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NUTRITIONAL VALUE OF TRADITIONAL WILD VEGETABLES USED BY THE KINNAURA TRIBALS OF HIMACHAL PRADESH, INDIA.

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ABSTRACT

After interacting with local people of Kinnaur, nine wild vegetables *viz*. *Allium wallichii*, *Crambe kotschyana*, *Diplezium esculentum* , *Eremurus himalaicus*, *Fagopyrum tataricum*, *Lepyrodiclis holosteoides*, *Rorippa nasturtium- aquaticum* , *Silene vulgaris*, *Urtica dioca* were selected for proximate composition analysis, including mineral and vitamin content. Young green shoot tips and leaves of *Crambe kotschyana* are very rich in proteins (36.68 mg/100gm); *Rorippa nasturtium-aquaticum* in minerals (16.76 mg/100gm); and *Diplezium esculentum* in vitamin C (56.87mg/100gm) and fiber (6.89mg/100gm). The range of nutrients present in these vegetables is comparable with the commonly used cultivated green leafy vegetables. Infact, the protein (4.20- 36.28mg/100gm) and iron (3- 44.2 mg/100gm) content is much higher than that most of the cultivated vegetables. The present study should be helpful to educate the local youth about the nutritional value of this plant wealth of the region and create an interest in its conservation, collection and sustainable consumption.

KEYWORDS: Proximate composition; Wild vegetables; Kinnaur; Plant wealth, Sustainable.

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INTRODUCTION

In many culture of India, plants have great ethnobotanical importance, whether it is nutritional, medicinal, and ritual or magical value. There are 1532 edible wild food species in India, mostly from Western Ghats and Himalayan regions (Arora and Pandey, 1996). Himachal Pradesh, a hilly State of Western Himalaya, is a repository of plant diversity and the traditional ethnobotanical knowledge. Because of varied altitudinal gradients and climatic conditions, the State harbours a rich plant diversity, including around 3400 species of flowering plants (Chowdhery, 1999). Utilization of plant resources in the day-to-day life has been an age old practice of the people inhabiting this hilly State. Many wild greens are eaten raw in salads or in boiled mixtures as 'blood cleansing' and 'intestine cleansing' agents. The wild vegetables provide adequate amount of crude fiber, fats, carbohydrates, proteins, water and mineral elements like Ca, Na, K, Fe, Mg, Mn, Cu, Zn etc, in addition to vitamins (Gogoi and Kalita, 2014). Kinnaura tribals are inhabitants of district Kinnaur of Himachal Pradesh and they mostly depend on wild plants for food, medicine, fuel, and house construction. The knowledge about wild plant used as food, vegetables and medicine has been handed down to them for generations, from father to son by means of oral tradition, coupled with observations in the field and at local gatherings of people. Mostly women and children go in groups to forests for the collection of wild foods, usually travelling great distances. However, this interest in the traditional collection of wild food plants is now fast declining due to loss of interest by younger generation of people who now have easy access to conventional vegetables. As a result, there is a complete ignorance among the younger generation about the nutritional and health benefits of the local wild food plants. The wild food plants score over conventional vegetables in that these do not require any formal cultivation, are inexpensive, have high quality nutritional value, and can help in improving malnutrition, so widespread amongst poor tribals. Tribal district Kinnaur being remotely located, the supply of vegetables comes from far off distances. These vegetables are sold at much higher prices in the local market, while on the contrary the local wild vegetables come free, are easily available in the wild, and are organic and fresh. Integrating wild vegetables into diet has been promoted as the most practical and sustainable way to achieve optimal dietary requirements in many developing countries (Chadha and Oluoch, 2003). There is now growing evidence that traditional green leafy vegetables have higher nutritional value than several known common vegetables (Sundriyal and Sundriyal, 2001; Nordeide *et al.,* 1996; Orech *et al.,* 2007). Dark green vegetables are probably the most concentrated source of nutrition of any food. They are a rich source of minerals (including iron, calcium, potassium, and magnesium), vitamins (including vitamins K, C, E and many of the vitamins from B group), and a variety of phytonutrients (including beta-carotene, lutein, and zeaxanthin) which protect our eyes from age-related problems (such as age-related muscular degeneration) among many other benefits. Dark green leaves also contain small amounts of omega-3 fatty acids which protect us from cardiovascular diseases. The green leafy vegetables can, therefore, provide substantial nutritional and dietary benefits to tribal populations living in remote rural areas and can prevent several chronic diseases caused by malnutrition. The present study on local wild vegetables of District Kinnaur, Himachal Pradesh (Fig.1) was conducted with an aim to check their nutritional value as per the belief of local inhabitants and also to educate the local youth about the nutritional value of this plant wealth of the region and create an interest among the local youth in the conservation, collection and sustainable consumption of local wild vegetables. Assessment of nutritional composition and health benefit of wild food plants is fundamental for promoting these plants amongst the locals and the larger population; important for community health, agriculture and nutrition education initiatives; and important for

improving the management and conservation of local biodiversity.

MATERIALS AND METHODS

2.1 Ethnobotanical study

For the present study, local herbal healers, elderly men and women, and shepherds were consulted, with a view to gain knowledge about the wild vegetables, their nutritional value, health benefits, and medicinal value, if any. Many remote villages were visited by the senior author during this study for an interaction with people about the identity and uses of the various wild vegetable plants collected. A majority of respondents well recognized these plants and the information provided by them about these plants was noted on a specially designed questionnaire and verified by cross-checking with various people from different villages of the area. Different localities of Kinnaur district were visited three times every year, during the years 2012-2013. Information was collected from local sources about the various plants used as vegetables by them and also their medicinal importance, if any. The information collected about each plant included: local name(s) of the plant, part of the plant used, mode of cooking and consumption, and medicinal value, if any. Sampling and collection of plants used by locals were also done. The selected plants were photographed in their natural habitats. All the plants were collected in polythene bags for further study, and also 5-6 specimens of each species were dried and mounted on herbarium sheets for future records. The plants were tentatively identified with the help of keys and descriptions given in the relevant floras and these identifications were later confirmed by comparing with the authentically identified specimens lying in the Herbarium of Panjab University, Chandigarh (PAN); Herbarium of Northern Regional Centre, Botanical Survey of India (BSD); and the Herbarium of Forest Research Institute, Dehra Dun (DD).

2.2 Samples and analysis

Samples of young wild leafy vegetables were collected from the various localities of district Kinnaur, varying in atlitude from 2200-4000m. The collected vegetables were shade dried naturally and preserved for subsequent analysis of their proximate composition (moisture, ash, protein and fat), carbohydrates, dietary fibers, minerals (K, Zn, Fe), vitamin C, K and B_9 (folic acid) contents. Proximate analysis was carried out using standard method (AOAC, 2000). Total, soluble and insoluble dietary fibre constituents were determined by the enzymatic method of Furda (1981). Potassium content was measured by using a flame photometer. Determination of Iron and Zinc was done by Atomic Absorption Spectrophotometer (AAS), using the reference standard of the relevant metals. Vitamin content was determined by HPLC.

RESULTS

3.1 Local wild vegetables

A total of 9 species of wild plants, 8 belonging to 5 families of angiosperms and 1 pteridophyte, were found to be extensively used as vegetables by the locals, mainly in Pooh block area. It was discovered that *Diplezium esculentum*, locally called “lingra”, is widely used in Nichar block and is also sold in the local market. Table 1 gives a list of these plants along with information about their botanical name, name of the botanical family, local/common English names, and the mode of consumption. The field photographs of all these plants are collected in figures 2 (a-i). Usually, only the young leaves of these plants are consumed by locals which are collected from the wild during the months of April- May. Besides being consumed fresh, young leaves and tender shoots of 6 species, *viz*. *Allium wallichii*, *Crambe kotschyana*, *Fagopyrum tataricum*, *Lepyrodiclis holosteoides*, *Silene vulgaris*, *Urtica dioca* are chopped, dried and stored for the winter season when conventional vegetables are not available and the local inhabitants depend entirely on these indigenous vegetables. Of these species, *Lepyrodiclis holosteoides, Silene vulgaris, Urtica dioca* and straw of *Fagopyrum tataricum* are also used as fodder for domesticated animals. All these vegetables grow wild while

Fagopyrum tataricum is found both as wild and also cultivated. All these vegetables are believed to increase and purify blood and also clean the digestive system.

3.2 Nutritional composition

The nutritional composition of the local wild vegetables examined in this study is presented in Table 2. A perusal of this table would indicate that all the vegetables are source of very high energy except only *Eremurus himalaicus*. *Eremurus himalaicus* has highest (74.47 %) and *Silene vulgaris* has lowest (13.29 %) moisture content. Protein content in various vegetables ranged from 4.20g/100g in *Eremurus himalaicus* to 36.68 g/100g in *Crambe kotschyana,* which is comparable to the commom leafy vegetables (Table-3). These vegetables have a very low fat content which ranges from 0.12g/100g to 0.72g/100g. Three species, *viz. Diplezium esculentum* with 6.89g/100g, *Lepyrodiclis holosteoides* with 5.22g/100g, and *Crambe kotschyana* with 5.08g/100g fiber are most rich source of dietary fiber. The ash content ranged from 2.80g/100g (*Eremurus himalaicus*) to 16.76g/100g (*Rorippa nasturtium- aquaticum*). The carbohydrate content in the various species varied considerably, ranging from 4.07g/100g in *Eremurus himalaicus* to 38.86g/100g in *Allium wallichii.* All the species investigated presently contain remarkably high amounts of Potassium (< 1000mg/100g) except only *Eremurus himalaicus* (with 920mg/100g), *Urtica dioica* (with 860mg/100g), and *Lepyrodiclis holosteoides* (with 520mg/100g) which possess lesser amounts of this mineral . The zinc content ranged from 17.8 mg/100g in *Lepyrodiclis holosteoides* to 1.6 mg/100g in *Eremurus himalaicus*. The highest iron content was found to be 41.8 mg/100g in *Allium wallichii* and lowest was 3 mg/100g in *Crambe kotschyana* . The vitamin C content ranged from 62 mg/100 in *Lepyrodiclis holosteoides*to 41.51 in *Urtica dioca*. *Crambe kotschyana* had highest vitamin C content (8.51 mg/100g) while the lowest content of this vitamin was found in *Diplezium esculentum* (1.24 mg/100g). The folic acid content in various species ranged from 0.003 mg/100g in *Lepyrodiclis holosteoides* to 0.103 mg/100g in *Allium wallichii*.

DISCUSSION

The role of wild traditional vegetables as source of food and medicine has been documented by several workers (Ogle *et al*., 2003; Lee *et al.,* 2003; Adebooye and Opabode, 2004; Ayodele, 2005). In the present study, it was found that the local wild plant species consumed as leafy vegetables contain significantly higher amounts of protein than the commonly cultivated leafy vegetables. Turan *et al.,* (2003) also reported more protein content in wild edible leaves consumed in Eastern Anatoliathan those of cultivated species such as spinach, lettuce, cabbage. The amount of iron is also higher than those of common leafy vegetables compiled by Hoe *et al.,* (1999). Ogle (2001) also reported higher iron content in wild vegetables as compared to the cultivated species. The amount of fiber, ash and carbohydrate was also found to be much higher than the common leafy vegetables as given by Hoe *et al.,* (1999). The results of present study shows that the local wild vegetables have all the essential nutrients essential for human diet for maintaining good health. All the wild leafy vegetables studied here (except only *Lepyrodiclis holosteoides*) also possess medicinal properties as reported by many workers (Kaul, 1997; Pieroni, 2000; Rivera *et al*., 2005; Khare, 2007; Acharya *et al*., 2011; Kaushik *et al*., 2011; Khan *et al*., 2013; Sayed*et al*., 2013) and therefore, these vegetables not only provides the essential nutrients to the consumers but also safeguard them against several ailments. Interestingly, the locals eat most of these green vegetable after frying in oil which makes available vitamin A in absorable form to our body. This vitamin is a fat-soluble and hence putting oil as dressing on the leafy vegetables if consumed raw as salad, or cooking them in oil, makes this vitamin available in absorbable form. Vitamin K is a star among all the vitamins and a cup of most cooked green vegetable provides at least 9 times the minimum recommended intake of vitamin K. It was observed by the present authors that the knowledge about the uses of

local plants is more common with the locals aged above 35 years as compared to younger residents. Disease of modern world like diabetes and blood pressure were rare among aged local people who are still dependent on ethnic life style. Young adults are also no longer interested in collection of the wild leafy vegetables as conventional vegetables are easily available in the market. This lack of interest in the local plant wealth by the younger generation can lead to complete loss of traditional knowledge of the local plant diversity. It is in this context that the present study shall help in popularising the importance of local plant diversity amongst the younger generation of local residents, besides creating awareness about the health benefits of these plants.

Table 1
List of local wild plants used as vegetable by local inhabitants.

Sr.No	Botanical name	Local/Common name	Family	Mode of consumption
1	*Allium wallichii* Kunth	Chiskan/ Himalayan onion	Liliaceae	Chopped leaves are fried in mustard oil and mixed with spices
2	*Crambe kotschyana* Boiss	Akharo	Brassicaceae	Chopped Leaves are boiled and then fried in mustard oil and mixed with spices
3	*Diplezium esculentum* (Retz.) Sw.	Lingda/ Paco	Athyriaceae	Fresh immature fronds are wiped with a cloth to remove red petiolar hairs. Then are boiled, cut and fried in mustard oil and mixed with spices
4	*Eremurus himalaicus* Boker	Prait/ Fox tail Lily	Liliaceae	Chopped leaves are fried in mustard oil and mixed with spices.
5	*Fagopyrum tataricum* (L.) Gautn.	Bro, Brass, Fafra/ Buck wheat	Polygonaceae	Chopped leaves are fried in mustard oil and mixed with spices
6	*Lepyrodiclis holosteoides* Fenz ex Fisch.	Latishaa	Caryophyllaceae	Leaves are fried in mustard oil, mixed with potato and spices.
7	*Rorippa nasturtium-aquaticum* (L.) Hayek	Tee-soma/ Water cress	Brassicaceae	Fresh leaves and potato are together fried in mustard oil and mixed with spices
8	*Silene vulgaris* (Moench) Garcke.	Cham- chom/ Bladder campion	Caryophyllaceae	Chopped leaves are fried in mustard oil, mixed with potato and spices.
9	*Urtica dioica Linn.*	Khorgya/ Northern Nettle	Urticaceae	Young leaves cooked mixed with *Silene vulgaris* and potato

Table 2
Nutritional composition of local wild vegetables investigated presently (per 100g dry leaves).

Plant name	Energy (Kcal)	Moisture (%)	Ash (%)	Fat (%)	Dietry fiber (%)	Protein (%)	Carbohydrate (%)	K (mg)	Zn (mg)	Fe (mg)	Vit C (mg)	Vit K (mg)	Folic Acid (mg)
A. wallichii	239.3	18.44	11.46	0.22	2.06	20.47	38.86	3160	1.7	41.8	41.84	4.29	0.103
C .kotschyana	225.06	16.64	12.55	0.22	5.08	36.68	19.09	2170	3.2	3	52.50	8.51	0.070
D. esculentum	237.6	16.55	10.27	0.72	6.89	21.02	36.76	1820	15	15	56.87	1.24	0.060
E. himalaicus	36.77	74.47	2.80	0.41	4.23	4.20	4.07	920	1.6	14.7	48.30	1.48	0.037
F. tataricum	226.04	16.80	13.94	0.24	3.76	26.81	29.16	2100	2.9	18.9	41.86	9.52	0.017
L.holosteoides	218.92	15.59	15.81	0.16	5.22	20.73	33.64	520	17.8	27.9	62.00	3.84	0.003
R. nasturtium-aquaticum	229.12	14.65	16.76	0.12	3.05	22.16	34.85	3220	6.5	18.8	48.22	2.87	0.063
S. vulgaris	235.91	13.29	15.50	0.19	2.64	30.24	28.31	6410	3.8	15.7	45.19	2.87	0.063
U. dioca	241.15	17.45	12.79	0.43	3.28	23.92	35.40	860	7.3	44.2	41.59	2.07	0.079

Table 3
Nutritional composition of some common cultivated leafy vegetables

Vegetable	Energy (Kcal)	Moisture (%)	Protein (%)	Fat (%)	CHO (%)	Fibre (%)	Ash (%)	K (mg)	Fe (mg)	Vit. C (mg)	Source of data
Cabbage(*Brassicaoleracea*var. *capitata*)	22	93.1	1.6	0.2	3.4	0.9	0.8	103	0.6	53.0	Hoe *et al.,* (1999)
Bathu (*Chenopodium album*)	59	83	0.5	0.8	8.28	1.92	2.94		13		Odhav *et al.,* (2007)
Cholai (*Amaranthus hybridus*)	268.92	83.48	17.92	4.65	52.18	8.61	13.80	54.20	13.58	25.40	Akubugwo *et al.,* (2007)
Chinese mustard (*Brassica juncea*)	34	91.7	2.1	0.7	4.7	-	0.8	-	6.8	89.0	Hoe *et al.,* (1999)
Lettuce (*Lactuca sativa*)	17	94.7	1.2	0.1	2.8	0-5	0.7	3545	1.5	27.6	Hoe *et al.,* (1999)
Spinach (*Spinacea oleracea*)	29	91.3	2.6	0.3	4.0	-	1.8	136	0.8	56.4	Hoe *et al.,* (1999)
Spring onion (*Allium fistulatum*)	19	95.0	0.6	0.1	3.9	-	0.4	-	0.4	17.0	Hoe *et al.,* (1999)

Figure 1
a) Map of India; b) Himachal Pradesh; c) Study area- tribal district Kinnaur.

Figure 1.

Figure 2
Field photographs of the species studied presently: a) Diplezium esculentum; b) Urtica dioica; c) Lepyrodiclis holosteoides; d) Rorippa nasturtium- aquaticum; e) Silene vulgaris; f) Fagopyrum tataricum (cultivated); g) Allium wallichii; h) Crambe kotschyana; i) Eremurus himalaicus.

Figure 2.

CONCLUSION

Indigenous communities in Kinnaur district nurture rich knowledge about edible and medicinal plants acquired over several generations of experimentation. All such plants possess nutrients comparable with common leafy vegetables and hence have the potential to fulfil the nutritional requirements of local inhabitants. Also, since the traditional knowledge about the importance of local plants is usually passed on to the next generation just by the word of mouth, this knowledge not only needs to be preserved in written records but also substantiated by modern nutritive and pharmacological experiments for a scientific validation and use as safe healthcare remedies.

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CONFLICT OF INTEREST

Conflict of interest declared none.

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