

## Full Length Research Paper

# Nutritive values of some non-conventional leafy vegetables and scarcity food plants of north east India

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Biochemical analysis was made for major nutritional components of eight non-conventional leafy vegetables and scarcity food plants of north east india, most of which occur in the wild. Crude protein content varied from 12.24 to 28.80%. Total carbohydrate varied from 5.35 to 18.80%. Lipid content was found to be low and varied from 2.06 to 6.16%. Total mineral content in the form of ash were found to be impressive and ranged from 11.58 to 24.58% with the exception of *Vitex nigando*, where it was only 6.05%. Calorific values varied from 108.9 to 215.46 Kcal/100 g. Methionine and tryptophan content varied in the range of 1.28 to 2.62 and 0.81 to 1.36 g/100 g protein respectively. The present findings show that many wild and non-conventional leafy vegetables, which are traditionally used by various ethnic groups of North East India and popularly referred to as “poor man’s food” are in fact nutritionally very rich which necessitate rethinking about these neglected food plants.

**Key words:** Non-conventional food plants, leafy vegetable, nutritive value, crude protein, carbohydrate, lipid, crude fibre, ash.

## INTRODUCTION

The NE region of india is one of the major biodiversity hotspot in the world. Wild edible plants (WEPs) are widely consumed as part of daily diet by the local people and are part of their traditional culture and food habit. WEPs are critical for the sustenance of ethnic communities and also as a source of income. However, WEPs received little attention in research activities, economic development, biodiversity conservation and sustainable management (Surjata et al., 2016). Majority of the non-conventional food plants are neglected which

grow naturally in the wild and need no input, maintenance or care (FAO - Traditional Food Plants, 1988). Non-conventional food plants have always played a pivotal role as supplement to major food plants in the food security system since time immemorial. In almost all countries of the world which are rich in floral biodiversity and have abundance of vegetation, there are established practices of using Non- conventional food plants as stand-by source of food at times of famine, natural calamity and at times when major crops fail due to local

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climatic aberrations etc. For example, in Assam (India) where flood is common during the rainy season; since time immemorial people have been using tender shoot of banana, corms of *Colocasia*, tender fronds of Fern as staple and scarcity food to survive during unfavourable time. In many parts of Nagaland, India, whenever paddy cultivation fails due to unfavourable climatic condition, Job's Tear (*Coix lacryma-jobi* var. *Ma Yuen*) is brought in as paddy substitute (Handique et al., 1986). Non-conventional food plants are defined as those wild and semi-wild species that grow naturally in forest, forest margins, community land, degraded and discarded lands etc; but invariably come from sources other than organized cultivation (Handique, 2003a). Such plants are routinely used as supplement to major food and are part of traditional knowledge and culture of various ethnic groups elsewhere and particularly North East India (Gogoi et al., 2014). Non-conventional food plants are therefore substitute to major food plants at times of scarcity and supplement to major food crops at normal times and thus they have become part of ethnic culture. Since the dawn of civilization man has identified nearly 80,000 plants to be edible out of which only about 130 are put to major use (Bhag Mal, 1990). Rural areas and tribal societies are the bastions of non-conventional food plants. Growing urbanization, influence and invasion of urban culture in rural areas and also tribal societies are causing fast erosion of ethnic culture and along with it knowledge and germplasm of non-conventional food plants. However, mere enumeration of such plants is not enough. A thorough assessment of their nutritive values is of paramount importance to find out how to make best use of them. The present work deals with the chemical analysis of the nutritive values of eight non-conventional food plants from Assam as well North East India.

## MATERIALS AND METHODS

The species for the present study are – *Musa bulbisiana* Colla (Musaceae), *Talinum triangulare* (Jacq.) Wild (Portulacaceae), *Chenopodium album* Linn. (Chenopodiaceae), *Stellaria media* (L.) Villars (Caryophyllaceae), *Vitex nigando* Linn. (Verbenaceae), *Leucas plukenetii* (Roth.) Sprang (Lamiaceae), *Paederia foetida* Linn. (Rubiaceae), *Enhydra fluctuans* Lour. (Asteraceae). Of these, *M. bulbisiana* is cultivated but cultivation is for the fruits and the tender shoot is used as scarcity food during flood in summer in Assam. Even otherwise it is consumed as a delicacy during the rainy season. *T. triangulare* is occasionally grown as ornamental herb in courtyard and also occurs as weed in garden. The rest are not cultivated and occur in the wild. *C. album* is a herbaceous garden weed during winter while *S. media* is a herbaceous summer weed. *V. nigando* is a medium sized shrub and its leaves are occasionally used for its medicinal value. *L. plukenetii* is an annual herbaceous weed that grows round the year but traditionally consumed in small quantities during autumn and winter for its medicinal value. *P. foetida* is a twinner and its leaves emit characteristic pungent odour upon smearing. It is available round the year and is known to have medicinal value for which it is consumed in small quantity. *E. fluctuans* is a semi-aquatic herb and used as vegetable during summer.

Freshly collected leaf samples were first washed with tap water and then distilled water and dried in oven at 50°C till constant weight was recorded. From this moisture percentage was computed and chemical analysis was on dry weight basis. Crude protein was estimated by microkjeldahl method (AOAC, 1970). Carbohydrate was estimated by anthrone method (Clegg, 1956). For estimation of total soluble sugar (TSS) finely grounded samples were stirred with warm 80% ethanol in a magnetic stirrer for about three hours and then centrifuged to obtain the supernatant which was evaporated to dryness. The dry residue was dissolved in distilled water and estimation was made 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 (AOAC, 1970). Crude fibre was estimated as per the method outlined by Sadasivam and Manickam (1996). For ash content, the sample was ashed in a muffle furnace at 600°C for four hours and the difference in weight was recorded from which ash content was calculated. Methionine and tryptophan were estimated as per the method outlined by Sadasivam and Manickam (1996). Calorific values were computed as per the formula of Sherman (1952). Three replications were made for each sample and standard error of means were worked out. The data were subjected to one way analysis of variance.

## RESULTS AND DISCUSSION

Of the major nutritional constituents, crude protein varied from 12.24 in *M. bulbisiana* to 28.03% in *C. album* and 27.8% in *T. triangulare* which are quite impressive. In terms of relative proportion, the other chemical constituents are crude fibre and total mineral in the form of ash content. Like crude protein lot of variations were observed with respect to crude fibre and ash also. Crude fibre varied from 8.16% in *C. album* to 27.5% in *M. bulbisiana*. Ash content was lowest in *V. nigando* with 6.05% which is unusually low because for all other species in the present study ash contents were above 10.0%. Highest ash content was observed in *T. triangulare* with 24.58% which is four times more than that of *V. nigando*. Total carbohydrates were comparatively low; ranging from 5.35% in *C. album* to 18.8% in *L. plukenetii*. The levels of total soluble sugar (TSS) were still lower, ranging from 0.9% in *S. media* and *C. album* to 4.9% in *L. plukenetii*. Likewise lipid levels were also low but there was not much variability unlike the other constituents. Lipid content ranged from 2.06% in *M. bulbisiana* to 6.16% in *L. plukenetii* (Table 1).

Non-conventional leafy vegetables are excellent sources of protein, crude fiber and minerals. The values for crude protein compares well with known conventional leafy vegetables like Spinach 23.75%, Fenugreek 28.0%, *Portulaca oleracea* 29.0% etc (Srivastava, 1990) and also various pulses which are regarded as main sources of plant protein, where protein content varies from 20.8 to 28.2% (Gopalan et al., 1989). There are reports that wild edible fern *Diplazium esculantum* contain as much as 33.27% crude protein (Handique, 2003b) which is among the best in case of leafy vegetables irrespective of non-conventional or cultivated. Although crude fibre itself is

**Table 1.** Major Nutritional constituents of eight non-conventional leafy vegetables.

Species	Moisture	Crude protein	Carbohydrate	T.S.S	Lipid	Crude fibre	Ash
<i>Musa balbisiana</i>	95.78 (0.285)	12.24 (0.182)	10.35 (0.385)	0.93 (0.085)	2.06(0.068)	27.50(0.884)	19.45(0.0)
<i>Talinum triangulare</i>	89.60 (0.210)	27.80 (0.177)	6.35 (0.337)	2.20 (0.185)	3.70 (0.128)	9.06(0.175)	24.58(0.054)
<i>Chenopodium album</i>	77.57 (0.665)	28.03 (0.255)	5.35 (0.515)	0.95 (0.146)	3.20 (0.188)	8.16(0.421)	21.42(0.118)
<i>Stellaria media</i>	86.65 (0.605)	18.58 (0.0)	7.20 (0.824)	0.90 (0.175)	4.86 (0.164)	10.36(0.542)	20.25 (0.0)
<i>Vitex nigando</i>	64.33 (0.854)	23.64 (0.815)	11.75 (0.418)	4.00 (0.222)	5.33 (0.358)	15.20(0.468)	6.05 (0.178)
<i>Leucas plukenetii</i>	73.72 (0.445)	21.21 (0.410)	18.80 (0.214)	4.90 (0.346)	6.16 (0.318 )	12.10 (0.368)	11.58 (0.241)
<i>Paederia foetida</i>	76.93 (0.545)	14.53 (0.0)	14.10 (0.265)	1.25 (0.215)	3.16 (0.284)	23.00 (0.618)	12.40 (0.218)
<i>Enhydra fluctuans</i>	84.25 (0.442)	23.42 (0.345)	8.12 (0.208)	1.50 (0.164)	4.16 (0.088)	14.08 (0.428)	14.60 (0.136)
#C.D. at 5%	--	1.4	1.06	0.42	0.34	1.5	1.26

# The values are for mean of three replications. Figure within parenthesis ( $\pm$ ) are standard error of mean.

**Table 2.** Methionine, tryptophan content and calorific value of eight non-conventional leafy vegetables..

Species	Methionine (g/100 g protein)	Tryptophan (g/100 g protein)	Calorific value (Kcal/100 g)
<i>Musa balbisiana</i>	1.28	0.81	108.9
<i>Talinum triangulare</i>	2.08	0.98	169.9
<i>Chenopodium album</i>	2.62	1.3	162.32
<i>Stellaria media</i>	2.1	1.36	146.86
<i>Vitex nigando</i>	1.43	0.94	189.53
<i>Leucas plukenetti</i>	1.62	1.08	215.48
<i>Paederia foetida</i>	1.54	1.22	142.96
<i>Enhydra fluctuans</i>	1.88	1.02	163.6
C.D at 5%	0.18	0.11	4.19

not a food component since it is not digested; its role in nutrition and health care is well recognised (Gopalan et al., 1989). Since it is not absorbed and retained by body it may be quite helpful in excretion and hence to overcome constipation problem. From this viewpoint, tender shoot of *M. balbisiana* with 27.5% and leaves of *P. foetida* with 23.0% crude fibre appears to be remarkable. Regarding ash content, with the exception of *V. nigando* (6.05%), all other species in the present study have appreciably high level of ash content.

This is consistent with the reported fact that most leafy vegetables are rich in minerals- Onayemi and Badifu (1987) reported such high values as 25.1% ash in *Amaranthus hybridus* and 27.32% ash in *Celosia argentia*. Since total carbohydrate and lipid were low, these leafy vegetables cannot be regarded as energy food. But this may be a point of advantage for those who need to avoid or minimise the intake of carbohydrate and lipid on health ground like diabetes patients.

Apart from being a good source of protein,

crude fibre and minerals, leafy vegetables are also known to be good source of various essential free amino acids (Handique, 1993); iron, phosphorous, calcium and vitamins particularly ascorbic acid and  $\beta$ -carotene (Ragu and Kapoor, 1997). Table 2 shows the levels of essential amino acids, methionine and tryptophan for the species under study which have been found to be impressive and higher than that of protein rich crops like chickpea (Yadav and Srivastava, 2002). The leaf is metabolically, the most active organ

and appears to be in abundance in areas with free amino acid. Impressive amount of various acids were also reported in several non-conventional leafy vegetables from Africa (Nkafamiya et al., 2010; Kubmarawa et al., 2008). Some non-conventional leafy vegetables are known to be rich in dietary antioxidants like flavonoids, tannins etc. and *in vitro* assay show that they are very efficient in scavenging free radicals (Salam et al., 2011). Since nutritional components are highly variable, calorific values also exhibited wide variation in the range of 108.9 Kcal/100 g in *M. bulbisiana* to 215.48 Kcal/100 g in *L. plukenetii*.

It is noteworthy that as per ethnic knowledge and practice particularly in North East India four species in the present study viz: *S. media*, *V. nigando*, *L. plukenetii* and *P. foetida* are known to have medicinal values as remedies for various stomach ailment. Accordingly they offer dual benefit of nutrition as well medicinal value.

## Conclusion

The present study revealed that *T. triangulare*, *C. album* and *S. media* are excellent sources of protein and minerals with moderate level of crude fibre. On the other hand species like *M. bulbisiana*, *P. foetida* are excellent sources of crude fibre with good amount of minerals. There is a general misconception that non-conventional leafy vegetables as well as other edible plants are nutritionally poor and hence unimportant. However, the present study as well as other studies (Handique and Handique, 2005; Gogoi et al., 2014) show that contrary to general belief they are nutritionally very rich which necessitate rethinking about these neglected food plants. Since these leafy vegetables are readily available at nominal or no cost, they are promising low cost food supplement and substitute for major food in times of scarcity. Therefore, they should be considered as reliable ingredients of food security system.

## Conflict of Interests

The authors have not declared any conflict of interest.

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