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A comprehensive review on common plants with remarkable medicinal properties: *Urtica dioica*

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Abstract

Urtica dioica (stinging nettle) is a perennial plant belonging to the Urtica family Urtica genus. Nettles (genus *Urtica*, Urticaceae) have received considerable attention as a food preservative consumed by both humans and animals. It has also been used in traditional medicine for centuries. You can make curries, herbal and sour soups from young leaves. Nettle root is used to treat urological disorders related to benign prostatic hyperplasia, and leaves are used to treat arthritis, rheumatism, and allergic rhinitis. The leaves contain fibre, minerals, vitamins, polyphenols and carotenoids of antioxidant compounds, rich in antioxidant compounds such as polyphenols and carotenoids. Nettle has anti-proliferative, anti-inflammatory, antioxidant, analgesic, anti-infective, anti-hypertensive and anti-ulcer properties in all parts of the plant (leaves, stems, roots and seeds), and has been shown to improve heart health.

Keywords: Urtica genus, food preservative, anti-inflammatory, antioxidant, traditional medicine

Introduction

From Prehistoric days, nettles (*Urtica dioica* L.) have been used as a wild vegetable. A perennial herb with sharp-edged leaves, it belongs to the Urticaceae family. They are most frequently found in Europe, North America, North Africa, and some regions of Asia. In Nepal's highlands and mountains, it can be found in the wild. Numerous ethnobotanical researches indicate that the use of stinging nettle slurry as a manure in organic farming for horticultural crops is spreading throughout Spain. Young leaves are a healthy culinary herb that can be used in herbal treatments as well as cooked and consumed foods. Nettle contains biologically active compounds like phenols and flavonoids, according to various studies, which may help prevent the formation of free radicals brought on by current lifestyle. The hairs and spikes on the nettle leaves and stems can sting the skin extremely painfully. There are 30 to 45 different shrub species of nettles. In rich soil, nettles can grow to a height of 40-120 cm. Women's health is benefited in a wide range of ways by the nettle's components. Its astringent qualities might lower painful symptoms including bloating and premenstrual cramps as well as decrease blood flow during menstruation. Stinging nettle can be beneficial for menopausal women. As a coagulant, stinging nettle aids in controlling excessive bleeding. Additionally, it will make nursing more comfortable and promote milk production. This review's goal is to evaluate the nettle's chemical components' pharmacological and nutritional effects. This information will be useful to nutritionists, farmers, and health professionals.



Fig 1: *Urtica dioica* with flower

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General description

It is common known that *Urtica dioica* burns when handled. It work by inserting a stinging liquid in a way comparable to that of a hypodermic needle, resulted in skin rashes, red blotches, and bruising (nettle actually stems from an Anglo-Saxon term meaning "needle"). Physiological and biochemical plant mechanisms both contribute to stinging nettle dermatitis. The molecular mediators of stinging nettle dermatitis are actually likely to include salts, proteins, formic and tartaric acids, alkaloids, enzymes, histamine, acetylcholine, and 5-hydroxytryptamine. Even though they can thrive in a variety of environments, stinging nettles prefer to grow in nitrophile soil, or ground high in nitrogen, frequently in big clusters. The name *Urtica* derives from the Latin word unreel, which means "to burn," and pertains to the plant's stinging properties. *Dioica* refers to as dioecious.

Botanical description

Urtica dioica L., commonly known as stinging nettle, is a perennial plant belonging to the Urticaceae family. Lacunar collenchyma covers each corner of the tall, green, quadrangular stem. It is conceivable to have 12 to 20 fibrovascular bundles. This plant has a maximum height of two metres.

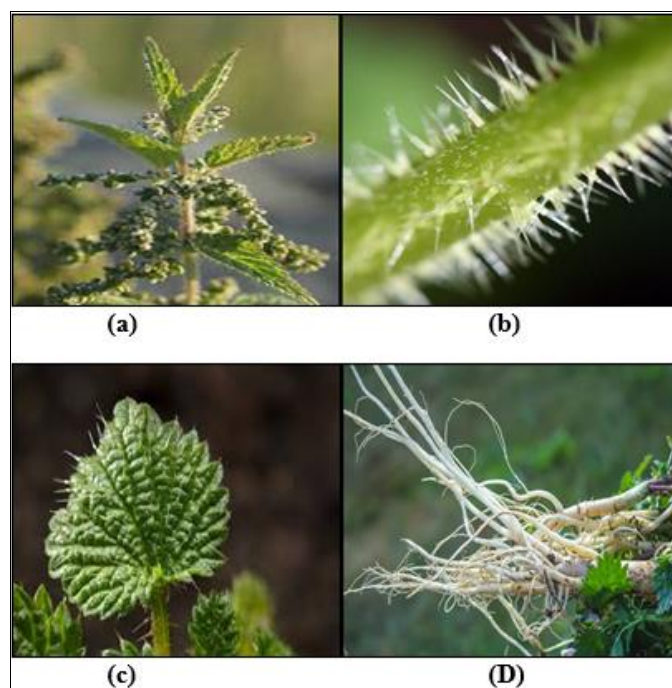


Fig 2: Part of *Urtica dioica* L plant (a) Flower (b) Trichomes (c) Leaf (d) Roots

The leaves are opposite, cordate at the base, oblong or oval, highly pointed, and dark green above and paler below. Those stinging trichomes on the stems and leaves transmit the histamine, acetylcholine, and serotonin-rich fluid. Every spring from May to September, the tiny, dioecious flowers, usually range in colour from brown to greenish, blossom. They grow as racemes in the upper axils of the leaves and have different male and female inflorescences. There is a rhizome and the root is typically diarchic. The fruit of the stinging nettle is spherical and bears minute, dark brown or nearly black seeds. The root system of the nettle, which enable it to grow, is composed of its taproot and small rootlets. *Urtica dioica* is an herbaceous perennial that grows in diffused shades, meadows, and abandoned fields up to an elevation of 1800 metres. The reddish or yellowish stems of

this species can attain a height of 120 cm, are unbranched, and exhibit a pyramid - shaped appearance.

Each leaf includes two pubescent stipules and a stalk that is half as long as the leaf blade that connects it to the stem. Both ends of the leaves are covered in fine trichomes, which also are comprised of shorter simple hairs combined with longer rigid hairs (the ones that sting) and cystoliths.

Geographical location

The range of *Urtica* species is sub-cosmopolitan and they are distributed all over world, with the notable exception of Antarctica and other tropical regions. The plant is typically found as a weed, mostly in moist, shady, and frequently artificial environments. The genus *Urtica* includes 46 species, such as the two most important species, *Urtica dioica* (stinging nettle) and *Urtica urens* (small nettle), which are native to Europe, Africa, Asia, and North America, respectively, and have since grown in other temperate regions around the world. Widespread weed species *Urtica dioica* is classified as an ecological keystone species and, as such, is essential for the biodiversity of the ecosystem. Islands endemics are especially common in this genus. *Urtica atrovirens*, *Urtica rupestris*, *Urtica stachyoides*, *Urtica portosanctana*, *Urtica bianorii*, and *Urtica domingensis* are some of the species. *U. dioica* subsp. *cypria* is found on Cyprus Island. This indicates that island colonisation within the species is different from other traits of flowering plants.

Phytochemical constituents

Nettle has a strong history, having been used as an herbal treatment for more than 2000 years. The plant's seeds, leaves, and roots are only a few of the medicinally useful aspects. Flavonoids, tannins, volatile substances, fatty acids, polysaccharides, is olectins, sterols, terpenes, protein, vitamins, and minerals are among the main chemical components of *U. dioica* L.

Due to its balanced protein composition and comparatively high mineral and vitamin content, nettle is growing in popularity. Provitamin A and vitamin C are abundant in it. The protein that makes up around 30% of the body's dry mass contains numerous amino acids that are crucial to human health. Minerals make up around 20% of the dry mass.

Along with other minerals and elements, the root of the stinging nettle contains calcium, manganese, copper, magnesium, and zinc. Kaempferol-3-O-rutinoside (rutin), myricetin, quercetin, and Isorhamnetin are some of the flavonoids that can be found in roots.

It was found that the root contains the lignans isolaricresinol, pinocresinol, neoolivil, Secoisolaricresinol, dehydrodiconiferyl alcohol, and 3, 4-divanillyltetrahydrofuran. The *U. dioica* root includes *U. dioica* agglutinin (UDA), a single-chain polypeptide with 89 amino acids and a significant amount of tryptophan, glycine, and cysteines. Phytosterols such stigmasterol, campesterol, stigmasterol-4-en-3-on, hecogenin, and sitosterol are present in the root. A broad range of active compounds can be detected in the stinging nettle's leaves. Nettle leaves contain a variety of components, including flavonoids, phenolic compounds, organic acids, vitamins, and minerals, in addition to tannins, volatile chemicals and fatty acids, polysaccharides, is olectins, sterols, terpenes, and proteins. Calcium, potassium, magnesium, phosphorus, iron, sulphur, zinc, manganese, copper, and nickel are some of the found naturally in stinging nettle shoots. The vitamins present in shoot sections are ascorbic acid (vitamin C), riboflavin

(vitamin B2), pantothenic acid (vitamin B5), folic acid (vitamin B9), vitamin K (phyloquinone), and vitamin A. The shoot contains flavonoids including such isorhamnetin-3-O-glucoside, kaempferol-3-O-rutinoside, and quercetin-3-O-rutinoside (rutin). The shoot contained naphthalene, carvacrol, carvone (E)-anethol, hexahydrofarnesyl acetone (E)-geranyl acetone (E)-ionone, and phytol. The biological activities that are found in the leaves, roots, and seeds of stinging nettles. Stinging nettle seeds both saturated and unsaturated fatty

acids, as well as carotenoids (lutein and violaxanthin), and beta-carotene.

Pharmacology properties

Researchers have discovered that the extract from the plant's leaves and roots has hypoglycemic, anti-inflammatory, anti-proliferative, antioxidant, antibacterial, hypolipemic, analgesic, anti-rheumatic, anticarcinogenic, antiviral, anti-colitis, and anti-Alzheimer activities.



Fig 6: Health benefits of stinging nettle

Anti-proliferative effect

Stinging nettle has been shown to be a safe treatment for decreasing prostate growth in older men. Prostate enlargement and prostate cancer are serious diseases that impact both men and their life's quality. Stinging nettle's capacity to stop or postpone the spread of cells, especially malignant cells, into nearby tissues is one of its properties.

Numerous studies have demonstrated that nettle roots can prevent a number of processes that contribute to the growth of benign prostatic hyperplasia.

UDA and methanolic alcoholic root extracts have been found to have anti-proliferative effects on prostate tumour cells in both *in vitro* and *in vivo* investigations. Lignins from root extract also prevent androgens from binding to the receptor molecules of the prostate, which decrease their capacity to promote cell proliferation in prostate tissues. Androgens are prevented from attaching to their transporter proteins SHBG (Sex Hormone Binding Globulin) and binding to the membrane receptors of the prostate. The root extract reduces oestrogen synthesis and, consequently, the conversion of androgens to oestrogens via blocking aromatase. Additionally, it was discovered that root extracts halt the prostate cell membrane's enzymatic activity. Also thought to benefit from the root extracts are the signs and symptoms of benign prostatic hypertrophy.

Anti-diabetic effect

Aqueous nettle leaf extracts exhibit anti-diabetic effects, according to an *in vivo* study. In diabetic mice, the effects of

hypoglycaemia were studied. These effects result from the reduced glucose absorption in their gut.

Numerous studies show that nettle increases the release of insulin, which reduces blood sugar levels. This conclusion was investigated in rats with and without illness after intra-peritoneal injection of an aqueous extract.

Anti-inflammatory activity

Chronic myalgia, arthritis, and other inflammatory illnesses can all be helped by nettle. Nettle tea or herbal supplements can effectively alleviate the symptoms of arthritis, gout, and muscle aches. Scientific studies have demonstrated a variety of pathways that lead to a reduction in the synthesis of lipid mediators and inflammatory cytokines.

Leaf extracts limit the production of prostaglandins and thromboxane by preventing the production of arachidonic acid cascade enzymes, particularly cyclooxygenases COX-1 and COX-2.

Nettle root aqueous extract also has anti-inflammatory properties. Similar to indomethacin, the polysaccharide component of this extract reduced the production of rat foot edema. The suppression of cyclooxygenase, lipoxygenase, and cytokine product is primarily responsible for its anti-inflammatory effect.

Anti-hypertensive effect

Stinging nettle tea lowers systolic blood pressure and relieves stress and tension in the cardiovascular system. Blood pressure was lowered by 15% and 38% after receiving an IV

infusion of an aqueous extract of nettle leaves at two concentrations: 4 and 24 mg/kg h. A decrease in blood pressure was associated with an increase in natriuresis and diuresis. On the other hand, when a modest dose (4 mg/kg h) was employed, the hypotensive effect appeared to fade within an hour, and a large dose (24 mg/kg h) had no effect at all. Root extracts showed a soothing effect when given to isolated areas of an aorta that was vaso-constricted. The production of nitrogen oxide by endothelial cells, the activation of potassium channels, and a detrimental inotropic effect are suggested to be the causes of this vasodilator action.

Detoxifying effect

It is also asserted that nettle eliminates toxins through the urine by neutralising acids that cause rheumatic and dermatological conditions, as well as other chronic inflammations of the body's systems. The detoxifying astringent of the stinging nettle impact on skin and blood disorders. Because it is a diuretic, stinging nettle can ensure that toxins neutralised in the body are quickly eliminated. It is classified as an alternative because it can improve the efficiency of nutrition absorption in the stomach and guarantee that digestion proceeds without a hitch, preventing the buildup of dangerous pollutants. Additionally, it activates the lymphatic system, which cooperates with the kidneys in the removal of toxins from the body.

Antioxidant effect

Nettle extracts can remove reactive oxygen species from the environment (ROS). Anti-radical activity was measured using spectrophotometry against the superoxide anion O₂⁻, hydroxyl radical OH⁻, and nitric oxide radical NO⁻. Numerous studies have demonstrated that leaf extracts in methanol and ethanol have antioxidant effects against the 1, 1-diphenyl-2-picrylhydrazyl radical (DPPH). Ferrozine, a red chromophore formed by residual iron (Fell- Ferrozine) with a maximum absorption wavelength of 562 nm, was used to study the chelation of ferrous iron. According to the absorbance tests, nettle has a significant chelating activity for ferrous ions. Nettle protected the liver against hepatotoxicity in rats treated with carbon tetrachloride (CCl₄) by reducing lipid peroxidation and increasing antioxidant defence system activity. The presence of phenolic chemicals is the primary reason of this antioxidant activity. It has been demonstrated that stinging nettle can treat acne and even prevent bacterial infections. Through its antioxidant capabilities, you can hasten the healing process, lessen the appearance of scars and blemishes, and boost anti-aging effects to get rid of wrinkles and age spots.

Analgesic and antinociceptive properties

The analgesic properties of nettle have been demonstrated in studies using rats and mice.

In a hot plate test at 55 °C, the aqueous extract of the leaves, given at a dosage of 1200 mg/kg, reduces thermal stimulation and increases pain resistance. The antinociceptive effectiveness of the hydro alcoholic extract of nettle leaves was evaluated using the acetic acid writhing test and the formalin-induced paw licking test. The findings show that the hydro alcoholic extract inhibits nociceptive responses in mice and rats in a dose-dependent manner.

Aids in women's health

Drinking nettle leaf tea has been shown to significantly improve the health of women. Because it has been used for a

long time to increase milk production, nettle is a well-liked herb for women's health. Women experience UTIs more frequently than men do. The diuretic effects of stinging nettle aid in the removal of more of the toxins linked to female urinary tract infections. Stinging nettle's astringent qualities may reduce the discomfort and bloating related to menstruation. Given that nettle contains so many elements, it is not unexpected that it has been used in pregnancy tea for a long time to provide nutritional support. Nettle is advantageous for women who are approaching menopause since it acts as a restorative for the body's hormonal fluctuations. Women are more likely than men to get UTIs. Stinging nettle works as a diuretic to help the body eliminate more toxins connected to UTIs. As a coagulant, the stinging nettle helps women avoid excessive bleeding.

In vivo wound-healing activity

(a)Preparation of *U. dioica* extract

The ethanol-water extract (yield = 20.6%) was dissolved at a concentration of 10% in sterile solution of glycerol and stirred to create a homogeneous ointment. A 50 l/mm² dosage of the *U. dioica* extract from this ointment was given topically to the wound.

(b)Animals

Wistarrats were provided by the Tunisian Central Pharmacy (160–180 g, any sex). The mice were housed in customary laboratory conditions at a temperature of °C. They have unrestricted access to food and water while living in separate cages. All studies were carried out in compliance with the European Community's regulations for the care and use of laboratory animals, which were approved by the Committee of Animal Ethics established by the University of Sfax Tunisia.

(C)Excision wound model

Under ketamine anaesthesia (100 mg/Kg body weight), the backs of twenty-four rats were sterilised and shaved prior to creating circular incisions. The rats' specified dorsal region was then methodically cut over its entire thickness. The onset of epithelialization and wound constriction were detected. Every two days after wound induction, the rate of wound contraction was measured. A tissue sample from the healed lesions was collected for histological investigation.

(d)Wound-healing activity

With a mean weight of 160 g, four groups of animals were made: Group I rats received only saline solution cleaning (control group), Group II rats underwent glycerol treatment (control group), Group III rats underwent treatment with the reference drug "CICAFLOA cream" (positive control), and Group IV rats received 50 L/mm² of ethanol water extract of *U. dioica* to treat wounds. The therapies were topically applied immediately after wound induction and every two days until the first group had totally recovered.

(e)Bleeding time in rats

Both sexes of adult Wistar rats were produced in three groups. A scalpel blade was used to slash the tip of each rat's tail to induce bleeding. As soon as the animal began to bleed, a timer was started in conjunction with applying the test chemical to the wound. In the control group, the severed tails were placed in either ordinary saline solution or clean water. The hydro alcoholic extract of *U. dioica* was applied to the clipped tails of the test group. To remove blood, all of the tails

were arranged vertically on top of the blotting paper. As soon as bleeding ceased, the stopwatch was stopped and the bleeding time was noted.

Ethno pharmacology application

Nettle has been used for ages to treat both humans and animals in a number of traditional medical systems in China, Persia, Turkey, Russia, India, and other nations. It is applied as an extract (juice), dried form, tincture, ointment, and/or supplement for medical treatments. Diabetes, anaemia, rashes, kidney stones, burns, allergies, and more ailments are among those it is used to treat. Eczema, rheumatism, and inflammation are all treated with it in traditional herbal medicine in China and Anatolia. The Jaintia tribe of India uses nettle fruit and leaf ash to treat fever. An excess of uric acid in the blood causes gout, a type of joint inflammation. It has been used in Turkish folk medicine to treat liver insufficiency, rheumatic pain, colds, and coughs. The oil from its seeds is used to treat rheumatoid arthritis. In anti-turgid treatments. The root powder and seed of *Urtica dioica* are used in Russian traditional medicine to cure dropsy, diarrhoea, and worms, according to the Committee on Herbal Medicinal Products. This herb is used in folk medicine systems in Morocco, Lithuania, and Africa. Nettles are used in Morocco as cholagogues, antirheumatics, astringents, diuretics, antidiuretics, and therapies for diabetes and high blood pressure. All parts of the plant are used as a diuretic, antihypertensive, antidiabetic, hemostatic, anti-asthenia, antianemic, antispasmodic, antirheumatic, and a treatment for headaches and chills. It is reportedly a typical home remedy for gastrointestinal and rheumatic issues in Italy. It is used to treat internal bleeding, heavy menstruation, and nosebleeds in traditional African medicine. In German homoeopathy for the treatment of urticaria, herpes, eczema, hypersensitivity reactions in the skin and joints, and burns; in Indian Ayurvedic Pharmacopoeia for uterine haemorrhage, cutaneous eruptions, eczema, and nosebleed. In North America as an anti-rheumatic drug and gynaecological aid. In the USA, it is commonly taken in a variety of food supplements. By serving as a diuretic, nutritional tonic, and supportive therapy, it aids in the reduction of rheumatic issues and allergy symptoms. In the early stages of benign prostatic hyperplasia, root is used to relieve urinary issues.

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