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Himalayan Stinging Nettle: Rich Source of Protein and Minerals

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Abstract
Realizing the significance of wild growing stinging nettle (Urtica dioica) as a solution to the prevailing malnutrition, this plant was chosen as a subject of study. The experimental material was collected from four different locations in Kumaun region of Uttarakhand and cultivated in 2 replicated plots in the field at Almora. Objective of this study is to explore the nutritional food potential of this wild plant. Nettle has been found to be rich source of protein, calcium, magnesium, potassium and iron. It contained 20 amino acids: arginin, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, serine, threonine, valine, tyrosine, alanine, proline, glycine, tryptophan, aspartic acid and aspargine, Glutamic acid and Glutamine, Cysteine and cystine It means it has all essential amino acids except tryptophan. Other than these, nettle also contained Cu, Mn, Zn and Na. This plant species needs thorough research for its utilization in human health.

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Introduction

Context-
Lifestyle related diseases are on the rise globally. However these conditions are a well-known problem in the west but much less understood is that they now account for the majority (53%) of deaths and disabilities in the developing world – taking 31 million lives a year. Diet and nutrition are important factors in the promotion and maintenance of good health throughout the entire life course. Their role as determinants of chronic NCDs is well established and they therefore occupy a prominent position in prevention activities (WHO 2002). Poor diet is one of the many factors responsible for such conditions and their impact can be reduced by making healthier choices earlier in life. Nutraceuticals are one of such choices that play a significant role in controlling the lifestyle ailments and have been receiving considerable attention due to their speculative safety. Coined by Stephen De Felice in 1989 ‘nutraceutical’ was derived from the words nutrition and

pharmaceutical. These are considered as food or part of food that gives therapeutic benefits and claimed prevention and treatment of diseases. To take the burgeoning challenge head on we need to take a clue from traditional food. The diet of rural and indigenous communities is still diverse as the studies in Himalayan and other regions indicate. These still use wild plants for food, medicines, fermented foods and beverages, dyes, oil, and as the domestic goods. They use wild plants for food that are rich in nutrition and play a significant role in well - being. Significance of the wild food plant increases more with global estimate that 1.02 billion people are undernourished and malnutrition is a major health burden in developing countries. One of such plant is stinging nettle.

Description of nettle-

Belonging to the family Urticaceae, Stinging Nettle (*Urtica dioica* L.) is a native to temperate and tropical Asia, Europe, northern America and northern Africa. It 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). The plant is called Stinging Nettle because

Figure 1: Stinging nettle (Urtica dioica)

its leaves and stems comprised hairs (trichomes) filled with a fluid that give severe sting when it comes in contact of body (photo). The composition of the fluid in trichomes comprised formic acid, histamine, acetylcholine, moroidin, leukotrienes and serotonin that cause irritation on touching it (Casarett et al., 2008). This property of nettle had made favorite weapon of punishment used by grandmothers and mothers on kids in Uttarakhand. However they were very well aware of the other side of the coin: 'its medicinal properties' that despite of causing irritation and/or mild rashes not going to harm children (Pant and Sundriyal 2016). One of the most notable anecdotal benefits of nettle is its reputed ability to improve learning through the application of fresh nettle to a student's back (Komeyev 2005).

Significance of stinging nettle- Tradition of using nettle as medicine had been prevalent worldwide including China (Wang et al 2001), Anatolia (Hayta et al 2014), Iran (Zargari 1994), Turkish folk medicine (Sezik et al 1997, Yesilada et al 1993), Russian folk medicine (HMPC 2012:4-9), USA (Ehlrich 2011), Italy (Guarrera 2005), Moracco (Ziyyat et al 1997, Bnouham 2002, Hmamouchi 1999, Bellakhdar 1997), Germany (Gemeinhardt 2011). Different parts of the plant seeds, leaves, roots have been used in all these folk medicines for the treatment of eczema, rheumatism and inflammation, colds and cough, and against liver insufficiency, as antipyretic, purgative, diuretic, in the therapy of advanced cancer, as antihypertensive remedy, against dropsy, diarrhoea and worms, to treat atrophy , sneezing and itching, hay fever, diabetes, hypertension, astringent, antirheumatic, diuretic, antidiuretic, and cholagogue, hemostatic, anti-asthenia, antianemic, antispasmodic, orally for their aphrodisiac and galactagogue effects as well as against tuberculosis and kidney stones, useful in asthma, pleurisy, and for the treatment of spleen-related illness, herpes, eczema, hypersensitivity reactions in the skin and joints, and burns, early stages of benign

prostatic hyperplasia. In India, the Ayurvedic Pharmacopoeia lists stinging nettle herb for uterine hemorrhage, cutaneous eruptions, eczema, and nosebleed. Jaintia tribe of Meghalaya (in India)uses fruit and leaf ash of Urtica dioica and use it to treat fever (Jaiswal 2010). For relief flogging of swollen joints due to arthritis/rheumatism is very common by the affected patients in Uttarakhand (Pant and Sundriyal 2016). 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).

Traditionally use of nettle leaves as part of food had been quite popular. On heating or blanching the stinging property of nettle is dissipated and makes it main ingredient to be used as green leafy vegetable, soup, pesto, omlette etc (Wetherilt, 2003; Menendez-Baceta et al., 2012, Pant and Sundriyal 2016). Historically its use as vegetable goes back to Ist century AD (Wetherilt, 1992, 2003). 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 (Ehlrich 2011). The plant is reported as a rich source of protein and minerals (iron, calcium, magnesium); also provides vitamin A, B1, B2, C, E and K along with a rich source of many trace elements (Cu, Zn, Mn and Co) and fibre. Spinach and rayi are very popular green leafy vegetables of Uttarakhand state of India. However Himalayan nettle has surpassed both of these in nutrient content (Saklani and Chandra, 2012). When comparing to spinach and parsley, the leaves of nettle comprise as much as double protein (Wetherilt, 1992). And also it has higher concentrations of essential amino acids than Brussels sprouts (Lisiewska et al., 2009).

Justification of the study- In unsion with food security, nutritional security is current buzzword. Realizing the situation of malnutrition, on 1 April 2016, the United Nations (UN) General Assembly proclaimed 2016–2025 the United Nations Decade of Action on Nutrition. Agriculture innovations during 19th century successfully provided enough food to feed more than seven billion mouths, However, today we are faced with issues of malnutrition and The United Nations Food and Agriculture Organization (FAO) estimates that about 815 million people of the 7.6 billion people in the world, or 10.7%, were suffering from chronic undernourishment in 2016. The 2017 Global Nutrition Report finds that the world cannot afford not to act on nutrition

'Medicine is not health care, food is health care' (Martin and Li, 2017) this signifies the assimilation of nutritional plants in our diet. As global population surges and the challenge of food and nutritional security threaten to become a crisis, the agriculture sector is desperately in need of alternative nutritive crops. The diet of rural and indigenous communities is still diverse that includes varied wild plants. Stinging nettle (Urtica dioica) is a wild plants, which constituted part of traditional diet not only of the hill region of Himalaya rather of whole world wherever it is found. Every part of this plant has utility for mankind. With adequate research this plant has potential to provide an answer for nutritional sufficiency if included in diet. Hence this study was conceptualized to explore its food potential.

2. Materials and Methods

Experimental area and geographic location-

Uttarakhand is a small Himalayan state of India. It comprises of two regions Kumaun

and Garrhwal. In both of these regions stinging nettle (Urtica dioica) is found abundantly in wild that grows in mountain areas from around 1200 -3000 m. The study was conducted in the Almora town of Uttarakhand state. It is located at 29.5971°N 79.6591°E. The average temperature for the year in Almora is 23.5 °C and the yearly average amount of precipitation 1,132.5 mm.

Collection of planting material-

Planting material of stinging nettle for laying experimental trial to achieve the objectives of the project were collected from 4 different locations varying in altitude. All these locations were in Almora district itself. In whole of the studies these were referred as different lines (Table 1). These lines are

Table 1

S.No.	Place of sample collection	Name of respective lines
1	Mukteshwar	M
2	Almora	A
3	Garampani	G
4	Ranikhet	Rn

Experimental work

Field experiment comprising of 4 lines collected from 4 different locations was laid in 2 replications R1 and RII in terraced field on the eastern slope of the hill. RII was sown in randomized design. Planting of the rhizomes was done on 10th June 2016. For laboratory analysis leaf samples were collected from the planted field trial. Leaves were harvested only upto the 6-8 inches from the tip. First collection of leaf samples comprising of tender leaves and shoots was done on 30th August 2016 for nutritional analysis. Seed collection was done on 17th December 2016. Leaf samples from both the replications were tested for nutritional components viz protein, iron, magnesium, calcium. To test the seasonal variation for nutritional content the samples were also collected in the month of March and June.

For testing leaf material was also collected from different places between Almora and Pithauragarh on the basis of height of the place from sea level (Table2). These are:

Table 2:

S.No	Location	Sample name	Height of place from sea level
1	Nakuleshwar road	N	About 1500 m
2	Near Gurna	Gr	Not known but it should be around 1300 m
3	Kandanaula	K	1316 m
4	Dhauladevi	D	1860 m
5	Garurabanj	Gb	1950 m

One of the random sample collected from the plants growing in the vicinity of the experimental area was used as check.

For laboratory testing all the samples were sundried. However samples to test the variation in drying technology samples were dried in shade and microwave also. Laboratory tests were done at National Collateral Management Ltd Gurgaon. Some of the samples were tested at GBPNIHESD Almora.

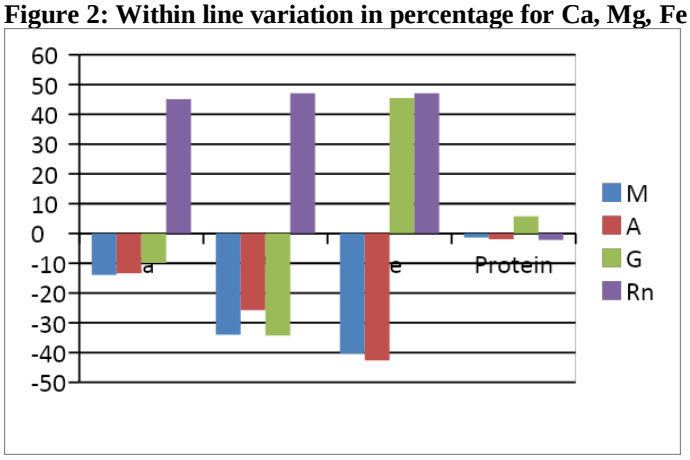
3. Results and Discussion-

Within line variation- single plant rhizomes of each collected nettle plant were planted in two replications in the field. Leaf samples were collected in the month of March 2017 from one plant in each replication and samples were analyzed for Ca, Mg, Fe and protein (Table3).

Table 3: Variation for Ca, Mg, Fe and protein between replications in single season (within line variation in percentage as compared to RI) March 2017

S. No.	Line	Replication	Parameters										
			Ca			Mg			Fe			Protein	
			mg/kg	%	Variation %	mg/kg	%		mg/kg	%		%	
1	M	R1	52070.88	5.207		9011.88	.901		673.63	.067		29.10	
2		R2	44827.30	4.482	-13.92	5952.17	.595	-33.96	420.48	.040	-40.3	28.75	-1.37
3	A	R1	53647.37	5.364		7728.68	.773		608.55	.061		30.68	
4		R2	46472.62	4.647	-13.37	5431.74	.543	-25.75	346.22	.035	-42.62	30.08	-1.95
5	G	R1	49254.97	4.925		6911.36	.691		334.69	.033		28.83	
6		R2	43479.68	4.437	-9.91	4538.03	.454	-34.3	479.30	.048	45.45	30.49	5.76
7	Rn	R1	39501.83	3.950		5265.37	.527		432.95	.043		30.97	
8		R2	57312.31	5.731	45.09	7745.38	.775	47.06	393.41	.039	-9.3	30.29	-2.19

Figure 2: Within line variation in percentage for Ca, Mg, Fe and protein content



Results for all the parameters indicated that nettle leaves are good source of calcium, magnesium, iron and protein. However within line variation prevails in all the lines.

To know the scale of variation within line result of sample from R2 was compared with result of RI for all parameter and percent variation was calculated. Graphical representation of data indicates that comparative to other characters within line variation for protein is lowest and for iron content the variation is maximum. However significance for this variation could not be ascertained as it will require larger number of sample analysis for each line and each parameter.

Table 4: RDA (source: Dietary guidelines for Indians, by NIN 2011 Manual)

Group	particular	Protein (g/day)	Calcium (mg/day)	Iron (mg/day)	Magnesium (mg/day)
Man	Sedentary	60	600	17	340
Woman	Sedentary	55	600	21	310
Boys	10-12 years	39.9	800	21	120
Girls	10-12 years	40.4	800	27	160

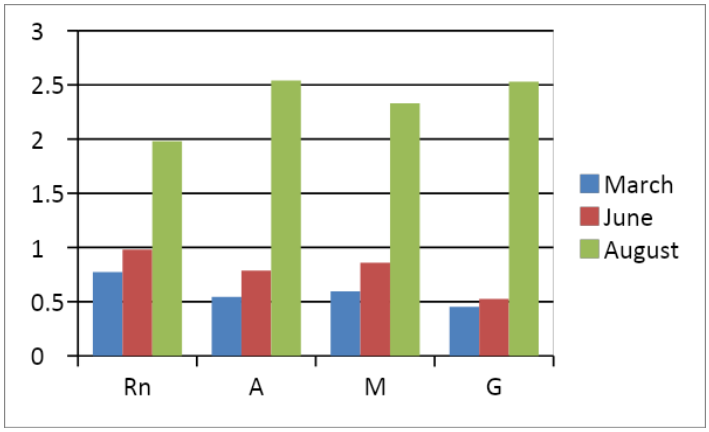
Seasonal variation- study of seasonal variation for nutritional components is desirable as to decide the harvesting protocol and take the maximum benefit per unit harvest. The leaf samples for knowing the seasonal variation were harvested from all 4 lines growing in experimental trial in the month of March (spring), June (summer) and August (monsoon). All of the samples were sundried and analyzed for Ca, Mg, Fe, and protein content (Table5).

Table 5: Seasonal variation for nutritional content in different lines –

S. No.	Line	Month of sample collection	Parameters						
			Ca		Mg		Fe		Protein
			mg/kg	%	mg/kg	%	mg/kg	%	%
1	Rn	March	57312.31	5.73	7745.38	.774	393.41	.039	30.29
2		June	50582.01	5.05	9813.96	.981	278.79	.027	30.34
3		August	34687.5	3.47	19861.0	1.98	22.37	.0022	29.31
4	A	March	46472.62	4.64	5431.74	.543	346.22	.034	30.08
5		June	52505.88	5.25	7874.38	.787	275.54	.027	30.33
6		August	31537.5	3.15	25416.5	2.54	157.24	.0157	20.56
7	M	March	44827.30	4.48	5952.17	.595	420.48	.042	28.75
8		June	48522.01	4.85	8608.83	.860	613.61	.061	29.99
9		August	42050.0	4.21	23333.5	2.33	98.03	.0098	26.81
10	G	March	43479.68	4.34	4538.03	.453	479.30	.047	30.49
11		June	31374.38	3.13	5247.63	.524	329.93	.032	30.57
12		August	31537.5	3.15	25278.0	2.53	184.21	.0184	21.56

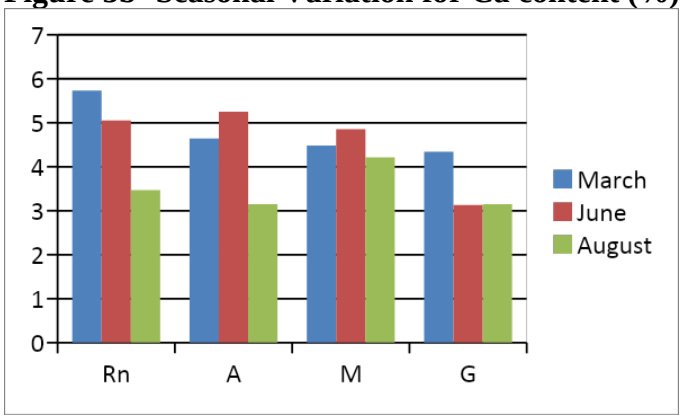
Results indicate that irrespective of harvesting season nettle can provide considerable amount of Ca, Mg, Fe and protein. Also seasonal variation is evident from data chart (Table 5 and figure3).

Figure 3a: Seasonal variation for Mg content (%)



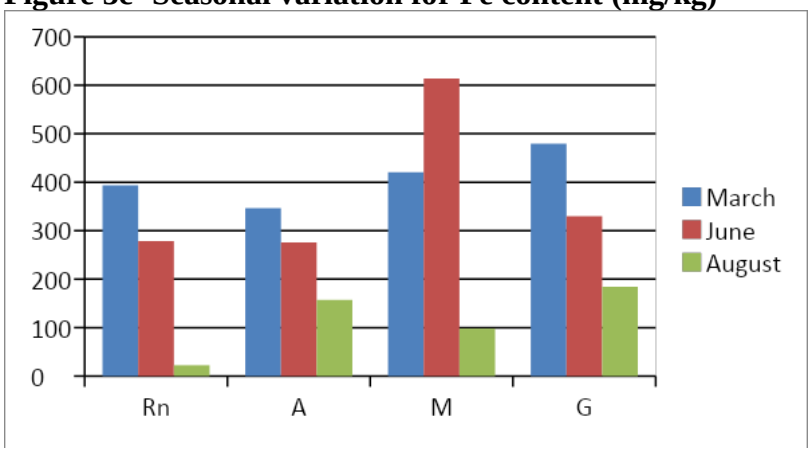
Our body requires macro and trace minerals for good health. Magnesium is one of such mineral which is required for more than 300 enzymatic reactions and regulation of blood pressure. Nettle is a very good source of this valuable mineral. It ranged from 25416.5 mg/kg – 4538.03 mg/kg (2.54%-0.45%). RDA for Indians is 310mg/day-340 mg/day. For all the lines magnesium content increased from spring to monsoon.

Figure 3b- Seasonal Variation for Ca content (%)



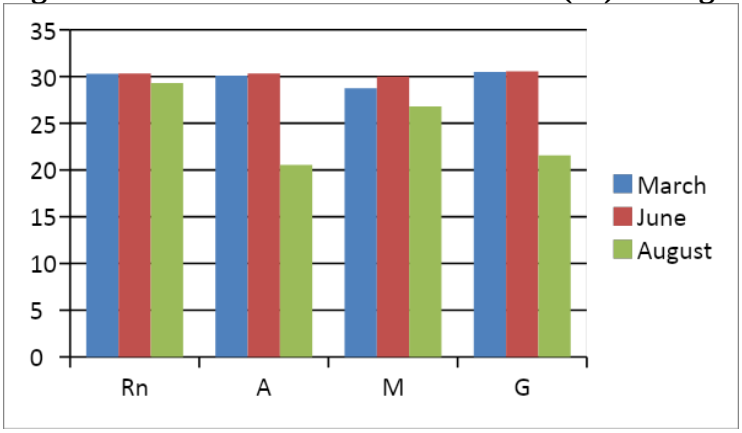
Calcium is another macro mineral which is necessary for proper structure and function of the bones and teeth. Other than this it assists in muscle function and blood vessel contraction. Nettle is such wild plant that can supply considerable amount of calcium for good health if included in diet. It ranged from 57312 mg/kg – 31374 mg/kg (5,73%-3.13%). Comparative data for Ca content over 3 seasons suggest that for Ca content was better in spring and summer seasons. With available data it is not possible to decide whether this variation is significant or not. Significance of variance will require more number of sample analysis per season per line.

Figure 3c- Seasonal variation for Fe content (mg/kg)



Iron is a trace mineral that helps in providing oxygen to muscles and also assists in the creation of certain hormones. Recommended dietary allowance for Indian children (10-15) years of age is 21-32 mg/day. For adults this requirement is 21-27 mg/day. Laboratory analysis (table 4) suggests that iron content ranged from 22.37 mg/kg to 613.61 mg/kg. Highest iron content was 613.61 mg/kg was observed in the month of June. As obvious from the graphical representation (figure 3c) iron content is quiet sensitive to seasonal variation and among all lines lowest iron content was observed in the month of August. Again significance of this variation can be ascertained only with larger number of samples per line per season. That may be done in future studies.

Figure 3d- Variation for Protein content (%) among cultivated lines



Protein is most important building material of our body as they are required to build and repair muscles and tissues. They are synthesized from twenty essential and nonessential amino acids. Recommended dietary allowance for Indians is 39.9 g/day to 60 g/day depending on age and gender. Average protein content of pulses is approximately 25%. As compared to it nettle protein content has valued as approximately 30%. Overall protein content ranged from 20.36% - 32.5%. As indicated by graph (figure 3d) there is less variability for protein content in the spring and summer yet during monsoon season protein content is lower in all cultivated lines than previous two seasons.

Drying process

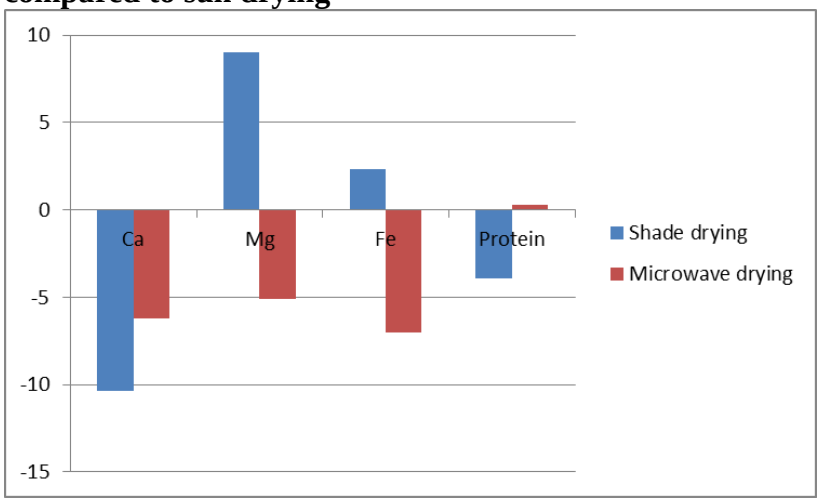
for utilizing nettle leaves as source of livelihood generation and have wider range of products so that more and more people can be benefited with this nutritionally rich plant, to have knowledge of appropriate drying process is must. Significance of drying process increases all the more to keep its nutritional components intact to maximum. One of the samples was dried in natural sun shine, shade and microwave. One sample from all three methods were analyzed for calcium, magnesium, iron and protein content (table 6).

Table 6: With shade and microwave drying, percent variation in nutrient content as compared to sun drying

S. No.		Method of drying			Difference from sundrying	Percent difference from sundrying
			mg/kg	%		
1	Calcium	Sun drying	47109.63	4.710		
2		Shade drying	42226.54	4.222	-4833.09	-10.36
3		Microwave drying	44178.75	4.417	-2930.88	-6.22
4	Magnesium	Sun drying	8228.13	.8228		
5		Shade drying	8967.85	.8967	739.72	8.99
6		Microwave drying	7808.30	.7808	-419.83	-5.10
7	Iron	Sun drying	257.31	.0257		
8		Shade drying	263.36	.0263	6.05	2.35

9		Microwave drying	239.27	.0239	-18.04	-7.01
10	Protein	Sun drying		29.53		
11		Shade drying		28.37	-1.16	-3.92
12		Microwave drying		29.61	0.08	.27

Figure 4: With shade and microwave drying, percent variation in nutrient content as compared to sun drying



Percent difference for all tested parameters for shade drying and microwave drying were calculated from sun drying method and graphically presented. The results indicate that protein content is comparatively less affected with the drying method. Result for individual parameter is variable yet overall result is indicative that sun drying is best option for drying the leaves. However one sample is too small a size to reach to conclusion. Nutrition content among lines from different locations- five more samples were collected dried and protein, Ca, Mg and Fe were determined. All these samples were also considerably high in all these nutritional components (Table 7). Protein content ranged from 28.85%- 30.19%, Ca ranged from 4.45%-5.23%), Mg varied from 7552.78 mg/kg – 1.052 mg/kg.

Table 7:

S.N0.	Line	Parameters						
		Calcium		Magnesium		Iron		Protein
		mg/kg	%	mg/kg	%	mg/kg	%	%
1	N	49907.45	4.99	10176.26	1.018	343.26	.0343	29.14
2	Gr	50639.22	5.06	7552.78	0.755	300.04	.0300	30.19
3	K	52276.32	5.23	10213.95	1.021	261.03	.0261	28.85
4	D	48232.79	4.82	7748.75	0.775	441.06	.0441	29.53
5	Gb	44498.88	4.45	10516.32	1.052	290.36	.0290	29.91

Amino acid composition-

Laboratory analysis of dried leaf sample indicates that nettle can supply considerable amount of amino acids (Table 8). It contained all 20 amino acids including 9 essential amino acids.

Table 8:

S.No.	Test Parameter Amino Acid (g/100 g)	Result
1	Arginine	2.01
2	Histidine	1.27
3	Isoleucine	1.04
4	Leucine	1.84
5	Lycine	1.75
6	Methionine	0.29
7	Phenylalanine	1.1
8	Serine	1.21
9	Threonine	0.96
10	Valine	1.30
11	Tyrosine	0.9
12	Alanine	1.28
13	Proline	2.27
14	Glycine	1.04
15	Tryptophan	<.1
16	Aspartic acid and Aspargine	2.26
17	Glutamic acid and Glutamine	2.47
18	Cysteine and cystine	0.7
	Total protein%	32.5

The 9 essential amino acids are histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, and valine. However methionine and tryptophan are in very low quantity. They are essential as our body cannot synthesize them. Hence it is mandatory to take them as food source. Rest of the amino acids is non-essential amino acids as body has capacity to synthesize them (Srilakshmi, 2003). Meat, dairy, eggs, poultry and seafood are best sources of protein and provide all essential amino acids whereas plant-based foods are called incomplete proteins, since they only provide some of the essential amino acids. Even the best popular sources of protein for vegetarian's beans, tofu, lentils and nuts are lacking in one or more type. Therefore it is advised to eat several types of plant proteins daily. We could not analyse within line variation, between line variation and seasonal variation for amino acid content, Rutto et al (2013) have suggested that amino acid content was largely unchanged in the spring as compared with fall growth. However there may be within species variation due to post harvest handling, climatic condition, soil condition, water availability as Khan (2014) has reported for wheat that the protein and amino acid composition varies with the crop varieties, application of fertilizers, irrigation practices, the soil and climatic conditions of the area. Data here suggest that dried nettle can be important source of amino acid and other nutrients for product development as it has higher concentration of amino acids than Brussels sprouts and better amino acid profile than many other green leafy vegetable

(Lisiewska et al., 2009). Most popular green leafy vegetables of Uttarakhand are spinach and rayi. The Himalayan nettle comprised nutrient content higher than both of these cultivated green leafy vegetables (Saklani and Chandra, 2012).

One of the significant uses of dried nettle can be in enhancing nutritive value of bread wheat flour and other cereal flours being rich in protein. Wheat (Triticum aestivum) is major source of protein but nettle has approximately 2,5 times more protein. High yielding varieties of wheat contain protein upto 12.33% and low yielding varieties contained upto 9.63% protein (Punia et al 2017). Wheat protein is deficient in certain essential amino acids, such as lysine, tryptophan, threonine, methionine and histidine (Nadeem et al. 1965; Paterson 1990; Khan et al 2014) and rich in glutamic acid and proline, which are the dominating non essential amino acids (Khan et al 2014). Not only wheat even other cereal proteins are low in lysine one of the essential amino acids that cannot be synthesized by humans and must therefore be obtained entirely from dietary sources. Thus, lysine content constitutes an important feature for defining the nutritive value of flour obtained from cereals (Luis et al., 2007).

Other micronutrients-

Table 9:

s. no.	Nutrient	Unit	Test result
1	Potassium as K	mg/kg	7497.03
2	Copper as Cu	mg/kg	7.14
3	Mangnese as Mn	mg/kg	36.79
4	Sodium as Na	mg/kg	14.6
5	Zinc as Zn	mg/kg	34.6
6	Vitamin A	mcg/kg	1556
7	Vitamin C	mcg/kg	5.08

One of the sample was analyzed for more micronutrients. The content of macro mineral potassium (K) and some trace minerals that are required in very small quantity yet perform vital functions in the body, like copper, zinc, manganese were determined in one of the sample. Vitamin A and Vitamin C were also determined (Table 9). In the dried leaf sample Mn content was highest 36.79mg/kg followed by Zn 34.6 mg/kg and and Cu 7.14 mg/kg. Rafajlovska et al (2013) have also reported Zn (27.44 mg/kg), Cu (17.47 mg/kg), and Mn (17.17mg/kg). RDA for Zn for adults is 10-12 mg/day and RDA for adult men and women is 900 µg/day (https://www.ncbi.nlm.nih.gov/books/NBK222312/). Although there is no specific RDA for manganese, it is estimated that most people require between 2 and 5 mg per day (Murray, Naturopath). These results are in consent with Rafajlovska et al (2013) that these determined quantities do not exceed the limits of health hazards and toxicological limits.

Today's popular belief is food is health and medicine is sick care. Plants play very important roles in relation to our health, as components of our diet. Significance of inclusion of plant-based foods, particularly fresh fruit and vegetables, and its inverse association is evidently being advocated with the risk of major chronic diseases like cardiovascular disease (Bradbury et al., 2014), obesity and Type 2 diabetes (Mozaffarian etal., 2011) and certain types of cancer (Martin et al., 2011, 2013; Parkin etal., 2011; Traka & Mithen, 2011; Norat et al., 2014; Wang etal., 2014a,b). on the backdrop of reality that approximately 10%

of world population and 30% of Indian Population is vegetarian significance of plants rich in protein and other macro and micro nutrients increases all the more. When we have plant like nettle that can provide macro nutrients, macro minerals, micro minerals, vitamins, phytochemicals for good health, it deserves adequate research attention.

Research highlights

Himalayan stinging nettle (*Urtica dioica*) was tested from Almora (State of Uttarakhand in India) for its nutrition value in dry leaf samples. Main findings of this research are:

- Nettle leaves are rich source of protein that contained on an average 30% of protein on dry weight basis and contained 20 amino acids with all nine essential amino acids.
- Nettle leaves are rich source of calcium that ranged from 3.95%-5.73%.
- Magnesium content of dry leaf samples ranged from 0.45% to 2.54%
- Nettle leaves are rich source of iron
- Nettle is good source of potassium, copper, zinc, manganese and vitamin A. It also contained vitamin C in some quantity.
- Sun drying is best method for drying the herbal parts.
- Nettle had been part of traditional food. Detailed focussed research is required to explore its food potential in modern scenario.

Limitations

The testing has been done on limited number of samples and limited parameters could be tested. More researches are required with relation to protein, minerals, trace minerals, vitamins and other bioactive compounds in fresh and dried parts of the species separately to be sure of harvesting stage and drying methodology, and food value. More researches are required to validate quality of product when stinging nettle is mixed with other food items.

Recommendation and future scope

Stinging nettle is 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 pay attention to such valuable multipurpose species and a thorough sincere strategy need to be devised. Also, proper policy and funding for testing such species can support more researches and validation studies. In view of the available information stinging nettle showed considerable nutritional prospects. It can be a low-cost and easily accessible substitute to human diets and source of livelihood for local rural with product development. However, before that it is recommended to further validate the claims on its food. Antinutritional factors cause negative impact directly or indirectly to consumer's health. Hence it is urgently needed to study anti nutritional factors like phytic acid, trypsin inhibitor, total phenol, poly phenol oxidase (PPO). 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. 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.

Conclusion

For sustainable development an important criterion is in the selection of plant. Nettle is an ideal plant that is an already well established local plant and not an alien introduction from an unrelated geographical area. It is an inclusive herb that grows in nature without intensive farming efforts and has been in use traditionally as food as well as medicine. This study validates its traditional use as nutritious green. It is a rich source of protein, Ca, Mg, K, Fe. It also provides Mn, Zn, Cu and Vitamin A. The results show that it can be considered as valuable source of nutrition. It can be used as fresh nutritious green wherever it is available naturally and dried leaves can be used for nutritious product development. As compared to nutritious grains and pulses net value of this plant increases manifold as green leaves can be harvested multiple times.

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