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Short Communication

NUTRITIONAL ANALYSIS OF EDIBLE WILD PLANTS USED BY HAKKI PIKKI TRIBES OF HASSAN DISTRICT, KARNATAKA, INDIA

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ABSTRACT

Objective: The aim of the study was to determine the nutritional composition of wild edible leaves, tubers, fruit and young shoot consumed by Hakki Pikki tribals of Hassan district.

Methods: The samples were analyzed for proximate nutritional composition (moisture, ash, proteins, carbohydrates, crude fat and crude fiber) using the AOAC procedures. The minerals were determined by using atomic absorption spectrophotometer.

Results: Moisture content of the analyzed samples were ranged between 75.8±3.1 and 64.3±1.4g/100g with the highest being in a fruit of *Momordica dioica* (75.8±3.1g/100g) carbohydrate content found maximum in 23±2.1g/100g in tuber of *Dioscorea oppositifolia.* The high content of vitamin-C in the fruit of *Momordica dioica* (77.1±11.9g/100g), the nutritive value was found highest in tuber of *Dioscorea oppositifolia* (130.40 kal/100g). The corm of *Colocasia esculenta* contained 326.7±7.6 mg/100g of the magnesium and considered a good source. The iron content in tender leaves of *Alternanthera sessilis* (14.3±1.8 mg/100g) was estimated to have maximum iron content.

Conclusion: Analysis of eight wild edible plants emphases the rich nutritional composition and their scope to be used as an alternate source of bio-nutrient.

Keywords: Wild edible plants, Proximate analysis, Mineral contents, Hakki Pikki Tribe, Hassan

Wild edibles play an important role in the diet of inhabitant in different parts of the world. These plants tend to be drought resistant and gathered both in times of abundance and times of need, used in everyday cooking these may be an important source of nutrients [1]. A large number of wild plants are grown in the Hassan district, some of which are edible and are consumed by the Hakki Pikki tribals. These are free and easily collected by the poor tribal and thus inexpensive, are a good source of nutrients. Depending upon certain factors like availability, socioeconomic conditions, tradition, taste and culture, some of edible wild foods are regularly consumed in the form of staple food whereas others are taken less frequently and on certain occasions. Many wild species may constitute an interesting genetic resource for the development of new food sources which could be utilized as alternative food and also select promising types of domestication [2]. Some of these locally used wild plant species have even become cultivated plants, proving their importance for agricultural products [3]. Wild edible plants providing adequate supplies of minerals, crude fat, protein and carbohydrates [4], some of the commonly consumed leaves, fruits and tubers of nutritive values of which has been reported in the food composition tables [5]. Many workers have reported the nutritional composition of various wild edible plants in use in India [6-10]. The database of the nutrient composition of these wild edibles still incomplete and there is a scope for further studies. The Hassan district occupies a western position in the state of Karnataka and lies between 12°30' and 13°35' North latitudes, and 75°35' and 76°40' East longitudes. The Hakki Pikki is a nomadic tribe in the state of Karnataka and most of them are wandering from one place to other. Ethnobotanical study of the wild edible plants traditionally consumed in Hassan district as described earlier [11-13]. Eight of the most commonly used plants were selected for nutritional analysis, are belonging to seven different families presented in table 1. Further, samples collected for nutritional analysis were healthy and free from infection. Botanical identification of the collected plant species was done with the help of floras [14-16] and cross verified with the help of authentic herbarium specimens of RRCBI, Survey of Medicinal Plants Unit, NADRI, Bangalore.

All plant samples were washed thoroughly to remove soil and other extraneous material and cut into small pieces and dried to constant weight was obtained. The dried samples were ground to a fine powder and all the analyses were carried out with the plant powder. The samples were packed in airtight sample bottles and stored in the refrigerator. To analyze vitamin C fresh samples were weighed immediately, stored in 6 % meta-phosphoric acid until analysis.

General use laboratory reagents like HCl, H_2SO_4, HNO_3, $HClO_4$, NaOH, K_2SO_4, $CuSO_4$, HPO3, were purchased from Sigma-Aldrich. Fe, Cu, Ca, Mg, standard analytical solutions for AAS were supplied by Merck. All chemicals used for the study were of analytical grade.

The recommended methods of the Association of Official Analytical Chemists [18] were used for the determination of moisture content, ash, crude fat and crude fiber. Ash was determined in silica crucibles by incineration in a muffle furnace (High Temperature Muffle Furnace-EMF-1H) at 550 °C-600 °C for 5 h and the crude fiber content was estimated from the loss in weight on ignition of dried residue remaining after digesting the fat free sample with 1.25% H_2SO_4 and 1.25% NaOH solutions. Crude protein determination involved the use of the routine Kjeldhal nitrogen assay (Nx6.25). Carbohydrate was determined when the sum of the percentages of moisture, ash, crude protein and crude fiber was subtracted from 100. Vitamin-C was determined by a reduction method using a dye 2, 6-dichlorophenol indophenol [19]. The Nutritive value (kcal/100 g sample) was calculated using the Atwater factors of 4, 9 and 4 for protein, fat and carbohydrate, respectively. All results for proximate composition are recorded on the basis of the edible portion fresh weight of the sample as g/100 g fresh/dry weight.

The ash obtained after combustion in the muffle furnace was used to prepare the ash solution, which was used for the estimation of minerals. Samples for estimation of mineral contents were digested using nitric/sulfuric acid mixtures and diluted, the solution was filtered into a 100 ml standard flask and made up to the mark with distilled water [19]. The individual mineral element was measured from this solution. The nitrogen was determined using the micro-

Kjeldhal method. Phosphorus was estimated calorimetrically using potassium dihyrogen phosphate as the standard [18]. The samples were analyzed for sodium, potassium, calcium, magnesium, copper, and iron using an atomic absorption spectrophotometer (Model No. AA-6400 F, Shimadzu Corporation, Japan). All results of the mineral composition are recorded on the basis for the edible portion of the sample as mg/100g dry weight. All determinations were carried out in triplicate for each nutrient analysis. For all analyses, the mean and standard deviation for each of the nutrients analyzed were calculated and reported.

Table 1: Description of the wild edible plants used in this study

Botanical names/family name	Local name (Kannada)	Parts used	Seasons of availability	Mode of consumption
Alternanthera sessilis (L.) R. Br. Ex DC. (Amaranthaceae)	Honagone soppu	Leaves	All season	Cooked as a vegetable
Celosia argentea L. (Amaranthaceae)	Anne soppu	Leaves	Nov-March	Cooked as a vegetable
Colocasia esculenta (L.) Schott (Araceae)	Kesavina Beru	Corm	May-Oct.	Eaten as a vegetable after cooking
Dendrocalamus strictus (Roxb.) Nees. (Poaceae)	Bidiru Kalale	Young shoots	Jan-April	Young shoots are used as vegetable and preparation of pickles
Dioscorea oppositifolia L. (Dioscoreaceae)	Hake genasu	Tuber	July-Jan.	Tubers are cut into small pieces and boiled in water, water is decanted, cooked and used as food
Momordica dioica Roxb. ex Willd (Cucurbitaceae)	Midi Hagala	Fruit	June-Aug.	Tender fruit used as a vegetable
Nelumbo nucifera Gaertner. (Nelumbonaceae)	Tavare beru	Root	May-Nov.	Roots are eaten cooked
Solanum nigrum L. (Solanaceae)	Ganike soppu	Leaves	All season	Cooked as a vegetable

Table 2: Proximate composition of wild edible plants studied (g/100g fresh weight) [a]

Plant species	Moisture	Ash	Crude protein (Nx6.25)	Crude fat	Crude fiber	Total carbohydrates[b]	Vit-C	Nutritive value[c]
Alternanthera sessilis (L.) R. Br. Ex DC. (Leaves)	71.4±4.2	1.5±0.4	4.5±0.7	2.9±0.3	3.4±0.7	16.3±5.0	11.5±2.9	109
Celosia argentea L. (Leaves)	69.6±3.4	3.6±0.3	5±0.7	0.5±0.1	10.8±1.7	10.6±1.7	23.9±3.1	66.6
Colocasia esculenta (L.) Schott (Corm)	71.1±2.1	3.7±0.3	4.2±0.4	2.4±0.3	3.5±0.3	15.1±1.1	4.2±0.6	99
Dendrocalamus strictus (Roxb.) Nees.(Young shoot)	70.4±2.3	3.8±0.4	2.2±0.4	0.3±0.1	11±1.8	12.3±0.7	2.0±0.4	61.1
Dioscorea oppositifolia L. (Tuber)	64.3±1.4	3.0±0.2	4.2±0.4	2.4±0.3	3.1±0.1	23±2.1	11±1.0	130.40
Momordica dioica Roxb. ex Willd (Fruit)	75.8±3.1	2.4±0.4	2.0±0.3	1.3±0.2	1.6±0.3	16.9±3.4	77.1±11.9	87.6
Nelumbo nucifera Gaertner. (Root)	70.1±2.1	1.7±0.2	2.1±0.2	1.1±0.2	5.0±0.6	20±2.8	13.2±1.6	98.8
Solanum nigrum L. (Leaves)	72±1.9	3.8±0.8	4.4±0.5	1.9±0.3	6.8±0.8	11.1±2.6	13.1±1.4	78.8

[a]Values are means of three determinations±SD (n=3)., [b]Calculated by difference., [c]Calculated by using Atwater factors.

Table 3: Mineral content of wild edible plants studied (mg/100 g dry weight)[a]

Plant species	Nitrogen (g)	Mg (mg)	Ca (mg)	P (mg)	K (mg)	Na (mg)	Cu (mg)	Fe (mg)
Alternanthera sessilis (L.) R. Br. Ex DC. (Leaves)	0.7±0.1	252.3±8.6	436.7±14.9	48.8±1.8	412.2±13.4	246.7±3.5	0.4±0.1	14.3±1.8
Celosia argentea L. (Leaves)	0.8±0.1	178±9.2	28.9±1.5	35.5±4	443±9.6	231.1±8.1	0.3±0.02	13.1±1.0
Colocasia esculenta (L.) Schott (Corm)	0.7±0.1	326.7±7.6	96.8±2.3	137.5±2.8	35.1±2.3	92±2.8	0.2±0.1	0.5±0.1
Dendrocalamus strictus (Roxb.) Nees. (Young shoot)	0.3±0.1	71±6.6	22.6±2.5	69.8±1.8	124.7±3.2	12.6±0.5	0.4±0.02	0.1±0.01
Dioscorea oppositifolia L (Tuber)	0.7±0.1	403.7±7.2	63.7±1.1	78.5±3.2	1128.3±3.1	103.7±5.6	2.8±0.2	2.0±0.2
Momordica dioica Roxb. ex Willd (Fruit)	0.3±0.05	22.7±3.5	41.8±3.9	35.2±2.6	151.7±11.2	2.8±0.2	0.1±0.02	2.1±0.1
Nelumbo nucifera Gaertner. (Root)	0.3±0.04	19.2±5.3	136.4±31.7	72.1±3.6	243.5±8	10.2±1.1	1.2±0.1	1.4±0.1
Solanum nigrum L. (Leaves)	0.7±0.1	222±11	20±4.4	75±3.6	45.6±2.4	3.2±0.3	1.3±0.4	11.5±3.2

[a] Values are the means of three determinations±SD (n=3).

The result obtained on proximate composition of the wild edible leaves, tubers, fruits and young shoots shown in table 2**.** The moisture content of the analyzed samples ranged between 75.8±3.1 and 64.3±1.4g/100g with the highest being in a fruit of *Momordica dioica* (75.8±3.1g/100g), tubers of *Dioscorea oppositifolia* had the low moisture content of 64.3±1.4g/100g, the moisture contents obtained from *Dioscorea* species were similar to reported values for tropical *Dioscorea* species from the south pacific region [19]. Followed by leaves of *Solanum nigrum* (72±1.9 g/100g) this is below the reported range (81.4-90.3g/100g) in some Nigerian green leafy

vegetable [20], while the rest of the plants had a moisture content of about 70 g/100g. The ash content was high except for leaves of *Alternanthera sessilis* (1.5±0.4g/100g), the rest of the wild edible plants contain appreciable amounts of ash. The leaves of *Celosia argentea* (5±0.7g/100g) and *Alternanthera sessilis* (4.5±0.7g/100g) had a high protein contents. The crude fat ranged between 0.3±0.1 g/100g in the young shoot of *Dendrocalamus strictus* to 2.9±0.3 g/100g in leaves of *Alternanthera sessilis*, tubers of *Dioscorea oppositifolia* and *Colocasia esculenta* (2.4±0.3g/100g) stands out as a being the best source of crude fat. Young shoot of *Dendrocalamus strictus* is an excellent source of crude fiber (11±1.8g/100g) and are low calories, the similarity values are recorded [21, 22]. Bamboo extract showed the antioxidant and anti-inflammatory effects [23]. Carbohydrate content found maximum in 23±2.1g/100g in tuber of *Dioscorea oppositifolia* followed by roots of *Nelumbo nucifera* (20±2.8g/100g), while the lowest amount recorded in leaves of *Celosia argentea* (10.6±1.7g/100g). Carbohydrate content recorded in this study was in agreement with those reported *Dioscorea* species [24]. *Nelumbo nucifera* roots enhancing body energy, anti-inflammants and relieving high internal body temperature [25]. Fruit are often recommended for their high content of vitamin-C its content was high in the fruit of *Momordica dioica* (77.1±11.9mg/100g). Nutritive value was found highest in tuber of *Dioscorea oppositifolia* (130.40 kal/100g) and least in the young shoots of *Dendrocalamus strictus* (61.1Kal/100g).

The result on mineral content in the wild edible fruit, tubers, leaves and young shoots, expressed as mg/100g of dry weight are presented in table 3. It is reported that the wild edible species from a good source of minerals for the local resident in different parts of the world [1, 26, 27]. The corm of *Colocasia esculenta* contained 326.7±7.6 mg/100g of the magnesium and considered a good source. The leaves were found a rich source of calcium, the highest amount found in the *Alternanthera sessilis* (436.7±14.9 mg/100g), the phosphorus content was found in the range of 35.2±2.6 mg/100g in the fruit of *Momordica dioica* to 137.5±2.8 mg/100g in corm of *Colocasia esculenta*. Potassium was found highest in tuber of *Dioscorea oppositifolia* (1128.3±3.1 mg/100g) can be considered an adequate requirement and corm of *Colocasia esculenta* contained low amounts of 35.1±2.3 mg/100g, the rest had potassium contents in the range of 45.6±2.4 mg/100g to 443±9.6 mg/100g. The leaves of *Alternanthera sessilis* had a maximum amount of sodium (246.7±3.5 mg/100g) and low in fruit of *Momordica dioica* (2.8±0.2 mg/100g). Plenty of elements are required in trace amounts for a wide range of function in the body, the essentiality of some of the trace element for humans are iron, copper, etc. The iron content of various plants showed relatively higher values in leaves, the tender leaves of *Alternanthera sessilis* (14.3±1.8 mg/100g) were estimated to have maximum iron content, followed by *Celosia argentea* (13.1±1.0 mg/100g) and *Solanum nigrum* (11.5±3.2 mg/100g). *Alternanthera sessilis* taken as leafy vegetables increase the flow of bile in the intestine stimulate lactation in nourishing mother [28]. While the copper content varied from 0.1±0.02 mg/100g in the fruit of *Momordica dioica* to 2.8±0.2 mg/100g in tuber of *Dioscorea oppositifolia*. The variation in the nutritional content might be related to their genetic origin, geographical areas, soil fertility, age of the plants and the harvesting periods [29]. This study represents a preliminary survey to obtain nutritional data for some of the wild edible plants consumed by Hakki Pikki tribal's scarcely reported. The results suggest that the wild edibles consumed in appropriate amount could contribute greatly towards meeting nutritional requirements for normal growth and adequate protection against diseases arising from malnutrition. If these wild edible plants, cultivated may have the potential to be a valuable food source.

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CONFLICT OF INTERESTS

Declared none

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