grows straight up, and it can be either hollow or solid, hard, fibrous, and very durable. Usually, the stem is single or divided into branches, and it has a bluntly square shape with four deep vertical grooves. The stinging hairs are 1 mm long, have a wide base, and the thickness ranges from very thin (sparse) to very thick (abundant), pointing upwards and are quite thick at the base[8]. The leaves are simple, dark green, with stipules, and they grow opposite one another. The edges are serrated, and the shape of the leaf is either oblong or ovate with a cordate base[9]. The bulblike tips of the stinging trichomes on the leaves and stems get broken off during the contact, and thus the only the sharp part of the tube is exposed, which comes through the skin. The trichomes, when piercing the skin, inject a mixture of acetylcholine, formic acid, histamine, and serotonin, which causes an itchy, burning rash in humans and other animal beings that can last for about 12 hours [10].

The flowers are small, greenish, and unisexual, typically occurring on separate male and female plants. Male flowers are more upright or spreading, while female flowers tend to be pendent. The male flowers consist of four perianth segments and four stamens, whereas the female flowers have two smaller and two larger perianth segments, along with a one-celled ovary topped by a sessile, tufted stigma [11].

The fruits are achene-type, single-seeded, measuring 1–1.5 mm in length, 0.7–0.9 mm in width, and 0.3 mm in thickness. They have a smooth surface with a dark marginal ridge and very thin walls. The tan-colored seed fills the fruit[12].

Phytoconstituents

The primary chemical components of *Urtica dioica* L. include flavonoids, tannins, volatile compounds, fatty acids, polysaccharides, isoelectins, sterols, terpenes, lignans, ceramides, coumarins, proteins, vitamins, and minerals[7].

The burning sensation caused by leaf trichomes is attributed to compounds such as acetylcholine, histamine, serotonin (5-hydroxytryptamine), and formic acid. The primary constituents of the plant's essential oils include carvacrol, carvone, naphthalene, (E)-anethol, hexahydrofarnesyl acetone, (E)-geranyl acetone, (E)- β -ionone, and phytol. The predominant flavonoids present are kaempferol, isorhamnetin, quercetin, isoquercitrin, astragalin, and rutin. Additionally, reported carotenoids include β -carotene, hydroxy- β -carotene, luteoxanthin, lutein epoxide, and violaxanthin[13,14,15].

Medicinal value

Anti-diabetic

Diabetes is a significant metabolic disorder that affects people around the world, no matter where they live, their ethnic background or social status, and the incidence is quickly climbing to an alarming level all over the world[16]. Different scientific investigations have revealed more about the working of *Urtica dioica* extract by showing that it not only promotes insulin secretion from β -cells but also stimulates the activity of hepatic glucokinase, hexokinase, and glucose-6-phosphate dehydrogenase enzymes as well [17,18,19].

The antidiabetic properties of the *Urtica dioica* extract may be attributed to its phytochemicals, including phenolic compounds and sterols [20]. Additionally, a recent study highlighted the beneficial effects of *Urtica dioica* extract on type 1 diabetes, showing that the intervention group exhibited reduced blood glucose and total insulin levels, further supporting its antidiabetic properties [21,22].

The plant's antioxidant properties, likely linked to its unsaturated fatty acids, may contribute to its antidiabetic effects by reducing oxidative stress[23,24,25].

Anti-inflammatory and analgesic properties

Several studies have explored the potential of *Urtica dioica* in treating inflammatory conditions, attributing its effectiveness to flavonoids and phenolic acids, which help reduce the production of inflammatory mediators [26]. As a result, *Urtica dioica* has been used in traditional medicine worldwide for centuries to treat anaemia, dermatitis, and joint pain [27]. Studies have demonstrated that stinging nettle tea or herbal supplements can effectively alleviate gout, relieve muscle pain, and lessen arthritis symptoms [8].

Urtica dioica inhibits nuclear factor kappa B (NF- κ B) activation, a key regulator of pro-inflammatory cytokines, and may help alleviate neural and muscular pain through its analgesic and anti-inflammatory properties [28].

Anti-helminthic effect

Essential oils extracted from *Urtica dioica* have been shown to possess anti-helminthic properties by compromising the integrity of helminthic cell membranes, resulting in cell lysis and death. This effect may be linked to bioactive compounds like terpenoids, which interact with helminthic membranes, disrupting their structure and function [29].

Flavonoids and phenolic compounds have demonstrated anti-helminthic properties by inhibiting embryonation, hatchability, and proliferation, thereby disrupting helminthic growth [30].

UD's antioxidant and anti-inflammatory properties may also aid in combating helminthic infections by reducing the oxidative stress commonly associated with these infections [31].

Anti-allergic activity

Nettle's anti-allergenic properties are primarily attributed to two mechanisms. It not only blocks histamine H1 receptors but also inhibits tryptase, reducing mast cell degranulation and the release of proinflammatory cytokines [32].

Studies have also shown that *Urtica dioica* (nettle) extract influences key receptors and enzymes linked to allergic rhinitis, chronic rhinosinusitis, and perennial allergic rhinitis [32][33]

In women's reproductive health

Stinging nettle as a diuretic prevents the accumulation of toxins linked to urinary tract infections in women [34]. Also, the astringent properties of stinging nettle may provide relief from menstrual pains as well as bloating. In addition, it works as a coagulant and thus protects women from heavy menstrual flow [35].

Plant-derived substances can play a major role in establishing hormonal equilibrium and enhancing fertility, and help treat certain reproductive disorders like the polycystic ovary syndrome (PCOS) [36]. The European Union Herbal Monograph on *Urtica dioica* warns that pregnant women should not use UD because it might cause contractions of the uterus [37,38].

Anti-cancer properties

UD is among several medicinal plants with therapeutic potential due to its proapoptotic effects on cancer cells [39]. The antimicrobial and antioxidant properties of stinging nettle, along with its potential to reduce cardiovascular risks and its chemopreventive effects on breast cancer cells, continue to be subjects of ongoing research [40,41].

A possible mechanism behind the anticancer effects of UD is its capacity to trigger apoptosis, or programmed cell death, in cancer cells. Research has shown that extracts from UD can modulate the expression of crucial regulatory enzymes involved in apoptosis, including ornithine decarboxylase (ODC) and adenosine deaminase (ADA). This modulation contributes to the induction of apoptosis, especially in breast cancer cell lines [42].

Urtica dioica has also been shown to possess chemopreventive properties against specific carcinogens[43].

Effect on the nervous system

Urtica dioica contains several compounds, such as scopoletin, 5-hydroxytryptamine (5-HT), and carvacrol, which have been reported to enhance hippocampal potentiation, aid in memory formation, and exhibit neuroprotective properties, respectively [44,45].

Hepatoprotective activity

Urtica dioica seed extract has demonstrated a protective effect against hepatic damage caused by ischemia-reperfusion, supporting liver health by enhancing the activity of paraoxonase, arylesterase, and liver tissue catalase [46].

Hepatoprotection refers to the ability to safeguard the liver from damage, prevent liver disorders proactively, and maintain a balance in liver enzyme levels [47].

Antihypertensive effect

Stinging nettle tea helps reduce systolic blood pressure and alleviates stress and tension in the cardiovascular system [48].

Anti-microbial and anti-fungal activities

Ethanol and aqueous extracts of *Urtica dioica* have demonstrated antibacterial activity against both Gram-positive and Gram-negative bacteria, as well as yeasts, including *Proteus mirabilis*, *Pseudomonas aeruginosa*, *Enterobacter aerogenes*, *Escherichia coli*, *Citrobacter koseri*, *Streptococcus pneumoniae*, *Staphylococcus aureus*, *Micrococcus luteus*, *Staphylococcus epidermidis*, and *Candida albicans*. Additionally, they have shown effectiveness against *Mycobacterium tuberculosis* in cases of multidrug resistance [49,50,51].

Antiviral effect

The strong and selective inhibitory effect of UDA on the intracellular replication of HIV-1, HIV-2, respiratory syncytial virus (RSV), and cytomegalovirus (CMV) has been well documented [52].

Detoxifying effect

It is believed that toxins, primarily acids, contribute to chronic inflammation, including skin and arthritic conditions. Nettle, with its alkalizing properties, helps neutralise these acids and eliminate toxins through urine [53].

Stinging nettle has a cleansing and astringent effect on blood and skin conditions. Additionally, it stimulates the lymphatic system, aiding the kidneys in toxin removal from the body [54].

Antioxidant effect

Stinging nettle is scientifically supported to be an effective treatment for acne and a preventive measure against bacterial infections. The plant's antioxidant properties facilitate quicker healing, lessen the visibility of scars and imperfections, and counteract ageing by shrinking wrinkles and age spots [54].

Cardiovascular activity

Urtica dioica extracts have displayed a range of cardiovascular benefits, such as vasodilation and blood pressure modulation, which indicate their possible cardioprotective effects [9].

The *Urtica dioica* leaf extract's effect on platelet aggregation may prevent thrombus formation, thus benefiting the heart and blood vessels. Its anti-inflammatory action, along with that of the other plants, can help keep the cardiovascular system clear and in good shape, hence reducing the chances of developing heart diseases [54,55].

In bone health

Stinging nettle is an excellent source of vitamin K, which supports bone health by stimulating osteoblastic activity, aiding in bone formation and strength. It is also rich in boron, a mineral essential for maintaining optimal calcium levels in the body. The high boron content in stinging nettle may help delay the onset of osteoporosis [35].

Conclusion

Herbal research in the modern era has gone through several transformations. Other systems of healing are effective, but some of their side effects can be life-threatening. Hence, based on the information provided in this article, *Urtica dioica* exerts therapeutic and nutritional effects. This vast world of phytochemicals is pharmacologically promising and is highly effective in treating physiological disorders. Extracts from the plant's leaves and roots have been found to have some medicinal properties that include hypoglycemic, anti-inflammatory, antiproliferative, anti-bacterial, analgesic, antioxidant, anti-rheumatic, anticarcinogenic, antiviral, anticolitic, and cardioprotective effects, among others. The plant may have other properties that still have not been discovered, but at present, its old-time medicinal uses are getting scientific validation all the more. The present article provides an in-depth description of *Urtica dioica*, focusing primarily on its possible impact on the search for new drugs, and presents its importance in future studies on the classical medicinal plants. Consequently, the conservation of this species becomes imperative, and additional research is highly recommended.

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