



Review article

Nutritional and pharmacological importance of stinging nettle (*Urtica dioica* L.): A review

Khuma Kumari Bhusal^{a,*}, Saraddha Khasu Magar^a, Ronika Thapa^a, Ashish Lamsal^a, Sagar Bhandari^b, Rashmi Maharjan^c, Sami Shrestha^d, Jiban Shrestha^e

^a Gokuleshwor Agriculture and Animal Science College, Tribhuvan University, Baitadi, Nepal

^b Institute of Agriculture and Animal Science, Campus of Live Sciences, Dang, Nepal

^c Central Department of Environmental Science, Tribhuvan University, Kathmandu, Nepal

^d Tribhuvan University, Institute of Forestry, Hetauda, Nepal

^e Nepal Agricultural Research Council, National Plant Breeding and Genetics Research Centre, Khumaltar, Lalitpur, Nepal

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ABSTRACT

Stinging nettle (*Urtica dioica* L.) is a wild herbaceous perennial blooming plant that is commonly known as stinging nettle. It's a common, multi-purpose crop that's sometimes overlooked. Europe, Asia, North Africa, and North America are all home to stinging nettle. It is a plant that's edible and has nutritional and medicinal properties. Young leaves can be used to make curries, herb soups, and sour soups. The root of the stinging nettle is used to treat mictional difficulties associated with benign prostatic hyperplasia, while the leaves are used to treat arthritis, rheumatism, and allergic rhinitis. Its leaves are abundant in fiber, minerals, vitamins, and antioxidant compounds like polyphenols and carotenoids, as well as antioxidant compounds like polyphenols and carotenoids. Stinging nettle has antiproliferative, anti-inflammatory, antioxidant, analgesic, anti-infectious, hypotensive, and antiulcer characteristics, as well as the ability to prevent cardiovascular disease, in all parts of the plant (leaves, stems, roots, and seeds). Stinging nettle improves fish reproductive performance, making it a cost-effective aquaculture plant. Fertilizer and insecticides can be made from the plants. This review examines the nutritional and pharmacological aspects of stinging nettle, as well as its possible health advantages. Scientists, farmers, and academicians interested in stinging nettle collecting, cultivation, research, and development would find this review useful.

1. Introduction

The Stinging nettle (*Urtica dioica* L.) has been used as a wild vegetable for centuries (di Tizio et al., 2012; Upreti et al., 2012). It is a perennial herbaceous plant with spiny leaves, belonging to the nettle family (Urticaceae). While stinging nettle can be found almost anywhere, it is most common in Europe, North America, North Africa, and parts of Asia. It can be found in the wild in the hills and mountains of Nepal. Nepali edible names includes nettle Sisnu, Sishnu, Lekali sishnu, Thulo sishnu, Ghario sishnu, Bhangre sishnu or Patle sishnu. The plant is widely cooked in areas where vegetables are scarce. The use of stinging nettle slurry as a fertilizer in organic farming for horticultural crops is becoming more common in Spain, according to many ethnobotanical studies (Benitez Cruz et al., 2009). Nettle has been used as a natural remedy for its healing properties for over 2000 years. However, it was not until the turn of the

century that its medicinal potential was fully appreciated, beginning with the identification of the chemical structure and pharmacological qualities of the principal chemically active compounds (Said et al., 2015). For almost a century, they have been considered a food or portion of food that has therapeutic properties and is supposed to prevent and treat diseases (Pant, 2019). Young leaves are a nutritious potherb that can be cooked and eaten, as well as utilized in herbal therapy (Singh and Kali, 2019). Some of the chemicals discovered in this plant include lignan, secolignan, norlignan, alkaloid, sesquiterpenoid, flavonoid, triterpenoid, sphingolipid, and sterol (Abdeltawab et al., 2012; Wang and Pan-topoulos, 2011). Formic acid, acetyl choline, serotonin, and histamine are thought to be present in the trichomes of the nettle (Singh and Kali, 2019). Some of its qualities include anti-proliferative, anti-inflammatory, antioxidant, analgesic, immunological stimulatory, anti-infectious, hypotensive, anti-ulcer, and cardiovascular disease prevention (Said et al.,

* Corresponding author.

E-mail address: bhusalkhuma2@gmail.com (K.K. Bhusal).

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2015). Stinging nettle is also used as a source of bast fibers for textiles and is occasionally used in cosmetics (Das and Petruzzello, 2015). Commercially, the plants are used to extract chlorophyll, a green coloring ingredient (E140) that is utilized in foods and pharmaceuticals (Nadiya and Khan, 2016). According to various studies, the stinging nettle plant contains biologically active chemicals such as phenols and flavonoids that can help reduce free radical generation produced by modern lifestyle conditions (Singh and Kali, 2019). Nettle tea has a number of health benefits, including reducing skin irritation and alleviating allergy symptoms. In Nepal, stinging nettle is used in IPM (Integrated Pest Management) to keep pests including cabbage butterfly larvae, hairy caterpillars, cutworms, red ants, termites, and aphids at bay (Sapkota and Shrestha, 2018). The chemical compounds in stinging nettle have a variety of health benefits for women. Because of its astringent characteristics, it can relieve unpleasant premenstrual symptoms including cramping and bloating, as well as reduce blood flow during menstruation. Stinging nettle can ease the transition and act as a restorative for women going through menopause, lowering the intensity of the hormonal shift in the body. Acting as a coagulant, stinging nettle can help prevent excessive bleeding. It will also help increase milk production and make breastfeeding more comfortable. The aim of this review is to evaluate the chemical compounds in nettle with their nutritional and pharmacological effects. This assessment will be useful for nutritionists, farmers and health professionals.

1.1. Botanical description of stinging nettle

Urtica dioica L., also known as stinging nettle, is a perennial plant in the Urticaceae family that belongs to the genus *Urtica* (Ahmed and Parsuraman, 2014). The tall, green quadrangular stem has lacunar collenchyma at each corner. It's possible to have 12–20 fibrovascular bundles (Corsi and Masini, 1997). This plant can reach a height of about 2 m (6.5 feet) (Petruzzello, 2022). The leaves are oblong or oval, opposite, cordate at the base, finely toothed, dark green above and paler below, and oblong or oval, opposite, cordate at the base, finely toothed, and dark green above and paler beneath (Testai et al., 2002). The stinging trichomes on the stems and leaves carry a fluid rich in histamine, acetylcholine, and serotonin (Tuberville et al., 1996). The little dioecious flowers, which develop as racemes in the axils of the upper leaves and are either male or female in separate inflorescences, are brown to greenish in color and flower every year from May to September (Corsi and Masini, 1997; Ahmed and Parsuraman, 2014). A rhizome is present, and the root is usually biarch (Corsi and Masini, 1997). The fruit of the stinging nettle is round and contains small dark brown or nearly black seeds. The root system of nettle is made up of a taproot with fine rootlets, which allows it to expand (Ghedira et al., 2009; Joshi et al., 2014).

1.2. Bioactive compounds

With a history stretching back over 2000 years, nettle has been used as a natural remedy for ages (Said et al., 2015). Medicinally, all plant components (seeds, leaves, and roots) are used (Jan and Singh, 2017). Flavonoids, tannins, volatile compounds, fatty acids, polysaccharides, isolectins, sterols, terpenes, protein, vitamins, and minerals are among the main chemical components of *U. dioica* L. (Joshi et al., 2014). Because of its balanced protein composition and relatively high mineral and vitamin content, nettle is becoming more well-known. It contains a lot of vitamin C and provitamin A (Guil-Guerrero et al., 2003). Protein accounts for about 30% of dry mass and contains numerous amino acids necessary by humans. Minerals account about 20% of the dry mass. Zinc, iron, cobalt, potassium, nickel, and molybdenum are all abundant (Said et al., 2015). Nutritional composition of *Urtica dioica* is given in Table 1.

Lectins, lignans, polysaccharides, and sterols make up the root of the nettle (Said et al., 2015). Minerals and trace elements are found in

Table 1. Nutritional composition of *U. dioica* L.

Vitamins	Daily Value (%)
Vitamin B1 (Thiamin) 0.0 mg	1
Vitamin B3 (Niacin) 0.4 mg	2
Choline, total 17.4 mg	3
Vitamin B6 0.1 mg	8
Vitamin B2 (Riboflavin) 0.2 mg	12
Vitamin A 2011.0 IU	67
Vitamin K 498.6 µg	416
Minerals	
Selenium 0.3 µg	1
Zinc 0.3 mg	2
Phosphorus 71.0 mg	7
Copper 0.1 mg	8
Potassium 334.0 mg	9
Iron 1.6 mg	9
Magnesium 57.0 mg	14
Manganese 0.8 mg	34
Calcium 481.0 mg	37
Calories	
Carbohydrates 7 g	2
Fiber 7 g	24
Protein 2.4 g	5

(Source: NutrientOptimizer, 2022; NutritionValue.org, 2022).

the root of the stinging nettle: calcium, manganese, copper, magnesium, and zinc (Rafajlovska et al., 2013). Roots include flavonoids such as kaempferol-3-O-rutinoside, myricetin, quercetin, kaempferol-3-O-rutinoside (rutin), and isorhamnetin (Wagner et al., 1989). Isolariciresinol, pinoresinol, neoolivil, secoisolariciresinol, dehydrodiconiferyl alcohol, and 3,4-divanillyltetrahydrofuran (Schöttner et al., 1997; Chaurasia and Wichtl, 1986) are lignans found in the root (Schöttner et al., 1997; Chaurasia and Wichtl, 1987). *U. dioica* agglutinin (UDA), a single-chain polypeptide having 89 amino acids and rich in glycines, cysteines, and tryptophans, is found in the root of *U. dioica* (Van Damme et al., 1988; Shibuya et al., 1986). Phytosterols are found in the root, including stigmasterol, campesterol, stigmast-4-en-3-on, hecogenin, and sitosterol (Seliya and Kothiyal, 2014; Chaurasia and Wichtl, 1987). The stinging nettle's leaves contain a wide range of chemical components. Flavonoids, phenolic compounds, organic acids, vitamins, and minerals, as well as tannins, volatile compounds and fatty acids, polysaccharides, isolectins, sterols, terpenes, and proteins, are plentiful in nettle leaves (Said et al., 2015; Nadiya and Khan, 2016; Kudritsata et al., 1987; Rafajlovska et al., 2013). Calcium, potassium, magnesium, phosphorus, iron, sulphur, zinc, manganese, copper, and nickel are minerals found in the stinging nettle shoot (Pradhan et al., 2015; Mihaljev et al., 2014; Rutto et al., 2013; Rafajlovska et al., 2013; Sekeroglu et al., 2006). Vitamins contained in shoot parts include ascorbic acid (vitamin C), riboflavin (vitamin B2), pantothenic acid (vitamin B5), folic acid (vitamin B9), vitamin K (phyloquinone), and vitamin A (retinol) (Rutto et al., 2013; Wetherilt, 1992). Flavonoids found in the shoot include kaempferol-3-O-rutinoside and isorhamnetin-3-O-glucoside, as well as quercetin-3-O-rutinoside (rutin) (Otles and Yalcin, 2012; Chaurasia and Wichtl, 1987; Ellnain-Wojtaszek et al., 1986; Ellnain-Wojtaszek et al., 1986; Ellnain-Wojtaszek et al., 1986). Gül et al. (2012) identified naphthalene, carvacol, carvone (E)-anethol, hexahydrofarnesyl acetone (E)-geranyl acetone (E)-ionone, and phytol in the shoot. The bioactive compounds found in leaves, root and seed of stinging nettle is given in Table 2. The seeds of stinging nettle contains saturated and unsaturated fatty acids, carotenoids (lutein and violaxantin) and β-carotene (Guil-Guerrero et al., 2003).

Table 2. Name of bioactive compounds found in leaves, root and seed of stinging nettle.

Parts	Bioactive compounds
Leaves and root	Vitamins (vitamin A, C, K, and B vitamins), minerals (calcium, iron, magnesium, phosphorus, potassium and sodium), fats (linoleic acid, linolenic acid, palmitic acid, stearic acid and oleic acid), amino acids (all of the essential amino acids), polyphenols (kaempferol, quercetin, caffeic acid, coumarins and other flavonoids), pigments (beta-carotene, lutein, luteoxanthin and other carotenoids)
Seed	Vitamins (vitamin A, B, C, E and K), minerals (iron, silicon, calcium, magnesium, manganese, phosphorus, potassium), beta-carotene, folic acid, essential fatty acids

(Source: Raman, 2018; Said et al., 2015).

1.3. Bioaccessibility of nettle based products

In the duodenum and after 48 h of colonic fermentation, nettle-enriched pasta showed lower carotenoid bioaccessibility than dietary supplements (Marchetti et al., 2018). After 24 h of intestinal fermentation, nettle capsules, like non-enriched egg pasta, produce carotenoids with the highest bioaccessibility (Marchetti et al., 2018). The highest levels of bioaccessibility are found in nettle enhanced egg pasta, which has a shorter colonic fermentation time (i.e., 2 h) (Marchetti et al., 2018). The phenolic chemicals 3-caffeoylquinic acid (3-CQA), caffeoylmalic acid (CMA), and rutin are abundant in nettle leaves (Bonetti et al., 2016). The bioavailability of native forms of 3-CQA, CMA, and rutin was shown to be low in a study by Bonetti et al. (2016) on duodenal trans epithelial transfer. The simulation of colonic metabolism revealed that gut bacteria ferment phenolic chemicals, indicating the need for more research into the effects of phenolic compounds on the large intestine (Bonetti et al., 2016).

1.4. Use of *U. dioica* L. in animal nutrition

Ethno-veterinary reports from Italy, Switzerland, Spain, and Austria show that *U. dioica* L. is used (Disler et al., 2014). *U. dioica* L. was utilized as a growth promoter and to encourage hen laying by Viegi et al. (2003), Bonet and Valles (2007), and Benitez et al. (2012). The protein, lipids, carbohydrates, vitamins, minerals, and trace elements included in nettle leaves are high, according to Rutto et al. (2013). With 30% protein by dry mass, nettle has a significantly greater amino acid profile than other green plants. Nettle also includes a high amount of polyunsaturated fatty acids (60%), half of which is linoleic acid (C18:2), an omega-6 fatty acid that increases the immune system, body resistance to bacterial and viral infections, and antioxidant activity (Upton, 2013). Chickens are protected against internal parasites when they are fed stinging nettle. Stinging nettle influences metabolic processes and supports the immune system in broilers. Stinging nettle, according to Hashemi et al. (2018), has a great growth-promoting power as well as the ability to alter hemoglobin and hematocrit in broiler chickens. Melesse et al. (2015) discovered that adding varied amounts of stinging nettle leaves to broiler feeds increased performance. Egg laying performance in poultry was boosted by up to 35%. The nettle-supplemented diet also resulted with improved growth and carcass quality. According to Khanal et al. (2009), stinging nettle powder supplementation in poultry and cooked preparation in pigs resulted in increased productivity. On-farm data have clearly revealed that nettle supplementation has the ability to boost productive performance in dairy cattle, not just by enhancing milk quantity and quality, according to Khanal et al. (2017). Pigs were administered a decoction of cooked nettle and *Malva sylvestris* after calving in several Italian locations to increase their resistance to infectious diseases (Viegi et al., 2003). Stinging nettle (both raw material and infusion) is administered to animals orally in Switzerland to enhance general strength and to cure genital, gastrointestinal, skin, and metabolic diseases (Disler et al., 2014). *U. dioica* L. is also used in traditional veterinary medicine in

Canada, where it is fed to ruminants as a tonic and to provide trace minerals, as well as to pregnant and lactating ones to promote fertility (Lans et al., 2007). Nettle is used to cure haematuria, rheumatism, neck sores, infertility, bone fractures, wounds, sprains, breastfeeding, belly ache, and internal injuries in animals in India (Pande et al., 2007).

1.5. Use of *U. dioica* L. as growth promoter and immuno-stimulant in fish

Stinging nettle can be utilized as a growth promoter and immune stimulant in a range of fish species, including economically important fish (*Oncorhynchus mykiss*), endangered fish (*Labeo victorinus*, *Huso*), and even ornamental fish (*Carassius auratus*). Giving rainbow trout a diet containing 1% stinging nettle reduced mortality after *Aeromonas hydrophila* infection, according to Awad and Austin (2010). In the *U. dioica*-fed group, they also noticed an increase in haematocrit, hemoglobin, anti-protease, total protein, serum bactericidal activity, respiratory burst, myeloperoxidase, complement, and lysozyme activity (Awad and Austin, 2010). Adel et al. (2017) discovered that feeding *O. mykiss* juveniles 3% *U. dioica* L. boosted weight gain, growth rate, and feed conversion ratio. After 8 weeks, the nettle group's hematological responses, such as haematocrit (Htc), hemoglobin (Hb), lymphocyte, neutrophil, and total red blood cell populations, as well as mucus bactericidal activity, all increased significantly (Adel et al., 2017). The cumulative mortality of rainbow trout juveniles infected with *Yersinia ruckeri* was significantly lower in the *U. dioica* L. group compared to controls in the same experiment, suggesting that dietary supplementation of *U. dioica* L. enhanced fish immunity and increased growth (Adel et al., 2017). Awad et al. (2012) also discovered that feeding rainbow trout a meal containing 1–2% of a herb mixture (*Lupinus perennis*, *Mangifera indica*, and *U. dioica*) for two months resulted in significantly higher weight increase, fish length, and growth rate in treated fish than in control fish. When 1% nettle extract (quercetin) was added to the trout diet, immune markers such as lysozyme, antiprotease, total protein, myeloperoxidase, bactericidal activity, and IgM titers all improved (Awad et al., 2013). At the conclusion of the feeding trial, rainbow trout were challenged with *A. hydrophila*, resulting in a higher weight, growth rate, and survival rate in the treated groups than in the control group (Bilen et al., 2016). Furthermore, all investigated immunological parameters increased after dietary administration of nettle extract, with significantly higher levels of phagocytic, lysozyme, and myeloperoxidase activity compared to controls (Bilen et al., 2016).

1.6. Use of *U. dioica* L. as vegetable

Stinging nettle is consumed as a leafy vegetable by Nepal's marginalized and underprivileged ethnic tribes. Stinging nettle contains calcium, iron, protein, phosphorus, and vitamins A and C. Diabetics, heart sufferers, and people with high blood pressure can all benefit from it. Sishnu ko saag is a common wild vegetable that grows as a weed on wastelands, walls, and hedges throughout Nepal's mid-western hills. The tender young leaves and shoots are cooked much like any other leafy vegetable (Shonte and De Kock, 2017). Because of its medicinal properties, it is a highly valued plant in Nepalese society. When harvesting nettle greens, just the sensitive highest shoots and top green leaves are selected or gathered. The lowest half of the bushes' mature and older leaves have no flavor. It's a popular dish on Nepal's five-star hotel menus. It is also regarded as one of the healthiest foods on the planet. Outside of the country, it's used as a soup, vegetable, tea, juice, and medicinal.

1.7. Use of *U. dioica* L. as botanical pesticides

Plant pesticides have been used for food preservation for hundreds of years. Nettles serve as a home for bugs' natural predators. According to Alhmedi et al. (2007), planting nettles resulted in a higher number of aphid predator species. Nettle extract can be used as an insecticide, fungicide, and acaricide under Basic Substance laws. As an insecticide,

nettle extract can be used to control codling moths, diamondback moths, and spider mites (Sharp, 2021). This fungicide can be used to prevent pythium root rot, powdery mildew, early blight, late blight, septoria blight, alternaria leaf spot, and grey mould (Sharp, 2021). These extracts inhibited the growth of *Acinetobacter calcoaceticus*, *Bacillus cereus*, *Bacillus spizizenii*, *Bacillus subtilis*, *Citrobacter freundii*, *Enterobacter aerogenes*, *Erwinia* sp., *Escherichia coli*, *Klebsiella pneumoniae*, *Micrococcus* sp., *Saccharomyces cerevisiae*, *Salmonella paratyphi*, *Serratia marcescens*, Methicillin-resistant *Staphylococcus aureus* (MRSA) and *Vibrio parahaemolyticus*. The phenolic compounds found in nettle may be responsible for this antibacterial activity (Modarresi-Chahardehi et al., 2012). Antimycotic activity against pathogenic fungi (*Alternaria alternata*, *Aspergillus flavus*, *Candida albicans*, *Ceratocystis ulmi*, *Fusarium oxysporum*, *Fusarium solani*, *Phoma exigua*, *Phytophthora carotovora*, *Porphyromonas gingivalis*, *Microsporium cookei*, *Microsporium gypseum*) were investigated (Gülçin et al., 2004; Hadizadeh et al., 2009).

1.8. Use of *U. dioica* L. in preparation of bread

Nettle leaf powder can be used as a high-protein supplement and is utilized in a number of foods, including bread (Adhikari et al., 2016). The addition of nettles to bread raised the concentration of nutrients such as fiber, calcium, copper, and iron substantially (Maietti et al., 2021). Nettle leaf powder/flour is added to bread and pasta as a high-protein supplement in starchy diets (Perez, 2022). Nettle leaves are high in protein, fiber, minerals, and other bioactive compounds, making them an ideal addition to bread and pastries (Man et al., 2019). Iron, zinc, magnesium, calcium, phosphorus, potassium (Said et al., 2015), cobalt, nickel, molybdenum, and selenium are all found in iraxa powder (Mihaljev et al., 2014). Nettle leaf powder includes approximately 30% protein, 4% fat,

10% fiber, and 15% ash on average (Man et al., 2019). According to Đurović et al. (2020), adding 5% nettle dried leaves to bread resulted in a substantial rise in ash content (1.83% vs. 1.06% for the control) but only a small increase in protein content (11.65% for the sample with 5% share of nettle leaves vs. 11.14% for the control). Nettle powder has a crude fiber content of 9.08% (Kregiel et al., 2018). Nettle bread was particularly rich in antioxidants (Forêt, 2021). Compared to regular breakfast cereals, nettle powder contains few calories. Nettle powder is considered a low glycemic index food. Whole grains alone can provide much-needed fiber (Perez, 2022).

1.9. Pharmacological properties of *U. dioica* L

Hypoglycemic, anti-inflammatory, anti-proliferative, antioxidant, antibacterial, hypolipemic, analgesic, antirheumatic, anticarcinogenic, antiviral, anti-colitis, and anti-Alzheimer activities are all found in the extract from the leaves and roots. Figure 1 shows the health benefits of stinging nettle.

1.9.1. Anti-proliferative effect

Prostate enlargement and Prostate cancer are both major problems for men as they get older, and stinging nettle has been demonstrated to be an effective approach to slow prostate growth. The ability of stinging nettle to restrict or postpone the dispersion of cells, especially malignant cells, into surrounding tissues is one of its properties. Multiple studies have demonstrated that nettle roots disrupt several pathways involved in the genesis of benign prostatic hyperplasia. UDA and methanolic alcoholic root extracts have been demonstrated to have anti-proliferative effects on prostate cancer cells in both in vivo and in vitro tests (Chrubasik et al., 2007; Lichius and Muth, 1997). Lignans from root extract

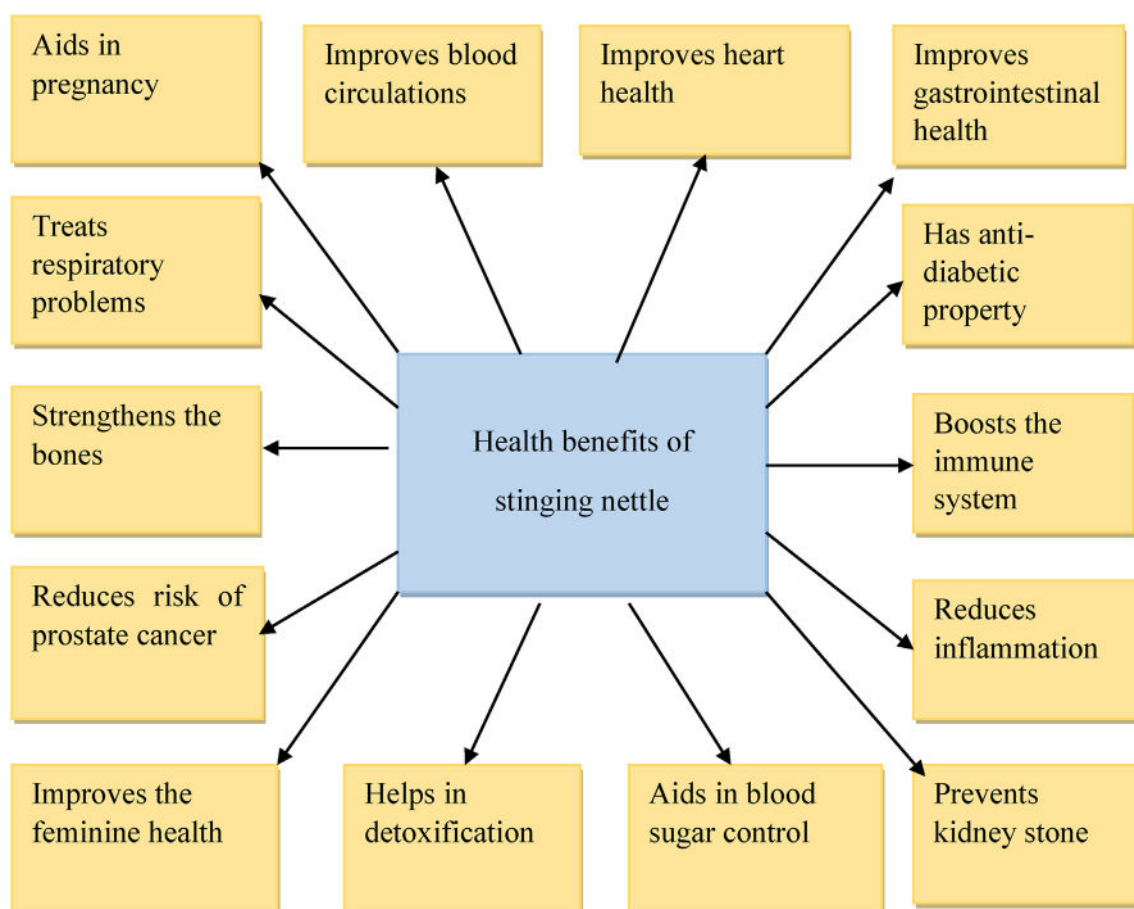


Figure 1. Health benefits of stinging nettle.

inhibit not only the binding of androgens to their transporter proteins SHBG (Sex Hormone Binding Globulin), but also their binding to the prostate's membrane receptors, inhibiting their proliferative activity on prostate tissues (Schöttner et al., 1997; Chrubasik et al., 2007; Hryb et al., 1995). The root extract reduces estrogen synthesis and thus the conversion of androgens to estrogens via blocking aromatase (Gansser and Spiteller, 1995). It was also discovered that root extracts inhibit the prostate cell membrane's enzymatic activity, halting its growth (Chrubasik et al., 2007; Hirano et al., 1994). The root extracts are also said to help relieve the symptoms of benign prostatic hypertrophy (Engelmann, 1996).

1.9.2. Anti-diabetic effect

According to an *in vivo* study, aqueous nettle leaf extracts have anti-diabetic effects (Ranjbari et al., 2016). Diabetic mice were used to test the hypoglycemic effects. The decreased glucose absorption in their intestine is the cause of these results (Bnouham et al., 2003). A number of studies have found that nettle stimulates insulin secretion, resulting in a reduction in blood sugar. This conclusion was confirmed by examining a healthy and a diseased rat following intra-peritoneal injection of aqueous extract (Farzami et al., 2003).

1.9.3. Anti-inflammatory activity

Nettles are useful for a variety of inflammatory conditions such as arthritis and chronic myalgia. Nettle tea or herbal supplements have been shown to effectively treat gout, relieve muscle aches and minimize the symptoms of arthritis. Nettle's ability to reduce inflammatory responses has been highlighted in scientific studies where several pathways lead to reduced production of lipid mediators and inflammatory cytokines. Leaf extracts suppress the production of prostaglandins and thromboxane by inhibiting the biosynthesis of arachidonic acid cascade enzymes, especially cyclooxygenases COX-1 and COX-2 (Roschek et al., 2009). In addition, the NF- κ B system involved in immunity (Farahpour and Khoshgozaran, 2015; Riehemann et al., 1999) and the PAF (platelet activating factor) system, inflammatory response and the antioxidant reaction is suppressed. In addition, several studies have shown that leaf extracts inhibit the release of interleukins IL-2 and IL-1, interferon (IFN) and the tumor necrosis factors TNF- and TNF-A (Konrad et al., 2000; Yilmaz et al., 2014). Due to its anti-inflammatory effect, Irakusa leaves are effective not only for acute inflammatory diseases but also for chronic diseases such as rheumatoid arthritis. An aqueous extract of nettle root also has anti-inflammatory properties. The polysaccharide fraction of this extract had a similar inhibitory effect on induced rat foot edema as indomethacin (Wagner et al., 1994). Suppression of cyclooxygenase and lipoxygenase, and cytokine synthesis all contribute to its anti-inflammatory effect.

1.9.4. Anti-hypertensive effect

Regularly drinking stinging nettle tea can help lower systolic blood pressure as well as relieve tension and stress in the cardiovascular system (Republica, 2018). Blood pressure was reduced by 15% and 38%, respectively, after IV injection of an aqueous extract of nettle leaves at two concentrations: 4 and 24 mg/kg h (Said et al., 2015). The decrease in blood pressure was connected to an increase in diuresis and natriuresis. Nonetheless, when a low dose (4 mg/kg h) was used, the hypotensive impact appeared to decrease after an hour, but it did not change when a high dose (24 mg/kg h) was employed (Tahri et al., 2000). Root extracts had a soothing effect when tested on isolated portions of a vaso-constricted aorta (i.e. aorta with a smaller diameter than usual). The release of nitrogen oxide by endothelial cells, the activation of potassium channels, and a negative inotropic effect are assumed to be responsible for this vasodilator effect (Testai et al., 2002).

1.9.5. Detoxifying effect

It is also said that toxins (typically acids) in the body's system cause chronic inflammations, such as dermal and arthritic disorders, and that nettle, with its alkalinity, neutralizes the acids and excretes toxins

through the urine (Yarnell, 1998). On blood and skin diseases, the stinging nettle has a cleansing astringent action. As a diuretic, stinging nettle can assist ensure that toxins neutralized in the body are quickly eliminated. It is classed as an alternative because it can improve nutrition uptake efficiency in the stomach and guarantee that digestive processes run smoothly, preventing the accumulation of toxic toxins. It also stimulates the lymphatic system, which supports the kidneys in removing toxins from the body.

1.9.6. Antioxidant effect

Reactive oxygen species are neutralized by nettle extracts (ROS). Antiradical activity was measured by spectrophotometry against superoxide anion O₂⁻, hydroxyl radical OH[·], and nitric oxide radical NO[·]. Several studies have shown that methanolic and ethanolic extracts of leaves have antioxidant activity against the 1,1-diphenyl-2-picrylhydrazyl radical (DPPH) (Kataki et al., 2012; Khare et al., 2012; Pourmorad et al., 2006; Gülçin et al., 2004). Using ferrozine, a red chromophore formed by residual iron (Fell-Ferrozine) with a maximum absorption wavelength of 562 nm, the chelation of ferrous iron was investigated. According to the absorbance values, nettle has a significant ferrous ion chelating activity (Gülçin et al., 2004). Another study showed that nettle reduced lipid peroxidation and enhanced antioxidant defense system activity in rats treated with carbon tetrachloride (CCl₄), protecting the liver against hepatotoxicity. The presence of phenolic chemicals is mostly responsible for this antioxidant activity (Kataki et al., 2012; Kanter et al., 2005). It's been proven that stinging nettle can aid acne patients and even prevent bacterial infections. Its antioxidant capabilities can aid expedite healing, lessen the appearance of scars and blemishes, and improve antiaging benefits to diminish wrinkles and age spots.

1.9.7. Analgesic and antinociceptive properties

In vivo, nettle has been shown to have analgesic properties in rats and mice. In a hot plate test at 55 °C, the aqueous extract of the leaves, given at a concentration of 1200 mg/kg, lowers thermal stimulation and increases pain resistance (Tita et al., 1993). The antinociceptive activity of the hydroalcoholic extract of nettle leaves was evaluated using the acetic-acid writhing test and formalin-induced paw licking test. The findings show that the hydroalcoholic extract reduces nociceptive responses in mice and rats in a dose-dependent manner. These analgesic properties could be attributed to flavonoids, caffeoyl malic acid, and caffeic acid (Farahpour and Khoshgozaran, 2015).

1.9.8. Antiviral activity

The antiviral activity of nettle was tested *in vitro* (Manganelli et al., 2005). UDA's specific and potent inhibitory impact on HIV (HIV-1 and HIV-2), respiratory syncytial virus (RSV), and cytomegalovirus (CMV) intracellular replication has been thoroughly documented (Balzarini et al., 1992). The N-acetylglucosamine-binding protein (UDA) from *U. dioica* hindered HIV entry and eventually selected for viruses with missing N-glycosylation sites in GP120. UDA has only a minimal influence on anti-HIV activity, even in mutant virus strains that lack at least 9 of the 22 glycosylation sites in their GP120 envelope, unlike mannose-binding proteins, which have a 50–100 fold decreased antiviral efficacy against UDA-exposed mutant viruses. UDA is the first of a new class of carbohydrate-binding agents with drug resistance profile that is very specific and targeted. It permits HIV to evade medication pressure by removing the essential glycans on its GP120 (Balzarini et al., 2005).

1.9.9. Anti-allergic activity

Stinging nettle has been shown to alleviate a variety of seasonal allergies. In trials, certain stinging nettle extract combinations have been shown to significantly reduce allergic reactions. Regular use of its tea has been connected to the cure of asthma in Australia for years. The anti-allergenic properties of nettle are mostly due to two processes. In addition to blocking histamine H1 receptors, nettle inhibits tryptase, which lowers mast cell degranulation and the release of proinflammatory

cytokines (Roschek et al., 2009). In a randomized double-blind research with allergic patients with allergic rhinitis, symptoms improved after one week of treatment (Mittman, 1990).

1.9.10. Aids in women's health

Nettle leaf tea is an excellent way to improve women's health. Since it has traditionally been used to support milk supply, nettle is a common women's health herb. Women are more likely to get UTIs than males. As a diuretic, stinging nettle aids in the clearance of more toxins linked to urinary tract infections in women (Mehta, 2017). Stinging nettle's astringent qualities may help reduce cramps and bloating during menstruation. Because nettle has so many nutrients, it's no wonder that it's been used in pregnancy tea for a long time to provide nutritional support. Nettle can help women who are approaching menopause by acting as a restorative for hormonal shifts in the body. Women are more likely to get UTIs than males. As a diuretic, stinging nettle aids in the clearance of more toxins linked to urinary tract infections. The stinging nettle acts as a coagulant, preventing excessive bleeding in women (Khan, 2018).

1.9.11. Aids in skin and bone health

Antihistamine, anti-inflammatory, and antibacterial properties of stinging nettle aid in the treatment of acne and skin problems (Gupta, 2021). Stinging nettle is high in amino acids, protein, flavonoids, and bone-building minerals like iron, calcium, magnesium, potassium, and zinc. Nettle contains vitamins and minerals that can help keep your bones strong (Gupta, 2021). Stinging nettle is one of the greatest sources of vitamin K. Vitamin K helps to maintain bone health by promoting osteoblastic (bone production and strengthening) activity. Boron is abundant in stinging nettle and is utilized to keep calcium levels in human bodies at a healthy level. Boron-rich stinging nettle can help to delay the onset of osteoporosis. You may make your bones strong and sturdy by eating nettle. This herb appears to be a one-stop shop (Khan, 2018).

1.9.12. Treating urinary tract infections

In herbal therapy, stinging nettle is used to treat urinary tract infections. The use of nettle leaf as a supportive therapy in patients with lower urinary tract infections (together with immunological and antibacterial therapy) and to prevent and treat the formation of urinary stones has been approved by researchers (Baraibar et al., 1983). It was also said to be utilized in Greece as a urinary assist and as an astringent for the treatment of kidney stones (Pourahmadi et al., 2014).

2. Conclusion

The stinging nettle plant can be found almost anywhere on Earth. Nettles can be eaten as a vegetable, juice, tea, or a flavoring in a variety of dishes. Stinging nettles have several health benefits. The nettle has antioxidant, antibacterial, and pro-health effects in all of its parts. Stinging nettle has significantly higher tannin content, total polyphenol content, antioxidant activity, carotenoids, and calorific value. The bioactivities of these functional components may be important in the prevention of arthritis, rheumatism, and cancer. The use of *U. dioica* L. in the diet, either as a single herb or in combination with other herbs, can boost growth and boost immune in fish, poultry and animals, making them more resistant to bacterial infection. The medical industry would greatly benefit from using nettle plants as a raw material source. This plants can be used to make fertilizer and pesticides. The conservation of this plant is important and more research is needed in the future.

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