Nutritional and therapeutic efficacy of Stinging Nettle- A review

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Abstract
Stinging Nettle (Urtica dioica L.; family Urticaceae) is widely used species by traditional societies in temperate and tropical Asia, Europe, northern America and northern Africa. Based on literature search this paper aims to evaluate efficacy of stinging nettle concerning to ethnopharmacology, phytochemistry, pharmacology, toxicology and other ethnobotanical uses. As food the species has nutritional and immunity modulating benefits. It has shown positive applicability for treating various ailments, such as BPH, diabetes, anemia, asthma, blood pressure, kidney problem, cancer, etc.; although these claims are based on different doses, nettle type and duration of intervention, and at times results have some inconsistency. As future prospects there is a need to take-up more coordinated researches and validation studies so that applicability of nettle could be established properly against various diseases. Also, proper quality control as well as toxicological investigations is required to guarantee the stability and safety of the clinical uses. The study however highlights that stinging nettle is characterized by considerable dietary and health-maintaining qualities and has strong potential for food and therapeutic purposes.

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1. Introduction

1.1 Context
It is estimated that there are around 250000 to 300000 known plant species on the globe, however only 150 to 200 are used as food by human (FAO, 1999a). Today, 75 percent of the world’s food is generated from only 12 plants and five animal species. Rice, maize and wheat collectively contribute nearly 60 percent of calories and proteins obtained by humans from plants. Contrary to this since the 1900s some 75 percent of plant genetic diversity has been lost as farmers have switched over to genetically uniform high-yielding varieties in place of local varieties and landraces (FAO, 1999b). With the ever increasing population and fast depletion of plant resources it has now become necessary that due attention is paid to explore new plant resource that has nutritional and health benefits in order to meet the growing needs of the human society (European Commission, 2011). The challenge is not only to feed world population but also ensure them with nutritionally rich and healthy food as improved nutrition has high impact on society as it leads to better health which would further lead to increased economic growth (Floros et al., 2010). Considering that deficiency of vitamin A, iron and iodine are most common public health problems there are many lesser known species in local diets that are rich in nutrients, metabolites, antioxidants, phytochemicals that regulate biological processes for preventing and controlling diseases (Sundriyal and Sundriyal, 2001). Often the species consumed in large quantities are most explored and investigated in food and nutrition science, and limited consideration is given to lesser known but otherwise highly potential species. There is need to create awareness among people about locally consumed species that form an important part of local diets.
1.2 Justification of Research

Stinging Nettle (Urtica dioica L.) is one such species that is found widely in temperate and tropical Asia, Europe, northern America and northern Africa and consumed by traditional societies. The species has been a subject of recent scientific interest and product development all over due to its traditional usage as food, fibre and medicine. As such there are over hundred reported uses of stinging nettle (Srutek and Teckelmann, 1998; Warren, 2006; Anonymous, 2007; Bisht et al., 2012; Namazi et al., 2012a). However limited efforts have been made to synthesize such information that can lead to devise future line of action regarding this potential species. This article fulfils such gap, it synthesizes information related to food and pharmacological values along with other uses of nettle. It is expected that the article would draw sufficient attention from scientific community for a planned research on this species in near future. Also, it would raise more awareness among planners and policy makers to devise policies that can exploit the species commercially in areas where it grows naturally in abundance, such as the Himalayan region and other areas. If properly researched, every part of the nettle plant (leaves, root, seed, stem) could be utilized for the benefit of people and environment. This paper explores ethnopharmacology context of stinging nettle by covering its multicontextual uses comprising food and medicinal value along with the discourse on disease prevention and treatment. It aims to review and interpret up-to-date and comprehensive information regarding nutrition and health benefits, ethnopharmacology, phytochemistry, pharmacology, toxicology and diverse other ethnobotanical uses of stinging nettle and significance of various claims regarding this species. An important aspect of the review is to generate awareness regarding potential of nettle among masses, scientists and policy makers so that the species is used for improving socioeconomic status of rural communities. It is expected that the information on this lesser known species will draw attention of researchers, industry, agronomists, agriculturists and policy planners for taking up R&D, and to devise sustainable use and management strategies in near future.

1.3 Work plan for the study

Selection of Stinging Nettle for the study was done considering its diverse facets. The available scientific literature indicates that plant has significant potential. The species is used commonly by native rural communities in areas where it grows naturally, and exhibits socioeconomic and environmental benefits. It has wide geographic distribution range, population size and phenotypic plasticity. An assessment of Himalayan region revealed that there has been hardly any change in the species availability in past 4-5 decades. It is also considered as a prospective species for climate adaptation and stress tolerance. Other than the food and fibre usage the species is found nutritionally rich and medicinally suitable for curing many diseases. Besides, it has positive role in maintaining soil fertility and nutrient recycling. It is easy to propagate the species by seeds as well as vegetative means, and the genetic selection can be made based on fast growth, soil recovery, range of products to be made from this plant. Thus stinging nettle has significant commercial implications; its promotion can bring significant benefit to rural communities, also it would be equally advantageous environment. Considering such potential of the species, a detailed work plan was prepared to investigate available scientific information on the stinging nettle using several resources, viz. scientific journals, technical reports, books, proceedings, papers and documents published with relation to its ethnobotanical relevance, ethnopharmacological usage, phytochemical status and pharmacological significance. Data were also collected with relation to other relevance of the species. In comparison to earlier reports it has more updated information that covers available literature till March 2015. Based on the detailed review some conclusions have been drawn along with the future perspectives of research and its possible uses.

2. Description of Stinging nettle

Stinging Nettle (Urtica dioica L.) belongs to the family Urticaceae, the plant is a native to temperate and tropical Asia, Europe, northern America and northern Africa. Worldwide the Nettle family comprises 45 genera and 700-1000 species (Walters and Keil, 1996). Urtica dioica is a perennial herb that grows commonly in waste lands, gardens, farmers field (as weed), as hedges in terraced fields. It is distributed between 1200 to 3000 m in Himalaya from Jammu & Kashmir to Arunachal Pradesh (Wealth of India 1998). Commonly called as Nettle, Common nettle or Stinging nettle, all over the world Urtica dioica is known with the different names. In the rest of the text ‘nettle’ will be used in place of Urtica dioica. The plant reaches up to 2 m height and comprised opposite and heart shaped finely-toothed leaves (Graphical abstract- photo 1). The plant is called Stinging Nettle because its leaves and stems comprised hairs (trichomes) filled with a fluid that give severe sting when it comes in contact of body (Graphical abstract- photo 2). The trichome consists of 1 to 8 mm long elongate cell with a multicellular pedestal (Thurston, 1974). The composition of the fluid in trichomes comprised formic acid, histamine, acetylcholine, moroiodin, leukotrienes and serotonin, and on touching it...
Some important usage as validated by the scientific literature (Oliver et al., 1991). This property of (Casarett et al., 2008), which may last for more than 12 hrs. Greenish-white female flowers appear in clusters at leaf axils; male flowers appear on different plants as groups of diagonally upright strands at the top of the plant. The seeds are small enclosed in the dried sepals. In the Himalayan region Nettle is consumed all over, however, brownly considered poor-man’s food despite of its high nutritional and medicinal values. The species also provide fibre and also used for making some items (Graphical abstract- photo 4-6). The nettle has been a subject of R&D investigation for past few decades in view of its versatile utility. Some important usage as validated by the scientific investigation are being provided in subsequent paragraphs under different sub-headings.

3. Efficacy of Stinging nettle

3.1 Ethnobotanical importance

Use of stinging nettle as vegetable is dating back to the 1st century AD (Wetherill, 1992, 2003). The young leaves and tender shoots are cooked as green leafy vegetable after blanching; it is also described eaten raw or included in omelets, soup and various dishes (Wetherill, 2003; Menendez-Baceta et al., 2012). The plant is reported as a rich source of vitamin C, protein and minerals (iron, calcium, magnesium); also provides vitamin A, B1, B2, E and K along with a rich source of many trace elements (Cu, Zn, Mn and Co) and fibre (Adamshi and Biegenska, 1984; Wetherill 1992; Sundriyal and Sundriyal, 2001; Warren 2006, Biesiada, et al., 2009; Krystofova et al., 2010; Kowol, et al., 2011; Biesiada, et al., 2010; Rafajlovskit, al., 2013). High proteins (26%) and calcium (5.09%) in leaves, stem and root make it a good source of nourishment (Rafajlovskit et al., 2013). Interestingly the quantities of elements found in its leaves, stem and root do not exceed of health hazards and toxicological limits. When comparing to spinach and parsley, the leaves of nettle comprise as much as double protein (Wetherill, 1992). The Himalayan nettle comprised nutrient content higher than the cultivated green leafy vegetables of spinach and rayi (Saklani and Chandra, 2012). Nettle has higher concentrations of phenylalanine, and lysine, along with lower concentrations of histidine and methionine (Wetherill, 1992; Rutto et al., 2013). In view of high lysine and protein content, nettle can be considered better than other green vegetables (Wetherill, 1992). On dry weight basis, nettle leaf is considered better source of essential amino acids than almond; it is also comparable to common bean (Phaseolus vulgaris) and chicken (Gallus gallus) (FAO, 1970 as cited in Rutto et al., 2013). As lysine is a limiting amino acid in wheat, a diet supplement with nettle can provide better nutritional balance in traditional staple diet. Nettle leaf flour in bread, pasta, and noodles can make it a protein-rich supplement. Stinging nettle also provide significant quantities of oleic (18:1), linoleic (18:2) and α-linoleic (18:3) acids and is a good source of unsaturated fatty acids (Rutto et al., 2013). High levels of linoleic and α-linoleic acids are found in young and mature leaves and the presence of relatively high concentrations of the same oils in nettle are found in the seeds, stem, and root portions. As the yield of edible part of nettle varies over the seasons, the blanching and cooking has a minimal impact on the fatty acid composition of nettle, implying that it can be a good source of essential fatty acids when eaten as a leafy vegetable (Rutto et al., 2013). Nine carotenoids are also identified in the leaves (Guil-Guerrero et al., 2003). Also, the properties of phenolic compounds in the leaves, stalks, and fibers have been reported (Gulcin et al., 2013; Pinelli et al., 2008). Processed nettle can supply 80–100% of Vitamin A (as β-carotene) (Rutto et al., 2013). Nettle tea made from fresh or dried leaves, sweeten with honey or sugar is considered good in taste that also comprised mineral contents (Ozcan et al., 2008) and trace elements (Kara, 2009). To make food more appetizing, nettle leaves can be used fresh, dried or powdered. Apart from using as a green vegetable, nettle can also be used as soup and as seasoning material with multiple dishes like pizzas, pastas, puddings, bread, etc. (Warren, 2006).

Most of livestock do not consume fresh nettle, except buffalo. However it is considered nutritious fodder in dried form that can be mixed with other hay and fed to animals; such combination are considered beneficial to increase body weight and meat quality (Hanczakowska et al., 2007; Khosravi, et al., 2008; Kwiecien and Mieczan, 2009). Use of nettle by broilers during the rearing period at a dose of 1% is found as growth promoters (Safamehr et al., 2012), that also enhances histological features of immune structures in caecal tonsils. Enhancement of immune potential of this lymphoid organ may be beneficial in prevention of related diseases and/or reduction of mortality rates (Hamedi et al., 2015). Adding dry powder of nettle in the diets of laying hens significantly increases egg production, (Mansoub, 2011a) and lowers the total cholesterol and triglycerides concentration (Mansoub, 2011b).
3.2 Ethnopharmacological application

Nettle has been used for centuries in various folk medicine systems in China, Persia, Turkey, Russia, India and various other countries to cure humans and animals. For treatments it is used as extract (juice), in dried form, as tincture, ointment and/or as a supplement. It is used to treat allergies, kidney stones, burns, anemia, rashes, internal bleeding, diabetes, etc. It is used for the treatment of eczema, rheumatism and inflammation in traditional herbal medicine in China (Wang and Wei, 2001), and in Anatolia (Hayta et al., 2014). In Turkish folk medicine, it has been used to treat rheumatic pain, colds and cough (Sezik et al., 1997) and against liver insufficiency (Yesilada et al., 1993). Its seeds fixed oil is used to treat rheumatism (Baytop, 1999; Pamuk, 1998). One of the notable anecdotal benefits of nettle is the application of fresh nettle on student’s back to improve learning ability (Komeyev, 2005). In ancient Persian medicine system it has been used in anti turgid treatment (Zargari, 1994). In the Russian folk medicine the root powder and seed of Urtica dioica used against dropsy, diarrhoea and worms as reported by the Committee on Herbal Medicinal Products (HMPC 2012: 4-9). The species is also used in oriental Marocco, Lithuania, and African folk medicine systems. In Morroco, nettle stalk and leaves are used to treat diabetes and hypertension; and as antirheumatic, astringent, diuretic, antidiuretic, and chologogue (Ziyyat et al., 1997). The whole plant is used as a diuretic, anti-hypertensive, anti-diabetic, hemostatic, anti-asthenia, antimanic, antispasmodic, antirheumatic and as a remedy for headaches and chills (Brouham et al., 2002; Hmamouchi 1999). Nettle seeds are administered orally for their aphrodisiac and galactagogue effects as well as against tuberculosis and kidney stones (Bellakhdar, 1997). In Italy it is reported to be used as a household remedy for gastrointestinal and rheumatic pains (Guarrera, 2005). A complied information on nettle’s use in Complimentary and Alternative Medicines reported that Greek physicians used nettle leaf useful in asthma, pleurisy, and for the treatment of spleen-related illness; in traditional African medicine it is used for cure nosebleeds, excessive menstruation, and internal bleeding; in German homeopathy for treatment of urticaria, herpes, eczema, hypersensitivity reactions in the skin and joints, and burns; in North America as anti rheumatic drug and gynecological aid; and in Indian Ayurvedic Pharmacopoeia for uterine hemorrhage, cutaneous eruptions, eczema, and nosebleed (Gemeinhardt, 2011). In USA it is generally taken as a component of wide range of food supplements. One preliminary human study suggests that nettle capsules helped reduce sneezing and itching in people with hay fever (Ehrlich, 2011). It is used as a diuretic, as a nutritive tonic and as supportive therapy to help relieve rheumatic complaints and allergy symptoms (Hoffmann, 2003; Tilgner, 1999). Root is used to help reduce difficulty in urination associated with the early stages of benign prostatic hyperplasia (http://webprod.hc-sc.gc.ca/nhpdbipsn/monoReq.do?id=166&lang=eng). To cure rheumatism and arthritis in the Himalayan region the traditional practice of flogging the affected body part with stinging nettle shoots is still in practice. Amongst Jaintia tribe, India fruit and leaf ash of nettle is applied to treat fever (Jaiswal, 2010). The joint inflammation caused by the excess uric acid in the blood is known as gout; and consuming nettles is reported to increase the excretion of uric acid from the body and is an effective treatment for gout in herbal medicine (Sinha, 2015; http://www.gouttreatmentme.com/nettle-tea-for-gout/). Other than the joint ailment it has been found effective in various other diseases, namely allergies, ulcer and bronchitis, pleurisy, asthma, colds, sciatica, stress, anemia, depressions and many more (Warren, 2006). According to Dr Christopher’s Herbal Legacy ‘Stinging nettle is an astringent, diuretic, tonic, anodyne, pectoral, rubefacient, styptic, anthelmintic, nutritive, alterative, hemetic, anti-rheumatic, anti-allergenic, anti-lithic/lithotriptic, haemostatic, stimulant, decongestant, herpatic, febrifuge, kidney deputative/nephritic, galactagogue, hypoglycemic, expectorant, anti-spasmodic, and anti-histamine’ (http://www.herballegacy.com/Dr_Christopher_Formulas.html). Nettle extract has diuretic, and hypotensive effects (Tahri et al., 2000).

3.3. Phytochemicals composition

The application of nettle to cure diseases with good healing properties can be attributed to the presence of certain phytochemicals, such as flavonoids, lignans, fatty acids, sterols, polysaccharides, glycoproteins, carotenoids, plastocyanins, tannins and lectins (Sajfrtová et al., 2005, Ghaima et al., 2013). Efforts are being made to identify and isolate such phytocompounds from different parts of the plant that has direct effect (Krystofova et al., 2010). It is reported that nettle comprised polysaccharides, vitamin C and carotene, beta-sitosterol, and the flavonoids quercetin, rutin, kaempferol, and beta-sitosterol (Newall et al., 1996; Schottner et al., 1997; Konrad et al., 2000). The leaves comprised diterpene lactone and Phlogantholide A. Polar extracts of the nettle roots contain the lignans that have binding affinity to SHBG in the in vitro assay (Schottner et al., 1997). Other than the lignans nettle is reported to have lectins, sterols, phenylpropanes, carotenoids, hydroxyl fatty acids, triterpenes, phenols, coumarins, fatty acids and carotinoids, flavonoids,
amines, chlorophylls and carotinoids (Seliya and Kothiyal, 2014). The main components of essential oil in nettle are carvacrol (38.2%), carvone (9.0%), naphthalene (8.9%), (E)-anethol (4.7%), hexahydrofarnesyl acetone (3.0%), (E)-geranyl acetone (2.9%), (E)-ionone (2.8%) and phytol (2.7%) (Gul et al., 2012).

3.4 Pharmacological significance
Considering that all parts of nettle (i.e. leaves, stem, inflorescence, seeds and roots) are used in traditional folk medicine system, establishing its scientific validity for broader utility has been an important subject of investigation in recent years, which was taken up on human, and animals through in vitro and in vivo experimentation (Dar et al., 2013; Joshi et al., 2014; Seliya and Kothiyal, 2014; Said et al., 2015). The results indicated that nettle is beneficial to cure rheumatism and arthritis (Riehemann et al., 1999; Schulze-Tanzil et al., 2002; Yang et al., 2013). It enhances anti rheumatic effectiveness and beneficial to patients either in pain relief and/or disease process modification (Chrubasic et al., 1997; Obertreis et al., 1996; Broer and Behenke, 2002; Chrubasic et al., 2007a; Randall et al., 1999, 2000; De Smet, 2002; Gupta et al., 2014; Jacquet et al., 2009; Rayburn et al., 2009). It is reported to be effective in curing allergies (Roschek et al., 2009; Thornhill and Kelly, 2000; Helms and Miller, 2006). Its extract comprised bioactive compounds responsible for inhibition of pro-inflammatory pathways related to allergic rhinitis that provide a mechanistic understanding of its role in reducing allergic and other inflammatory responses in vitro (Roschek et al., 2009).

Significant correlations were found among phenolic phytochemicals and radical scavenging activity of nettle (Hall and Cuppett, 1997; Mandal et al., 2009; Biesiada et al., 2010; Khare et al., 2012, Ghaima et al., 2013). The free radicals are normally generated during normal body metabolic function and also can be acquired from the environment. Use of nettle supplement is considered to have effective antioxidant role (Toldy et al., 2005; Kukric et al., 2012), which can be used to reverse the harmful and pathological effect of the free radicals (Yanishiera et al., 2006; Kataki et al., 2010). High content of phenolic compounds and ascorbic acid are reported in young leaves of nettle (Ioana et al., 2013). The hepatoprotective, prophylactic, and anthelmintic activity of nettle are also determined (Kataki et al., 2012).

Nettle fruit extracts is reported to protect liver cells from the negative effects of fluoride (Gutowska et al., 2014; Juma et al., 2015a, b). It also has liver regeneration capacity and increases antioxidant defense in body (Kanter et al., 2003; Oguz et al., 2013; Kandis et al., 2010). In rats it decreases hepatotoxic effects of CCl_{4} in sixty days (Naz and Mehboob, 2014) probably by promoting the antioxidative defense systems (Yener et al., 2009) thus exhibit potential to cure liver injury (Oguz et al., 2013). Consumption of nettle leaves reported to decrease cholesterol levels, enhance the liver function and regulate blood cholesterol abnormalities in mice (Daher et al., 2006; Nassiri-Asl, 2009; Nigam et al., 2014).

Benign Prostatic Hyperplasia (BPH) is found approximately in 50% (age 51–60 years) to 90%
(age 81–90 years) men (Berry et al., 1984). Nettle showed positive effect to cure prostate problem (Hryb et al., 1995; Lichius and Muth, 1997; Kornard, 2000; Schneider and Rubben, 2004; Safarinejad, 2005; Nahata and Dixit, 2012; Ghorbanibirgani et al., 2013). The aqueous extract of nettle exhibits potential role in prostate therapy (Levy et al., 2014), in mice the induced growth could be reduced by 33.8% by the polysaccharide fraction (POLY-M) of the 20% methanolic extract of stinging nettle roots (Lichius et al., 1999). It is reported to have anti-proliferative effect on prostatic epithelial cells, which could be a potential mechanism of action in patients with BPH (Durak et al., 2004). The nettle root could prevent from some of prostatic hyperplasia effects, so that percentage of folded alveoli in ventral lobe reduced insignificantly (Moradi et al., 2015). Nettle also forms the part of many herbal medicines that act as anti-inflammatory, anti-tumor, antiviral remedies; it relieves the symptoms of benign prostatic hyperplasia due to diverse phytosterol, lignan and polysaccharide compounds in it with varied level of success (Wagner et al., 1994; Mills and Bone, 2000; Farahpore et al., 2015). However, despite of positive results of nettle in the treatment of BPH, there is some contradictory evidence about its effectiveness level (Marks et al., 2000; Chrubasik et al., 2007b). Therefore there is a need to further verify the claims through proper experimentation.

Hyperandrogenism is considered one of the common endocrine disorders and cause of infertility by lack of ovulation; and application of nettle has shown improvement in women suffering from such disease (Najafipour et al., 2014). Nettle extract is also found useful antimicrobial agent that has the potential for pharmaceutical and food industry (Lichius and Muth, 1997; Modarresi et al., 2012; Ghaima et al., 2013). In synthetic condition, the extract can halt the viral propagation such as those causing Aids and hepatitis (Chrubasik et al., 2007 as cited in Lahigi et al., 2012). Its extract has exhibited promising anti-bacterial activity against multi-drug resistant strains (Lahigi et al., 2012; Singh et al., 2012, 2013).

Nettle is a good source of bioactive compounds justifying its use in folk medicine, to treat various diseases. Part of the anti-inflammatory effect of nettle extract may be ascribed to its inhibitory effect on NF-kappa B activation (Riehemann et al., 1999; Tekin et al., 2009; Dar et al., 2012; Khalili et al., 2012; Ghaima et al., 2013; Farahpore et al., 2015). Evidence suggests that adding nettle might allow for a lower analgesic dose in some patients (Gagnier et al., 2006). The presence of a relatively high concentration of flavonoids and caffeic acid derivatives enriched in the lipophilic fraction of the this herb suggest mainly anti-inflammatory, antioxidant and analgesic activities (Schulze-Tanzil et al., 2002; Chrubasik et al., 2007; Biesiada et al., 2010). The clinical trial of Nettle seed extracts showed positive results for treatment of renal dysfunction (Treasure, 2003). Seeds are also recommended as a restorative kidney tonic for severe cases of kidney failure (Winston, 2001).

Diabetes mellitus is a serious metabolic disorder that can cause several functional and morphological alterations in the central nervous system (Gispen and Biessels, 2000), and nettle has positive role in the treatment of diabetes (Mehri et al., 2011). The aqueous extracts of nettle leaves show anti diabetic activity by improving the glycemic status in diabetes induced rats and also significantly lowering cholesterol levels. There is a glucose lowering substance in nettle that does not increase insulin secretion and can be absorbed through intestinal lumen (Riazi et al., 2007). It is found effective in both Type 1 and Type 2 diabetes (Farzami et al., 2003; Golalipour et al., 2006, 2007; Golalipour and Khori, 2007; Das et al., 2011). It has a protective effect on the morphometric alterations of hepatocytes in the periporal and perivenous zones of the liver lobule in diabetic rats (Golalipore et al., 2010). However it has no effect on renal morphometric indices (Golalipore et al., 2007b). The possible mechanism by which nettle mediated its antidiabetic effect could be by improvement of pancreatic secretion of insulin from existing β cells of islets (Nigam et al., 2014). Nettle is also used traditionally in treatment and/or prevention of cardiovascular disease (Namazi et al., 2012b). In vitro and in vivo studies of the crude aqueous and methanolic extracts of the nettle plant roots, as well as purified fractions have produced hypotensive responses (Testai et al., 2002). Dose dependent nettle has an anti platelet effect in experimental rats in which flavonoids is mainly implicated (El Haouari et al., 2006). However there is still a need to undertake further experimentation to strengthen these claims (Golalipore et al., 2011) as all these claims are based on different doses, nettle type and duration of intervention. Therefore further experimentation will help to determine exact mechanism of action, effects and side effects, and exact quantity to be taken of U. dioica in various diseases.

3.5 Side effects and toxicity

Use of herbs is although a time tested approach to strengthen the body and treating disease; it may sometime trigger some side effects and can also interact with other herbs, supplements, or medications. However, nettle is generally considered safe if used as prescribed. The occasional side effects reported for nettle may comprise mild stomach upset, fluid retention, sweating, diarrhea, and hives or rash (mainly from
topical use). It should never be applied to open wounds (Ehrlrich, 2011) despite of its minimal allergenic significance (Vega-Maray et al., 2006). There may be miscarriage abortifacient risk of nettle (De Smet, 2002), therefore lactating mothers should consult physicians before using its skincare products (Uslu et al., 2011). Nettle root can cause gastrointestinal complaints, sweating, and skin reactions (Heinrich, 2003). Nettle juice can sometimes cause diarrhea (De Smet, 2002).

Although some recent studies consider nettle to be safe there are a few reports about the toxic effects of nettle (Dar et al., 2013). The aqueous extract has shown some possible abortive and uterine-stimulant effects when used orally (Bush et al., 2007). It has been reported to be slightly toxic with intravenous LD50 of 1310 mg/kg. Its toxicity has been attributed to the presence of hydro soluble constituents, (suspected to have a pyran-coumarin structure), a substance eliminated by boiling (Baraibar et al., 1983). The risk for adverse events during nettle root treatment is very low (Chrubasic et al., 2007a). Standardized nettle extract (at doses up to 50% concentration) showed no mortality in mice. There were no toxicity signs and no noticeable behavioral changes in salivation, sleeping pattern, diarrhea or lethargy in treating animals. The LD50 level of the hydroethanolic extract was found to be 5770 mg/kg in mice (Farahpore et al., 2015). Toxicity tests showed higher safety margin of all the solvent extracts with LC (50) > 1000 µg/mL each on A. salina (Dar et al., 2013). Oral dose of 1000 mg/kg for 3 days showed no mortality or behavioural change upto 1000 mg/kg in the albino rats (Nigam et al., 2014). No cytotoxic effect of 20% methanol extract on cell proliferation was observed (Konrad et al., 2000). There were no adverse reactions attributed to the drug phthalic containing nettle as a constituent, other than digestive (flatulence and diarrhea, fish-smelling eructation) (Jacquet et al., 2009). However some toxic effects are observed in horses (Bathe, 1994) and in somatic cells of Drosophila (Graf et al., 1994). There is need of more researches on side and toxic effects of nettle so as to establish it as user friendly.

3.6 Other relevance of stinging nettle
Nettle has been used as a textile for at least 2000 years in Europe, and use of fibers from stinging nettle to make sail-cloths, sacking, cordage and fishing nets is done in Europe and America (Bacci et al., 2009). The plant produces long and strong fibers similar to that of hemp and flax, which are soft and flexible; and careful processing can make it as fine as silk fibre (Wealth of India, 1998). Cultivated plants produce high fibre content (from 5% to 17%), which can be increased further through breeding (Bredemann, 1959) (Photo 5-6).

As the search for plants that enable to produce quality fibre that is produced organically is rising day-by-day, nettle holds high promises for the future (Vogl and Hartl, 2003). The development, cultivation and processing of nettle has become a topic of research in many countries during 1990s. A study on the agronomic behavior and morphological characteristics of 170 provenances of nettle species showed that promising and desirable traits, such as frost tolerance, optimum growth and with high fiber content (long, straight, stable and unbranched stalks, abundance of leaves and strong tillering) can be developed through cross-breeding (Bredemann, 1959). Thus Nettle has the potential to be used as an alternative to cotton which is a pesticide intensive crop.

Other than using as fibre Nettle can also be used to prepare the herbal dye (greenish-yellow), which is extracted from the leaves, stems and roots (Kowalchik and Willium, 1998). Mixing of nettle in compost heap not only adds nutrients but also accelerates the breakdown of organic matter into robust humus (Walldin, 2004; Cooper, 2009; Thun, 2010). Water extract of nettle acts as positive growth stimulating effect on plants as it increase nitrogen content in treated crops (Peterson and Jensén, 1988). When mixed with compost, it adds to quality of manure as being rich source of nitrogen thus helps to replenish soil (http://www.telegraph.co.uk/gardening/7645974/Nuelles-Bad-guys-come-good.html) and helpful in promoting organic agriculture. Presence of stinging nettles in landscapes seems to enhance the density of aphidophagous insect communities necessary for aphid biocontrol in field crops (Alhmiedi et al., 2009). Anti bacterial property of the nettle seed extract has high activity against phytopathogens (Korpe et al., 2013). These reports clearly indicate that there are diverse environmental benefits of nettle; therefore promoting its cultivation on a commercial basis can prove to be a ‘carbon neutral’ business with no waste.

Conclusions and future prospects
In light of long and multiple traditional uses and recent photochemical and pharmaceutical studies summarized, U. dioica has demonstrated a strong potential for food, health-maintaining and therapeutic purposes. The best edible parts are young leaves and tender shoots that can be cooked as green vegetable, soup, or used for seasoning purposes. Review indicates that in-vitro, in-vivo and clinical researches are validating its use in traditional and herbal medicines. As herbal medicine it is useful to cure rheumatism and arthritis along with treating allergies, anaemia, asthma, bronchitis, burns, colds, depressions, diabetes, internal bleeding, kidney stones, pleurisy,
rashes, sciatica, stress, etc. with varied level of claims. The species has antioxidant role, it is considered to decrease cholesterol levels and cure prostrate problems, works as anti-inflammatory, anti-tumor, antiviral and anti microbial. Mixing of dry nettle leaves in feeds is reported to increase its quality as well as animal growth. The plant has other diverse environmental benefits; it produces long and strong fibres similar to that of hemp and flax and careful processing can make it as fine as silk fibre. It is also used to prepare a herbal dye, addition of Nettle in compost heap adds nutrients and accelerates breakdown of organic matter in humus.

As food the plant has nutritional and immunity modulating benefits, the leaves and tender shoots are recommended for human consumption as vegetable, soup and ingredient to various dishes. It is suggested that more researches are to be done with relation to protein, minerals, vitamins and other bioactive compounds in fresh and dried nettles. Also, there is a need to assess its processing potential along with the impact of different processing methods on nutritive qualities of nettle. Equally important is to know the side effects of the nettle consumption concerning which very limited information is available at present. The pharmaceutical investigations have shown broad range of applicability of using this herb independently or in combination for treating various ailments, such as BPH, diabetes, anemia, asthma, blood pressure, kidney problem, cancer, etc.

In Himalayan states though the Nettle grows abundantly, it has so far not received the required scientific attention (Saklani and Chandra, 2012). Use of stinging nettle as vegetable was common in past in Himalayan region and there is huge genetic variability of nettle in the region, however in recent times its use is limited to interior villages (Sundriyal et al., 2004). It has better prospects for food, health and therapeutic intents. Besides, the plant has other diverse environmental benefits; mixing in feeds it increase animal growth, its long fibres has promising potential to be used in textiles, it can be used as herbal dye, and adding in compost it improve quality of manure. Therefore raising awareness among rural communities regarding use of this plant will help them in many ways. The communities must be educated to use the species as food as well as to make diverse products from this species. Despite being environmentally friendly and free excess natural resource, extraction of nettle fibre and making clothes from them is a costly affair at the moment. To make it cost effective, propagation of species is highly warranted. With multiple uses nettle can be focused as high value and low-calorie nutritious food beneficial to human health, which is a valuable source of minerals and vitamins in vegetarian and other specialized diets. In future more researches are required on all these aspects so that plants could be used to its fullest potential in the areas where it grows abundantly. Such efforts would benefit millions of people, particularly in rural areas.

**Research Highlights**

In traditional folk system all parts of nettle (i.e. leaves, stem, inflorescence, seeds and roots) are used for different purposes, and in recent years scientific validation for the utility is being established through experimentation on human, animals and in **vitro** and **in vivo** experimentation.

As food stinging nettle has nutritional and immunity modulating benefits and it comprised higher nutrient content than the cultivated green leafy vegetables, however more researches are needed to assess protein, minerals, vitamins and other bioactive compounds in fresh and dried nettles.

As medicinal plant the species has positive results for treating BPH, diabetes, anemia, asthma, blood pressure, kidney problem, cancer, etc. although it needs further validation through researches.

The species comprised socioeconomic and environmental benefits; there is huge potential to exploit species commercially, which can benefit rural communities in areas where the species grow naturally.

**Limitations**

More researches are required to validate quality of product when stinging nettle is mixed with other food items. Also, more researches required with relation to protein, minerals, vitamins and other bioactive compounds in fresh and dried parts of the species separately. Although the species is claimed to be beneficial for curing BPH, diabetes, anemia, asthma, blood pressure, kidney problem, cancer, etc., however at times, there is inconsistency among the results. There is a need to further standardize the doses for treating such diseases along with efficacy of nettle prototypes and duration of intervention. Therefore further validation is required. Besides, limited information is available regarding use of nettle as soil fertility enhancer.

**Recommendations**

In view of the available information stinging nettle showed considerable nutritional and therapeutic prospects. It can be a low-cost and easily accessible...
substitute to human diets. However, before that it is recommended to further validate the claims on its food and pharmacological values through extensive R&D so that inconsistency among the findings can be omitted. For this purpose, more coordinated researches and validation studies are required to be taken up in near future. Also, proper quality control as well as toxicological investigations is required to guarantee the stability and safety of the clinical uses.

**Funding and Policy Aspects**

Considering that there are many potential species that comprised good food value such species are needed to be investigated in detail so that they can be used to fulfill the food demand of ever growing population. The local government should be informed about such species and a thorough strategy need to be devised for cultivation and multiplication of such species. Also, proper policy and funding for testing such species can support more researches and validation studies. There is a need to bring more and more plants into our food-sphere so that sustainability in food supply can be achieved.

**Author’s Contribution and Competing Interests**

Dr V Pant (VP) envisaged the concept of review and both authors developed a broad framework. Both did the literature survey, and Dr RC Sundriyal (RCS) prepared final draft and did all correspondence.

The authors have no competing interest.

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**References**


randomised double-blind placebo-controlled clinical trial. Arthritis Research & Therapy, 11, 192.


Rafajlovska V., Kavrakovski Z., Simonovska J., Srbinoska M., 2013. Determination of protein and...


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