



PROXIMATE COMPOSITION OF EDIBLE AQUATIC VEGETABLES: A PRELIMINARY ASSESSMENT OF FOUR SPECIES FROM BANGLADESH

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Abstract: The proximate composition of four commonly found edible aquatic plants (both leaves and stems) from south-western coastal regions of Bangladesh, such as Helencha (*Enhydrafluctuans*), Malancha (*Alternantheraphiloxeroides*), Shapla (*Nymphaea nouchali*) and Kochu (*Colocasiaesculenta*) was determined to evaluate their nutritional value in terms of crude protein, lipid and moisture contents. The moisture contents of leaves ranged from 59.41 ± 1.0 % to 67.16 ± 1.0 % and that of stems from 70.19 ± 1.0 % to 83.03 ± 1.0 % (fresh weight). The crude protein contents of leaves ranged from 9.04 ± 0.2 % to 20.58 ± 0.5 % and that of stems 6.34 ± 0.4 % to 19.64 ± 0.6 %; the lipid contents of leaves ranged from 1.12 ± 0.2 % to 2.96 ± 0.1 % and that of stems 1.11 ± 0.3 % to 2.02 ± 0.2 %; and the ash contents of leaves ranged from 13.39 ± 0.5 % to 16.13 ± 0.5 % and that of stems from 14.29 ± 0.5 % to 17.28 ± 0.5 % (dry weight). The results revealed that the plants contained essential amount of protein, lipid and moisture which compete favourably well with those of commercially available agricultural vegetables.

Keywords: Proximate composition, *Enhydrafluctuans*, *Alternantheraphiloxeroides*, *Nymphaea nouchali*, *Colocasiaesculenta*

Introduction

Bangladesh possesses enormous area of wetlands supporting naturally occurring aquatic and semi aquatic plants provide cost effective source of food for the local people (Chakraborty, 2006). Vegetables contain naturally low calories and fat and provide an array of vitamins, minerals and fiber (Roberts and Barnard, 2005). It represents a major portion of our diet both quantitatively and qualitatively. The biggest contribution of vegetables to the daily diet is fiber. The quality of food depends upon the presence of relative concentration of various nutrients such as protein, fat, carbohydrate, vitamins and mineral. Among them protein content is highly important and lipid is also a greater source of energy. Nutrition plays a critical role in wellness by not only providing essential nutrients, but also promoting good health and preventing diseases. Besides being consumed as a vegetable most of these plants are also used traditionally in the treatment of diseases. So these plants not only provide food value to human but also play vital role in medicinal value. About 25% of all

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prescribed medicines today are derived from plants (Ngaski, 2006). Not all aquatic plants are fit for human consumption but many have reported food uses. Amongst the semi aquatic plants, *Heléncha*, *Maláncha*, *Shapla* and *Kochu* are known to be consumed as important vegetable in Bangladesh.

Bangladesh is a low-lying, riverine country (Mazid, 2002) where a large number of plants grow in aquatic environment that provides many benefit to fish, wildlife and people (Chakraborty, 2006). Some aquatic plants are used as a source of food. These aquatic plants are nutritious but low demanding and hence low priced due to lack of awareness.

Heléncha is a trailing marsh herb which are often found as floating on water. It is an edible semi aquatic herbaceous vegetable plant. The stems of this plant are long and the leaves are sessile, linear-oblong, acute or obtuse, entire or subcrenate. The heads of this plant are axillary, terminal and sessile; and flowers are white. *Maláncha* is a perennial, polymorphic herb. It's stem and leaf both are consumed and some cases also used as medicinal plants. The stems of this plant are found as creeping or floating, ascending towards apex, rooting at the lower nodes, branched, hollow, with a longitudinal hairygroove on two opposite sides. *Kochu* is a herbaceous perennial plants with a large corm on or just below the ground surface. The whole plants are consumed as a tasty vegetables. It is also sold as an ornamental aquatic plant because of its spectacular flowers. *Shapla* is a day-blooming plant with submerged roots and stems. Part of the leaves are submerged, while others rise slightly above the surface. It is considered as a medicinal plant and mainly used to treat ingestion. It's tuber and rhizomes is used as popular food items (Ahsan, 2015a).

It is apparent thus these plants resources play a significant role in nutrition, food security and income generation. While these plants are used for long by rural people, widespread use of these food materials are yet to be realized. A better knowledge and understanding of their nutritional properties might help in mainstreaming these aquatic vegetables (Ahsan, 2015b). The present study was undertaken to determine the proximate composition of those four edible aquatic plants to understand their nutritional profile.

Materials and methods

Whole parts of *Heléncha*, *Maláncha*, *Shapla* and *Kochu* were collected from different areas of Khulna region and taxonomically identified. The stems and leaves of these plants were separated for subsequent analysis.

The proximate composition of the edible aquatic plants were analyzed for the content of moisture, crude protein, crude fat, and ash, according to the standard methods (AOAC,2000). The moisture content of the samples was determined by complete drying at 105°C. The loss in weight of the sample is the measure of moisture content. The dried matter obtained was ground to fine powder and stored in airtight containers prior to further analysis. The crude protein content was determined by micro kjeldahl procedure; factor Nx6.25 was used to convert nitrogen into crude protein. The lipid content was extracted by chloroform/methanol/water extraction method (Bligh and Dyer, 1959). The ash content was determined by complete removal of the organic residue by muffling at 550 °C in a muffle furnace for 8 hours (Pearson, 1976). Statistical analyses were performed with R Statistical Software Package (2015).

Results and discussion

The results of the proximate composition analysis of the selected edible aquatic plants are presented in Table 1.

Table 1: Proximate composition (%) of four edible aquatic plants (dry weight basis)

Proximate composition	<i>Helancho</i>		<i>Malancho</i>		<i>Kochu</i>		<i>Shapla</i>	
	Stem	Leaf	Stem	Leaf	Stem	Leaf	Stem	Leaf*
Moisture% (Fresh wt.)	71.03±1.0	67.16±1.0	70.19±1.0	60.19±1.0	77.01±1.0	59.41±1.0	83.03±1.0	
Protein%	19.64±0.6	20.58±0.5	16.50±0.4	19.97±0.4	6.34±0.4	9.04±0.2	12.62±0.8	
Lipid%	2.02±0.2	2.96±0.1	1.81±0.1	1.12±0.2	1.11±0.3	1.79±0.4	2.00±0.1	
Ash%	17.28±0.5	16.13±0.5	14.73±0.5	13.93±0.5	14.91±0.5	13.39±0.5	14.29±0.5	

*Not determined

The amount of moisture in aquatic plants is comparatively higher than terrestrial plants (Boyd, 1968). The moisture contents of the examined aquatic plants, which ranged from 59.41±1.0 % to 83.03±1.0%, was highest in *Shapla* (stem) while *Kochu* (leaf) had the least and in general the moisture content in stems was higher than leaves. It was observed that the moisture content in these species were comparable with four wild leafy vegetables in Eastern Cape, South Africa which ranged from 57.16±92.18 to 89.87±1.87% (Afolayan and Jimoh, 2009). Similar results have been reported in India, where the moisture contents of wild vegetables were ranged between 62.73±0.99 and 87.13±0.08 % (Kalita *et al.*, 2014). As these plants contain a large amount of moisture, it does not mean that these plants are less nutritious because, there may be present other good biochemical product at a higher amount. The proximate composition of *Shapla's* leaf was not determined because it is not consumed and used usually.

The protein contents of these plants on dry basis (Table 1) were observed to range between 6.34±0.4 to 20.58±0.5%, highest in *Helancho* (leaf) and lowest in *Kochu* (stem) and the average protein content was higher in leaves than stems. So, leaves may be more nutritious than stems which is comparable with four wild leafy vegetables which ranged from 13.25± 0.05% to 26.44± 0.20% % (Afolayan and Jimoh, 2009) and higher than that of wild vegetables (Kalita *et al.*, 2014) which ranged from 1.5 ± 0.3 to 16.8± 0.63%. Most plants contain curtailed proteins, but the combination of different vegetables may improve the situation. Lack of protein, either in quality or quantity, contributes to low body mass, growth retardation in children and developmental deficiency during pregnancy. Therefore, leafy vegetables with high crude protein may be used as cheap sources of protein, especially for vegetarians and for the poor's who struggle to afford animal protein due to higher costs. Generally, and to a certain extent, the consumption of these wild vegetables may contribute to filling the protein gap in human diets.

The *Helancho* leaf possesses more lipid than the other three. However, all these edible aquatic plants contain a desirable amount of lipid, which is appropriate for health. Therefore, they are good in their nutrient content.

The ash content in these plants ranged from 13.39 ± 0.5 to $17.28 \pm 0.5\%$, the highest amount being found in *Helencha* (stem) and the lowest by Kochu (leaf) and leaves contain less ash than stems. The higher values of ash indicates the presence of adequate minerals in it. These value is comparable with wild leafy vegetables which ranged from $13.0 \pm 0.00\%$ to $27.75 \pm 0.25\%$ (Afolayan and Jimoh, 2009) and higher than that of wild vegetables which ranged from 0.65% to 22.8% (Kalita *et al.*, 2014).

Thus it is clear that amongst the four species *Helencha* is nutritionally rich, although the rest three are also nutritious. Furthermore, for all the cases, the leaves are more nutritious than that of stems.

Conclusion

Amongst the four aquatic plants, *Helencha* is the most nutritious, but the rest three are also nutritious and there is a considerable amount of major nutrients and could serve as a high standard supplementary item of diet. However, further studies are necessary to determine the micronutrients contents of these edible aquatic plant species.

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References

- Afolayan, A. J. and Jimoh F. O. 2009. Nutritional quality of some wild leaf vegetables in South Africa. *International Journal of Food Sciences and Nutrition*, 60(5):424-431
- Ahsan, M.N. 2015a. *Edible aquatic plants of South West coastal districts of Bangladesh*. A book let published as an output of a research project funded by Ministry of Education, Government of the People's Republic of Bangladesh
- Ahsan, M.N. 2015b. *Mainstreaming of eccentric aquatic production system as a climate adaptive alternative livelihood strategy for the coastal community*. An output of a research project funded by Ministry of Education, Government of the People's Republic of Bangladesh AOAC.2000. Official Methods of Analysis. Association of official Analytical Chemist, EUA
- Bligh, E.G. and Dyer, W.J. 1959. A rapid method of total lipid extraction and purification. *Can. J. Biochem. Physiol.* 37: 911-917
- Boyd, C. E. 1968. Fresh-water plants: a potential source of protein. *Economic Botany*, 22(4): 359-368
- Chakraborty, T. R. 2006. *Management of Haors, Baors, and Beels in Bangladesh: Lessons for Lake Basin Management*. IUCN Bangladesh Country Office, Dhaka, Bangladesh, 1-15
- Kalita,P.;Tag.H. N. and Sarma A. K.2014. Evaluation of Nutritional Potential of Five Unexplored Wild Edible Food Plants from Eastern Himalayan Biodiversity Hotspot Region (India). *International Journal of Biological, Veterinary, Agricultural and Food Engineering* 8(3):

- Mazid, M.A. 2002. *Development of Fisheries in Bangladesh: Plans and Strategies for Income Generation and Poverty Alleviation*. pp. 43-46
- Ngaski, M.M. 2006. *Phytochemical Screening and proximate composition analysis of Cassia siamea leaves*. M.Sc. Dissertation, Usmanu Danfodiyo University, Sokoto, Japan
- Pearson, D. 1976. *Chemical Analysis of Foods*. Church Hill Livingstone, London, UK
- Roberts, C. K. and Barnard, R. J. 2005. Effects of exercise and diet on chronic disease. *Journal of Applied Physiology*, 98(1): 3-30
- R Development Core Team. 2015. *R: A Language and Environment for Statistical Computing* (R Foundation for Statistical Computing, 2015)