Nutritive Values of Five Wild Edible Ferns of North East India

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A number of wild ferns which are abundant in North East India, have been used as leafy vegetables by various ethnic groups since time immemorial. Analysis for major nutritional components on dry weight basis shows that they are very rich in crude protein; ranging from 18.63 to 33.2 mg/100 mg. Total carbohydrate varies from 5.6 to 11.01 mg/100 mg. Lipid contents are low, ranging from 2.42 to 3.8 mg/100 mg. Crude fibre and ash content vary from 7.8 to 20.93 mg/100 mg and 9.66 to 14.0 mg/100 mg respectively. The analysis corroborates the traditional belief that some wild ferns are nutritionally rich.

Key Words: Edible fern, North East India, Nutritive value

Introduction

Ferns are generally dismissed as a group of lower plants occurring in the wild with little or no economic importance. A lesser known fact about these plants is that many fern species have been used as leafy vegetables by various ethnic groups of North East India and many other tropical countries since time immemorial. Some of them are so delicious and popular that they have become part of ethnic culture and tradition. The tender leaf of *Diplazium esculantum* is one such fern widely consumed in Assam and other North Eastern States of India. In fact one of the most popular dishes in Assam, 'Mas-tenga' is prepared out of the tender leaf of *D. esculantum*, pseudo-fruit of ou-tenga *(Dillenia indica)* and the fish 'Magur Mas' *(Clarius batrachus)*. It is not possible to state exactly since when they began to be used as food but as per legend and also historical account they are in use as food from even before 15th century. The fern which is perennial in nature, is collected from the wild throughout the year except in the winter months. It is very popular among all sections of society, particularly middle class and poor. During the time of scarcity, particularly when there is flood; the rural people become overdependant on this fern. In these days of increasing concern for biodiversity, it is important to assess lesser known food plants for their nutritive values to make best use of them. The present work deals with the chemical analysis of five edible species of fern to assess their nutritive value.

Materials and Methods

Five wild edible fern species from Assam and Nagaland States of North East India were collected for analysis of major nutritional components. The species are – *Diplazium esculantum* (Retz.) Copl., *Ceratopteris thallictroides* (Brongn.), *Diplazium squamigerum* (Mett.) C.Chr., *Diplazium sp.* and *Dryopteris cochleata* (D.Don) C.Chr. All these are terrestrial ferns growing in moist, shady places except *Ceratopteris* which is an aquatic fern found mostly in shallow wetlands of Assam. *D. cochleata* is a high altitude fern collected from areas near Khonoma (Altitude 5000 ft.), Nagaland. These are non-conventional leafy vegetables in the sense that they are not cultivated. They are perennial and grow luxuriantly during summer and autumn, when they are sold in the local markets. In case of *D. esculantum* only the tender leaf with circinate vernation are eaten.

The plants were collected from their natural habitats during summer when growth is luxuriant. The fresh leaves were washed with distilled water and dried in an oven at 50 C till constant weight was recorded. Moisture content was calculated and chemical analysis was done on dry weight basis. Crude protein was estimated by microkjeldahl method. The value of nitrogen thus obtained was multiplied by the conversion factor 6.25 to get the crude protein value. Carbohydrate was estimated by anthrone method (Cleg., 1956). For estimation of total soluble sugar, finely grounded samples were stirred with warm 80% ethanol in magnetic stirrer for about three hours and then centrifuged to obtain the supernatant which was evaporated until dry. The dried residue was dissolved in distilled water and total soluble sugar was estimated by anthrone method. Total lipid was estimated by extracting the sample with petroleum ether in soxhlet apparatus for over eight hours following which the solvent was evaporated away. From the difference in weight of the flask, total lipid was calculated. Crude fibre was estimated as per the method outlined by Raghuramualu *et al.* (1983). For ash content, the sample was ashed in a muffle furnance at 650^0 C for three hours and weight of ash was recorded. Three

replications were made for each sample and standard error of the values were calculated.

Results and Discussion

Among the five fern species in the present study, *D. esculantum* contains the highest amount of crude protein which is 33.27 mg/100 mg followed hy *Diplazium* sp. with 29.11 mg/100 mg; which are relatively high protein values. Even the lowest value of 18.63 mg/100 mg found in *Dryopteris cochleata* is a relatively good amount. Both *C. thallictroides* and *D. cochleata* contain about 20 mg/100 mg crude fibre, the highest in the present study while the lowest value of 7.8 mg/100 mg was observed in case of *D. esculantum.* Ash content varied from 9.66 mg/100 mg to 14.0 mg/100 mg; the highest recorded in *D. cochleata* followed by *D. esculantum* with 13.15 mg/100 mg. However, lipid contents were fairly uniform, ranging from 2.4 to 3.8 mg/100 mg. Total carbohydrate level varied from 8.93 to 11.01 mg/100 mg with the exception of *D. esculantum* where it is quite low with 5.6 mg/100 mg. The level of total soluble sugar varied from 1.65 to 3.85 mg/100 mg. The total soluble sugar constitute about 17.0 to 35.0% of total carbohydrate (Table 1).

It is clear that the edible ferns are excellent source of protein, minerals and crude fibre. Crude fibre itself is not a nutrient component since it is not digested but it is considered to be nutritionally important and in fact, a daily intake of 40 gm dietary fibre is recommended by Gopalan *et.al.* (1989). The protein content of some of the ferns is at par or even superior to some of the best known leafy vegetables like spinach, fenugreek, portulaca, chenopodium etc. where protein content vary from 24 to 31 mg/100 mg (Srivastava, 1990). Thus *D. esculantum* with 33.27 mg/100 mg crude protein appears to be among the leafy vegetables with very high protein content, if not highest of all. In case of *D. esculantum* only the tender young leaves are eaten and hence it was analysed. It is a well known fact that young tender leaf with active growth is metabolically much active than older leaves and hence supposed to contain higher amount of enzymatic protein. This may be a reason why in *D. esculantum* protein is much higher than the other ferns where both young and old leaves are eaten. Apparently for the same reason crude fibre in *D. esculantum* is quite low. Apart from high protein and mineral content, *D. escultantum* is rich in various essential free amino acids (Handique, 1993), thus enhancing its nutritive value. Some of these ferns are available in rural as well as urban markets of whole North East India at a very cheap rate throughout entire summer and autumn. Morover the regeneration ability and frequency is so high that within 3 to 4 days fresh harvest can be made from the same locality thereby ensuring steady flow of the vegetables to the local markets. In rural market, one pack of tender leaves of *D. esculantum* weighing about 500 gm is priced at just Rupees 2.00. This is equal to 30.27 gm crude protein. By contrast, same amount of beef muscle contain 29.04 gm, fowl 36.0 gm, pork muscle 21.3 gm and mutton muscle 26.36 gm crude protein. But market

Table 1. Major nutritional components of five edible fern species used as leafy vegetable

Species	Moisture %	Major nutritional components (mg/100 mg dry weight)					
		Crude protein	Total carbohydrate	T.S.S.	Total lipid	Crude fibre	Ash
Diplazium esculantum	81.84	33.27	5.60	1.85	3.80	7.80	13.15
	±0.987	±0.811	±0.202	±0.0	±0.173	±0.343	±0.155
Ceratopteris thallictroides	85.86	21.01	11.01	3.85	2.70	20.93	10.83
	±0.328	±0.902	±0.280	±0.086	±0.144	±0.444	±0.0
Diplazium sp.	78.53	29.11	9.10	2.07	2.42	15.66	12.66
	±0.488	±0.936	±0.208	±0.0	±0.0	±0.242	±0.182
Diplazium squamigerum	78.95	27.80	8.93	2.40	3.08	14.33	9.66
	±0.866	±0.277	±0.480	±0.115	±0.086	±0.190	±0.0
Dryopteris cochleata	77.56	18.63	9.86	1.65	3.30	20.33	14.00
	±0.208	±0.144	±0.308	±0.086	±0.0	±0.190	±0.0
Fowl*	72.2	25.9	—	—	0.6	—	1.3
Pork muscle*	77.4	18.7	—	—	4.4	—	1.0
Spinach*	92.1	25.31	36.70	—	8.86	7.59	21.5
Cabbage*	91.9	12.22	56.79	—	1.23	12.34	7.4

* Source : Gopalan *et al.* (1989)
± Standard Error of mean
T.S.S.: total soluble sugar

price for the same amount of meat varies from Rupees 50 for fowl and mutton to Rupees 35 for pork in local markets.

Dietary allowance (RDA) for Indian people recommended by Indian Council of Medical Research in 1988 (Gopalan *et al.,* 1989) varies based on age group, profession etc. For example, for an adult person doing heavy work recommended net energy requirement is daily 3500 kcal., protein 60 gm and fat 20 gm. Therefore, the tender leaf of the fern *D. esculantum* can provide nearly half of daily protein requirement. Of the five fern species *D. esculantum* is found in almost all the states of North East India except in high altitude areas while the other two *Diplazium* species and *D. cochleata* are seen in some rural markets of the tribal states of Nagaland and Manipur. Arora and Pandey (1996) in their enumeration of wild edible plants of India listed 21 pteridophyte species as edible out of which 16 are used as leafy vegetables. The present study shows that some of the edible ferns are among the cheapest and nutritionally among the best.

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