REVIEW ARTICLE

Pharmacognostical review of *Urtica dioica* L.

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Urtica dioica L. belongs to the family Urticaceae, is a perennial herb commonly known as 'stinging nettle'. This herb is found in many South Asian Countries, Indian subcontinent and has been known in the world as a medicinal herb for a long time. *U. dioica* is widely used by the traditional medicinal practitioners for curing various diseases such as nephritis, haematuria, jaundice, menorrhagia, arthritis and rheumatism. Phytochemical studies revealed the presence of many valuable chemical compounds like phytosterols, saponins, flavanoids, tannins, proteins and amino acids. The plant also has been used as food, fiber, paint, manure and cosmetics. *U. dioica* has been reported to have various pharmacological activities like antibacterial, antioxidant, analgesic, anti-inflammatory, antiviral, immunomodulatory, hepatoprotective, anti-colitis and anticancer effects. The current review summarizes published information about the ethnopharmacology, phytochemistry, biological activities and toxicological reports of *U. dioica.* The present review summarizes all the research work carried out on this plant in order to provide updated information for future works.

Key words: *Urtica dioica* L., Ethanomedicinal uses, phytochemistry, pharmacology, toxicology

INTRODUCTION

Urtica dioica L. of family Urticaceae, is a perennial plant which is commonly known as stinging nettle. It is widely distributed throughout the temperate and tropical areas around the world.[1] It is found in the Himalayas from Kashmir to Kumaon at altitudes of 2,100-3,200 m.[2] The genus *Urtica* is derived from word '*uro*' to burn or '*urere*' denotation to sting.[3] Vernacular name of the plant are *Bichu Butti* in Hindi and Punjabi, *Vrishchhiyaa-shaaka* in Sanskrit, *Anjuraa* in Unani and *Shisuun* in (Kumaon) folk language.[4,5] Since olden eras, public have taken advantage of this sting by flailing arthritic or paralytic limbs with fresh plant to stimulate circulation and bring warmth to joints and extremities in a management known as urtication.[6] Traditionally, the leaves and roots of plant are used internally as a blood purifier, emmenagogue, diuretic, nasal and menstrual haemorrhage, rheumatism, eczema, anaemia, nephritis, haematuria, jaundice, menorrhagia and diarrhea.[4,7,8] The plant elaborates different classes of organic compounds of medicinal importance including phytosterols, saponins, flavanoids, tannins, sterols, fatty acids, carotenoids, chlorophylls, proteins, amino acids and vitamins[1,9,10] The compounds which are reported from the plant are beta-sitosterol, trans-ferulic acid, dotriacotane, erucic acid, ursolic acid, scopoletin, rutin, quercetin and p-hydroxylbenzalcohol.[11] The plant has been reported to have various pharmacological activities[9,12] such as antioxidant[13] anti-inflammatory, antiulcer[14] anti-colitis, antiviral[1] anticancer[15] antibacterial, antimicrobial, antifungal[14,16-18] antiandrogenic[19] insecticide[20] immunomodulatory[21] hypocholesterolemic[22] hypoglycemic[23] cardiovascular effects[22] analgesic[14] natriuretic, hypotensive[24] hepatoprotective[25] and rheumatoid arthritis.[26] This review intent to summarize diverse studies on this plant and critically evaluates the issues associated to ethnomedicinal uses, phytochemistry, pharmacology and toxicology of *U.dioica.*

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Ethnomedicinal uses of *Urtica dioica* L.

Traditionally, stinging nettle is used to treat stomachache in Turkish folk medicine.[27] Balkan countries use the leaves in the form of an infusion as a remedy for the treatment of diarrhoea, vaginal discharge, internal and external bleeding.[7] The ancient Egyptians also apparently used the infusion of nettle for the relief of arthritis and lumbago.[28] The great nutritive values produced by the leaves to be involved in the human consumption as a tonic for strengthening the body, in the preparation of soups and several dishes.[29,30] In Europe, the flowers, leaves and seeds are used as diuretic, astringent and tonic. Nettle tea and tincture are curative of feverish gout, as well as of intermittent fever and ague. Fresh nettle juice in doses forms one to two table-spoonfuls is a most useful remedy for all sorts of bleeding, whether from the nose, the lungs, or some internal organ.[31] The decoction of the leaves and

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stalks taken in moderate quantities a cure for minor skin maladies. When dried, the leaves often relieve asthma and similar bronchial troubles by inhalation.[31] Plant is also used for sciatica, for incipient wasting, for difficulty in breathing or some heart troubles (where such stimulation along the backbone affords more prompt and complete relief than any other treatment), for some coughs, palsy, suppression of the menstrual flow in women, rheumatism and for lack of muscular energy.[31] Folia Urtica is used in the alcohol preparation which is used in the therapy for chronic hepatitis, cholangitis, cholecystits and habitual constipation.[2] The ethnomedicinal uses of stinging nettle in various countries are shown in Table 1.

Table 1: Ethnomedicinal uses of *Urtica dioica* L.[32]

Region	Ethnomedicinal uses
Brazil	Asthma, bronchitis, cough, bleeding, diabetes, diarrhea, dysentery, fever, liver support, lung problems, menstrual disorders, pneumonia, skin disorders, ulcers, urinary problems, and to increase perspiration
Belize	Childbirth, diarrhoea, dysentery, prostate problems, rashes, skin problems, sores
Cuba	Bruises, burns, flu, hemorrhoids, urinary insufficiency, wounds
Dominican	Dysentery, fertility (veterinary), lung problems, and to increase perspiration
Germany	Arthritis, inflammation, prostate diseases, rheumatism, urinary insufficiency, urinary tract disorders
Guatemala	Bruises, dermatitis, erysipelas, fever, gonorrhoea, kidney disease, skin disease, skin irritation/eruptions, sores, ulcers, wounds, and to increase perspiration
Greece	Asthma, inflammation, laxative, pleurisy, spleen disorders, urinary insufficiency
Haiti	Blood purification, coughs, diarrhoea, digestive problems, fever, flu, fractures, scurvy, skin problems, wounds
India	Eczema, nosebleeds, skin eruptions, uterine haemorrhages
Mexico	Asthma, chest problems, childbirth, constipation, diarrhoea, dysentery, elephantiasis, fever, gastrointestinal disorders, haemorrhages, kidney problems, leprosy, malaria, rashes, skin problems, syphilis, uterine disorders, wounds
Peru	In the treatment of arthritis, asthma, diabetes, dysentery, bleeding, diuretic, expectorant, hair, head lice, hemorrhoids, inflammation, intestinal inflammation, kidney stones, liver disease, muscle pain, nasal ulcers, pain, respiratory problems, rheumatism, sciatica, swelling, urinary insufficiency, wounds, and to increase perspiration
U.S.	Allergies, arthritis, BPH, bleeding, hair loss, hypertension, inflammation, prostatitis, rhinitis, sinusitis, urinary insufficiency, wounds
Venezuela	Syphilis, wounds, and to lower body temperature, increase perspiration
Elsewhere	Aches, allergic rhinitis, asthma, bacterial infections, baldness, bleeding, bronchitis, bruises, burns, cancer, catarrh, chest problems, childbirth, cholecystitis, constipation, cough, dandruff, diarrhoea, dyspnea, edema, elephantiasis, epilepsy, fever, gout, hair loss, haemorrhages, hypertension, insanity, iron-deficiency anaemia, kidney stones, leprosy, liver diseases, lung problems, menstrual disorders, neuralgia, obesity, osteoarthritis, pain, paralysis, prostate disorders, rheumatism, skin diseases, sprains, stomach problems, swelling, tumors, uterine disorders, urinary problems, worms, wounds and to promote perspiration

BPH – Benign prostatic hyperplasia

Macroscopic Description

Urtica dioica is a perennial herb bearing opposite, cordate, pointed leaves [Figure 1a]. Flowering and fruiting time is from June to October. Flowers are monoecious, individual flowers are either male or female but both sexes can be found on the plant [Figure 1b]. The stem and leaves of the plant are covered with stinging trichomes [Figure 1c].[33] The plant has wide spreading rhizomes and stolons, which are bright yellow as are the perennial roots [Figure 1d]. The fresh leaves are bright green, with strongly serrated edges and a clearly visible venation on the lower surface [Figure 1e]. Both the leaves and stems are covered with erect and bristly glandular hairs that contain acetylcholine, formic acid, 5-hydroxytryptamine and histamine. The plants cause skin irritation if touched without gloves.[34]

Leaves are simple, opposite, coarsely toothed; lamina is 1.5-20 cm long and 0.6-12 cm wide; often folded up along the midrib, lower ones flatter. The veins raised below and with a few stinging hairs, leaves are lighter in colour at lower surface and mostly hairless at upper surface; petioles 0.7-7 cm long, grooved above and along the sides with stinging hairs; stipules pale green, 5-15 mm long and 2-4 mm wide, paired, entire, pointed, erect, hairy; internodal length 0.5-8.8 cm. Stem is erect, hollow to solid, fibrous and tough, mostly simple or branched, bluntly square with 4 deep vertical grooves; 2-14 mm thick near the smooth naked reddish purple base; stinging hairs 1 mm long, tapered to a fine sharp point, few to numerous, pointing upward, thick at the base. Flowers are green, blooming. Inflorescence is panicle, each 2-8 cm long from the upper leaf axils, four per node and not longer than the subtending leaves; pedicels less than 1 mm long and lightly hairy; subtending bracts (of flower clusters) green, 1.5 mm long, hairy, flower clusters unisexual. Fruits are of achene type, 1-seeded, 1-1.5mm in length and 0.7-0.9 mm in width, 0.3 mm thick, smooth, with a dark marginal ridge, very thin-walled. Seed is tan, completely filling the fruit.[35] Rhizomes are cylindrical and tapering, occasionally branched, about 6 mm thick at upper end; outer surface is yellowish-brown; internodes with deep longitudinal furrows. Numerous, smooth, very thin and wiry roots arising from the nodes, fracture fibrous and tough. Root is grayish-brown, irregularly twisted, about 5 mm thick, distinct longitudinal furrows, hollow in cross-section, cut surface white; fracture is fibrous and tough.[36,37]

Microscopic Description

Leaf

Transverse section of the *Urtica dioica* leaf has been reported to have a layer of upper and lower epidermis embedded with stomata; stomata are present more on the lower side, the cells of the upper being larger in size than that of the lower one;

Figure 1: Parts of *Urtica dioica* L plant. (a) *Urtica dioica* Linn. Whole plant; (b) Flower; (c) Trichomes; (d) Roots; (e) Leaf

enclosed with striated cuticle, unicellular to multicellular. Non glandular and glandular trichomes with unicellular stalk and cylindrical unicellular head are prominent, meristele shows radially arranged rows of vessels and an arc of phloem, 3-5 rows of collenchymatous tissue lie underneath, lamina shows a row of palisade underneath the upper epidermis. Mesophyll occupied by 5-6 row of spongy parenchyma embedded with rosette and cluster crystals of calcium oxalate and obliquely cut vascular bundles.[38]

Stem

Transverse section of the dicot stem is quadratic with prominent corners; several vascular bundles are located at each corner; between bundles the cells are thickened and pitted; fiber caps with an irregular outline occur outside of the phloem; fiber cell walls are slightly thickened, with a large cell lumen; small calcium oxalate cluster crystals 10-20 µm diameter are present in parenchyma; Pith parenchymatous with central cavity.[38,39]

Rhizome

The transverse section of rhizome has been reported to consist of cork, cortex, pericycle, vascular bundle and pith. The cork comprises of brown thin walled cells and cortex composed of tangentially elongated parenchymatous cells. The pericycle region consisting of fibres in small groups as well as single; elongated fibres with thick lignified walls. However pericycle fibers in the secondary phloem region are large in size and having a cluster crystal of calcium oxalate. The vascular tissue separated by wide medullary rays. The secondary phloem mainly comprises of parenchymatous cells whereas secondary xylem is dense and lignified, the lignified and non lignified tissue of secondary xylem are separated by medullary rays; lignified cell of secondary xylem have medullary thickened walls and several simple pits. Pith is composed of rounded non lignified parenchyma.[37]

Root

The transverse section of root has shown cork, phelloderm and vascular bundle having primary xylem in the center. The cork is thin walled and phelloderm in very narrow. The vascular bundle consisting of secondary phloem and xylem with an alternating zone of lignified and non lignified parenchymatous cell separated by medullary rays as in the rhizomes. The centre consisting of strand of primary xylem with occasional small vessels.[37]

Powder Microscopy

Leaves

The powder of the leaves has been reported to contain cystoliths and small glandular trichomes; covering trichomes; stinging trichomes (mostly broken); fragments of flowers (pollen grains, calcium oxalate crystals) and stems (fibers, calcium oxalate) are present.[38,39]

Root and Rhizomes

The powder of the root and rhizomes reported to contains pericycle fibers with thick lignified wall occurring in single or in groups. The xylem vessels are bordered pitted as well as simple slit shaped pits associated with thick walled

fibres. The medullary rays cells are abundant thin walled parenchymatous cells containing large cluster crystal or scattered crystals of calcium oxalate. The presences of brownish cork fragments are also reported.[37]

Phytochemical Studies

The main chemical constituents of *Urtica dioica* are flavonoids, tannins, volatile compounds and fatty acids, polysaccharides, isolectins, sterols, terpenes, protein, vitamins and minerals.[1,8,40-44] The compounds responsible for the burning sensation properties of leaves trichomes are acetylcholine, histamine, 5-hydroxytryptamine (serotonin), leukotrienes and formic acid.[45-47] The main components of essential oil of *U. dioica* are carvacrol (38.2%), carvone (9.0%), naphthalene (8.9%), (E)-anethol (4.7%), hexahydrofarnesyl acetone (3.0%), (E)-geranyl acetone (2.9%), (E)-β-ionone (2.8%) and phytol (2.7%).[40] The flavonoids are mainly kaempferol, isorhamnetin, quercetin, isoquercitrin, astragalin, rutin and their 3-rutinosides and 3-glycosides.[11,42,48] The shikimic acid derivatives like phenylpropanes, caffeic acid and various esters of this acid such as chlorogenic acid and caffeoyl malic acid have been identified.[49-52] The carotenoid such as β-carotene, hydroxy-β-carotene, lutoxanthin, lutein epoxide and violaxanthin are reported.[42,53-55] The leaves are rich in vitamins B, C, K and minerals such as calcium, iron, magnesium, phosphorus, potassium and sodium.[45,56] Other chief constituents present are essential amino acids, glucokinnins and a very high content of chlorophyll.[41,57-59] The chemical structures of various isolated chemical compounds from *Urtica dioica* Linn. are shown in Table 2 and Figure 2.

Pharmacological Activities

Antioxidant Activity

Antioxidants are emerging as prophylactic and therapeutic agents which scavenge free radicals or reactive oxygen species and prevent their damaging effect. Free radicals have been associated with pathogenesis of disorders like cancer, diabetes, cardiovascular diseases, autoimmune diseases, neurodegenerative disorders and are implicated in aging.[64] The hydro-alcoholic extract of *Urtica dioica* plant has shown significant results for antioxidant activity with half inhibitory concentration (IC_{50}) value of 88.33 ± 2.88 µg/ml.[34] The aqueous (5% decoction) and methanolic extracts at the concentration 50-500 mg/ml have shown significant antioxidant potential.[13] The aqueous extract in a dose-dependent manner 12.5-800 mg/ml inhibit lipopolysaccharide-stimulated nitric oxide productions.[58] The aqueous extract has significant reducing power, free radical scavenging, superoxide anion radical scavenging, hydrogen peroxide scavenging and metal chelating activities. The 50, 100 and 250 µg/ml dose of aqueous extract has shown 39, 66 and 98% inhibition on peroxidation of linoleic acid emulsion, respectively

Table 2: Phytoconstituents reported in *Urtica dioica* L.

Secondary metabolites	Phyto-constituents	References
Flavonoids	kaempferol, isorhamnetin, quercetin, isoquercitrin, astragalin, and rutin	[42,48]
Phenolics	Phenylpropanes, caffeic acid, chlorogenic acid and scopoletin	[48,60]
Carotenes	β-carotene, hydroxy-β-carotene, lutoxanthin, lutein epoxide, and violaxanthin	[43,54, 55,61]
Essential oil	esters, free alcohols, and ketones identified as 2-methyl-2-hepten-2-one, acetophenone, ethyl ketone, traces of nitrogenous substances, phenols, and aldehydes	[55]
Fatty acids	Palmitic, stearic, oleic, linolenic and linolenic	[44,62]
Other constituents	Vitamins C, B, K and minerals such as calcium, iron, magnesium, phosphorus, potassium and sodium	[8,55,63]

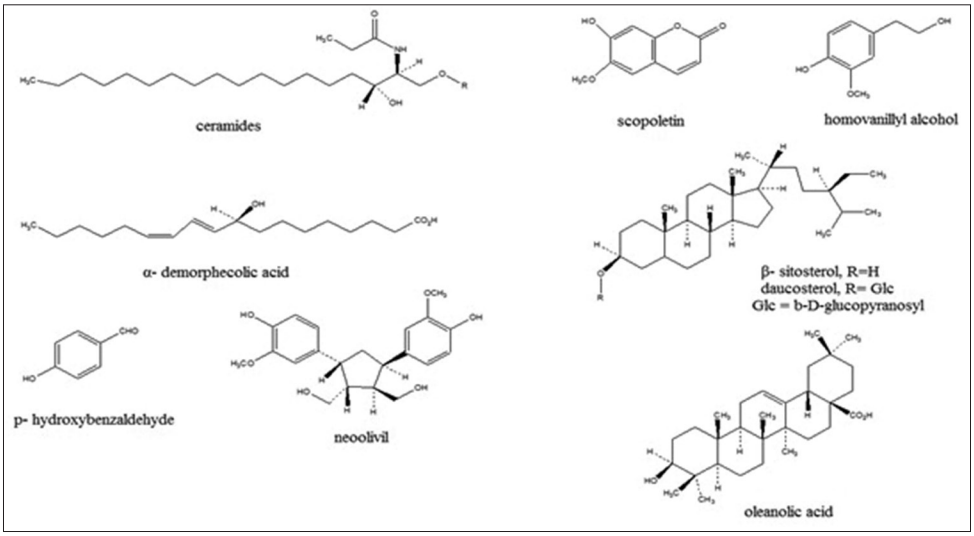

Figure 2: Structures of chemical constituents of Urtica dioica L.

while 60 µg/ml of alpha-tocopherol, exhibited only 30% inhibition.[14]

Antidiabetic Activity

The aqueous extract of plant 250 mg/kg has shown a significant glucose lowering effect against alloxan induced diabetes in rats.[59] The fructose induced insulin resistance in male rats has been shown to decrease serum glucose level on administration of hydro-alcoholic leaf extract.[65] The leaf extract was administered in perfused islets of langerhans both in normal and streptozotocin induced diabetic rats which showed a significant enhancement of insulin secretion thereby decreasing the blood sugar level.[66] The cold methanolic extract of leaves (250 mg/kg) has also shown significant antihyperglycemic effect in alloxan induced diabetes.[67]

Hepatoprotective Activity

Hepatoprotection is the ability to prevent damage to the liver, prevent the liver affections prophilactically and maintains balance in liver enzymes. The leaves extract of plant has shown maximum hepatoprotective activity at dose 400 mg/kg as suggested by decreased level of serum alanine transaminase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP), total bilirubin levels and significant decrease in malonyldehyde (MDA) level as well as a significant increase in superoxide dismutase (SOD) level.[10,68] In CCl_4 induced hepatotoxicity plant extract has shown significant hepatoprotective effect in isolated rat hepatocytes (*in-vitro*) and same in rabbits (*in-vivo*) with protective effect against hepatocellular degeneration and necrotic changes.[25,69,70] The *Urtica dioica* seed extract has also shown protective effect on hepatic damage created with ischemia-reperfusion and it exhibited liver protection effect by increasing the activity of paraoxonase, arylesterase and liver tissue catalase activity.[71]

Anti-hyperlipidemic Activity

The plant has very potent antihyperlipidemic activity as it lowers the levels of lipids and lipoproteins in blood. The aqueous extract 150 mg/kg given for 30 days to rats fed on normal or high-fat diet, improved the blood lipid profile. The significant decrease in total cholesterol, low density/high density cholesterol (LDL/HDL) ratios via lower concentrations of LDL and plasma total apo-protein B has been observed.[72] The ethanolic extract of the plant at dose 100 and 300 mg/kg has shown significant reduction in the level of total cholesterol and LDL level in hypercholesterolemic rats.[73,74]

Diuretic Activity

The aqueous extract of whole plant has been reported to produce diuretic and natriuretic effects in rabbits.[75] The aqueous extract of aerial part of the plant was administered at low dose (4 mg/kg/h) and high dose (24 mg/kg/h) which shows diuresis effect by increase diuresis (11 and 84% respectively) and natriuresis (28 and 143% respectively). Hence, the plant has shown to have potential diuretic effect.[24] The ethanolic extract of *Urtica dioica* at dose 1 g/kg (p.o) has no effect on diuretic activity but the urine output increased significantly at dose 500 mg/kg (i.p).[76] Carceres *et al*., 1987,[76] reported an increase in urine production by 20% after 1g/kg oral dose in 10% decoction in rats. The diuretic effect of stinging nettle was approximately 25% of that achieved with hydrochlorothiazine (25 mg/kg).[77]

Antiviral Activity

The N-acetyl glucosamine-specific lectin from *Urtica dioica* is a strong inhibitor of syncytium formation between HUT-78 cells and CD4 + Molt/4 cells permanently infected by HIV-1 and HIV-2.[78] The mannose binding site of HIV virus is highly susceptible after due to mutation in HIV. However the N-acetyl glucosamine region is the conserved site. Therefore *U. dioica* extract posses affinity for N-acetyl glucosamine region exhibit better anti-HIV activity. Further plant extract exhibit specificity for N-glycosylation of GP-120 may serve as an better alternative to prevent the development of drug resistance.[79] The aqueous extract of the plant indicates a significant inhibition on the development of syncytia with low doses (0.5-1 µg/ml) and increased when the concentration rose until it reached an inhibition level of 84% which, however began to show cytotoxic effects.[80]

Antimicrobial Activity

The plant has been tested for antimicrobial activity against various Gram positive and Gram-negative bacteria: *Bacillus subtilis* IP 5832, *Lactobacillus plantarum* 299v (Lp299v), *Pseudomonas aeruginosa* and *Escherichia coli*. The result has shown minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) of the extract ranged from 9.05 to more than 149.93 mg/ml^{-1}.[17] Screening of antibacterial activity of plant methanolic extract has been done on six bacteria strain such as *E. coli, P. aeruginosa, Klebsiella pneumoniae, Streptococcus pyogenes, S. aureus* and *S. epidermidis*. It showed significant inhibitory activity against *S. pyogenes*, *S. aureus* and *S. epidermidis*.[81] The antimicrobial activity of stinging nettle extract has been reported for *S. areus, Enterococcus faecalis, B. subtilis* and *E. coli*.[82,83] The flavonoids patuletin isolated from plant extract has also been tested for antimicrobial properties and the compound showed significant activity against *S. aureus, S. faecalis, E. coli* and *C. albicans* with MIC of 0.02, 0.02, 0.002 and 0.001 g/ml, respectively.[84]

Cardiovascular Effect

On intravenous (i.v) administration of *Urtica dioica* fraction 0.1 mg/kg cause a decrease of MAP mean arterial

pressure (79.59/0.5 mmHg) in comparisons to basal value (96.59/0.5 mmHg) which show that plant have antihypertensive property.[85] The aqueous extract (1 and 2 g/l) has been studied on the isolated, spontaneously beating, Langendorff rat heart and the isolated rat thoracic aorta in order to characterize the cardiac and vascular effects.[86] The increase in the concentration of KCl (40-60 mM) that is by the raise of the levels of membrane depolarization due to decrease in the vaso-relaxation action of plant. These effects proposed the involvement of hyper-polarization factors, probably bound to potassium channels opening.[87]

Anti-inflammatory, Analgesic and Anti-arthritic Activity

The plant methanolic extract at doses 200 and 400 mg/kg has been shown to inhibit dose dependently acetic acid-induced abdominal twitches and carrageenan induced paw edema.[88] The N-Methyl-D-aspartate (NMDA) injection-induced brain lesion and subsequent inflammation in wistar rats significantly decreasing the nuclear factor kappa B (NF-kB) binding activity to DNA on administration of *Urtica dioica* leaf supplementation which suggests a significant anti-inflammatory effect.[89-91] In acetic acid induced writhing test in mice, aqueous extract in a dose 50, 100 and 200 mg/kg (i.p.) produce a dose dependent inhibition in writhing.[14] Leaves extract has been used as anti-inflammatory remedies in rheumatoid arthritis due to suppression of cytokine production. It has been concluded that anti-inflammatory effect of the plant may be due to its inhibitory effect on NF-kB activation.[26]

Immunomodulatory Activity

In mouse splenocytes there was stimulation of lymphocyte proliferation and an increase in the proportion of T-lymphocytes due to immunomodulatory action of aqueous extract (400 g/ml).[58] The ethanolic extract of plant at dose 50 and 100 mg/kg body weight (b.w) given orally for 14 days showed significantly lower activity of cytochrome P450, lactate dehydrogenase (LDH), NADPH-cytochrome P450 reductase (cyt P450 R), total sulfhydryl groups (T-SH), non-protein sulfhydryl groups (NP-SH) and protein bound sulfhydryl groups (PB-SH).[92] The compounds quercetin-3-O-rutinoside, kaempherol-3-O-rutinoside and isorhamnetin-3-O-glucoside present in the methanolic extract of the aerial parts of the plant contribute to the immunomodulatory activity of the plant.[21]

Anthelmintic Activity

The methanolic extract of leaves exhibited potent anthelmintic activity which has been investigated using earth worms (*Pheretima posthuma*) and the results revealed a dose dependent increase in anthelmintic activity of the extract at dose 25, 50, and 100 mg/ml.[10,93]

Effect on Benign Prostatic Hyperplasia

The effect of *Urtica dioica* root on testosterone induced BPH has been studied by *in-vitro* studies for assessing the 5α-reductase inhibitory potential. The administration of petroleum ether, ethanolic extracts 10, 20 and 50 mg/kg (p.o.) and isolated β-sitosterol 10 and 20 mg/kg (p.o.) has been under taken for BPH studies. There was decrease in prostate/body weight ratio weekly urine out-put and serum testosterone levels, Prostate-specific antigen levels carried out which conclude that *Urtica dioica* can be used for the management of BPH.[94]

Anticancer Activity

The aqueous extract of plant has been investigated for cytotoxic activity against MCF-7, MDA-231 breast cancer cell lines by using the XTT cell cytotoxicity assay. On MCF-7 cells; IC_{50} value at 48th hr was 34 µg/ml increasing the concentration of aqueous extract up to 29.2 µg/ml has been observed to decrease MDA-231 cell viability to 43%.[95] The aqueous extract of the plant roots demonstrated a dose dependent inhibition of the globulin binding to its receptor and directly inhibits cell proliferation of HeLa cells and block binding of epidermal growth factor to its receptor.[96]

Hypotensive Effect

The aqueous extract of *Urtica dioica* reported to have positive inotropic effect associated with a marked decrease in heart rate without effecting heart pressure.[86] However, the continuous intravenous perfusion of the aqueous extract at a dose of (4 and 24 mg/kg/h) has shown decreased in blood pressure by 15% and 38% respectively.[24]

Toxicology Studies of Urtica dioica

The intraperitoneal LD_{50} of aqueous leaf extract has been found to be 3.625 g/kg in mice. Doses greater than 750 mg/kg were associated with a decrease in spontaneous activity, loss of muscle tone and hypothermia.[97] The fixed oil of the herb has completely non-lethal even at dose reaching 12.8 ml/kg.[98] In toxicity studies, rabbits of about 2 kg received orally 50 ml of a 50% ethanol extract for 10 days. Occasional diarrhoea was observed; Bodyweight decreased by 40% and death occurred after several days of treatment. Autopsy revealed purulent blisters around the injection site. Prior to death, the respiration increased and a central excitatory behaviour has been observed in the rabbits.[78,99] The LD_{50} of an aqueous extract or infusion of the roots for i.v administration to rat has been reported to have 1.721 g/kg and 1.929 g/kg b.w respectively. Whereas, oral administration of an infusion of the roots can be tolerated up to 1.310 g/kg b w.[41]

CONCLUSION

The objective of this review is to show the recent advances in the exploration of the plant *Urtica dioica*

Linn. The information as presented in this review on the pharmcognostical and various biological properties of the plant will provide detailed evidence for the use of this plant in various ailments. The plant is reported to contain mainly kaempferol, isorhamnetin, quercetin, isoquercitrin, astragalin, rutin which might be useful in the development of new drugs of versatile nature to treat various diseases because of their potent antioxidant property. Till now, no study is available leading to pure active components for particular disease hence; there is scope for research work leading to commercial utilization of the *Urtica dioica* L. in near future.

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