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Short Communication

Nutrient Analysis of Some Commercially Important Molluscs of Bangladesh

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Abstract

This proximate study was carried out to determine the nutrient content of six commercially important molluscs. The selected molluscan species were *Pila globosa, Bellamya bengalensis, Melania tuberculata, Lamellidens marginalis, Anisus convexiusculus* and *Helix sp*. These species were assessed for their proximate and mineral compositions designed to establish their nutritive values on the wet weight basis. The analysis of muscles revealed that the composition of crude protein varied from 8.272%±0.05% in *Pila globosa* to 12.927%±0.57% in *Anisus convexiusculus*, moisture content varied from 74.6%±0.04% in *Melania tuberculata* to 85.9%±0.68% in *Lamellidens marginalis* and in case of ash content it varied from 1.036%±0.02% in *Pila globosa* to 4.607%±0.01% in *Anisus convexiusculus*. Carbohydrate content varied from 2.902±0.03% in *Pila globosa* and 7.566%±0.37% in *Melania tuberculata*. The fat and crude fiber content was marginally small in all of the species. The concentrations of calcium, phosphorus, iron, sodium and potassium in the flesh and shells of the molluscs were determined. It becomes pretty clear that molluscs are excellent sources of some required trace and minor elements needed for the proper growth and development of human being and can also be used as high-nutrient supplementary feed for domestic animals, birds and even for fish culture.

Keywords: Freshwater; Snails; Proximate analysis; Nutrition; Minerals.

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1. Introduction

Molluscs are one of the larger invertebrate groups in the freshwater habitat of Bangladesh. Several works have been done on their diversity and abundance but nutritional perspective is still not well studied. The information on economic importance on different species of

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gastropods in India is available [1, 2]. The use of freshwater molluscs as protein-rich food is very much in practice in a number of countries viz. India [3], Mexico [4, 5], Taiwan, Formosa [6], The Philippines [7, 8] and Thailand [9].

Freshwater molluscs play a vital role in the economy and tradition of West Bengal in India serving as a food of 80.81% families belonging to more than 30 castes of general schedule and tribal peoples (personal communication with Dr. S.K. Raut, India). Some workers in Bangladesh [10, 11] investigated on the role of snails as supplementary feed of prawns. The importance of these snails in mitigating the protein deficiency in poor countries like Bangladesh cannot be overlooked. Accordingly, the present study is an attempt to focus the possible use of freshwater edible snails in Bangladesh as a food of human and domestic animals as well as a supplementary feed for shrimp culture in Bangladesh.

The findings of the study may help to select the appropriate species for feed formulation. Gross harvesting of snail species is causing an environment problem in the wetland ecosystem of Bangladesh. By applying the knowledge of nutritional status one can select the required species to harvest. That may help conserving the wetland ecosystem, which is an urgent need nowadays.

2. Materials and Methods

2.1. *Study areas*

Chanda Beel is the most important Beel in the Madhumati river floodplain ecosystem in the south central region of Bangladesh. Chanda Beel is the home to over 100 species of fish and other aquatic animals, 150 aquatic plants and over 50 species of birds [12]. Local people are heavily dependent on these natural resources for their livelihoods, particularly on fish, fisheries like molluscs and on some aquatic weeds like ‘Shaluk’. For the current study, sample snails were collected from the Chanda Beel of Gopalgonj District, Bangladesh.

2.2. *Selection and identification of species*

Species were selected on the basis of abundance and use pattern in the study area. Species having economic importance were selected for the analysis of nutrient values. The snails were harvested and collected from the wetland, and identified later [12, 13]. The museum specimens of the Zoological Museum, Department of Zoology, University of Dhaka were also compared with the collected samples for the confirmation.

2.3. *Species collection and preservation*

The Sampling was done monthly and was based on a random free hand collection procedure. The collection of sample was made by Ekman-dredge. The samples collected

from the study area were washed with fresh water and preserved in freezer. Before preserving they were identified and packed within some labeled pots.

2.4. *Sample preparation and preservation*

The shells were carefully removed using the forceps and scalpels so that the edible parts could be separated. The flesh was dried, crushed and powdered. This powder was used for the analysis. The vials of powdered sample were preserved in a dessicator. Only minerals were analyzed from the shells, as those are rich in minerals. 0.50 gm sample was added with one drop of nitric acid and kept in a muffle furnace at 600˚C to get the ash samples to make stock mineral solutions.

2.5. *Procedure of nutrient analysis*

Moisture, ash and crude fiber contents of the flesh were determined by the method of the Association of Official Analytical Chemists [14]. Nitrogen was determined by the Micro-Kjeldahl method as described by Pearson [15] and the percentage nitrogen was converted to crude protein by multiplying by 6.25. Fat content was determined by the method of Bligh and Dyer [16]. Carbohydrate was determined by the difference between 100% (accepted total value of nutritional status) and the sum of the values of protein, moisture, fiber, fat and ash.

2.6. *Estimation of mineral content*

2.6.1. *Preparation of mineral stock solution*

The ash (obtained from both of molluscs flesh and shells) was dissolved in standard flasks with distilled, de-ionized water containing a few drops of concentrated hydrochloric acid. After warming and evaporation to dryness on boiling water bath the ash becomes free of acid. After filtrating through the Whatman No. 40 filter paper, the suitable aliquots were then taken for the estimation of calcium, phosphorus, iron, sodium and potassium.

Phosphorus was determined colorimetrically as described by Pearson [15] with KH_2PO_4 as a standard. The other minerals were analyzed by following the methods reported by Association of Official Analytical Chemists [14].

3. Results

3.1. *Nutrient composition in flesh*

About three-fourth of the flesh of molluscs is water by weight, ranging grossly from 74.6% to 85.9%. The flesh of *Pila globosa* contains 85.5±0.02 % water. Among the studied molluscs the highest record was for the species *Lamellidens*, 85.9±0.68 %. For the

flesh of *Helix sp*., *Belamya bengalensis* and *Melania tuberculata* the proportions were 83.2±0.02 %, 82.1±0.04 % and 74.6±0.04 % respectively. The flesh of Garden snail, *Anisus convexiusculus* contains 75.7±0.07 % of moisture.

Among the species the highest amount of protein was recorded from *Anisus convexiusculus* (12.927±0.57 %), followed by *Melania tuberculata* (12.357±0.34 %). The species *Melania tuberculata* is the highest fat containing species. Species *Anisus convexiusculus* contains more then 4.6% of ash, which is followed by *Melania tuberculata* and *Bellamya bengalensis*. More than 7.5% of dry flesh of *Melania tuberculata* is carbohydrate. The least amount of carbohydrate was recorded from *Pila globosa*, only 2.902±0.03 %.

The analysis of the nutrients from the flesh of different molluscan species results that molluscs are moderate sources of protein. Other than that molluscs can be regarded as a source of carbohydrate also. The species *Melania tuberculata* contains a considerable amount of carbohydrate around 7.5%. In this analysis, the highest amount of ash was recorded from *Anisus convexiusculus.* The present study says that these molluscs are a negligible source of fat. In this study the highest amount of fat was recorded for the species *Melania tuberculata*, it was 1.793±0.18% followed by *Belamya bengalensis* (0.984±0.02%). The result of the analysis is shown in Table 1.

Table 1. Proximate content in the flesh of different molluscs species in percentage (%).

Species	Moisture	Ash	Protein	Fat	Carbohydrate	Crude Fiber
Pila globosa	85.5±0.02	2.599±0.02	8.272±0.05	0.725±0.03	2.902±0.03	0.0256±0.01
Helix sp	83.2±0.02	1.036±0.01	8.640±0.17	0.571±0.01	6.548±0.05	0.0035±0.01
Bellamya bengalensis	82.1±0.04	3.640±0.04	8.966±0.26	0.984±0.02	4.308±0.17	0.0355±0.01
Melania tuberculata	74.6±0.04	3.683±0.03	12.357±0.34	1.793±0.18	7.566±0.16	0.0454±0.02
Lamelhidens marginalis	85.9±0.68	2.184±0.02	6.464±0.24	0.507±0.10	4.943±0.29	0.0025±0.01
Anisus convexiusculus	75.7±0.07	4.607±0.01	12.927±0.57	0.972±0.21	5.793±0.37	0.0370±0.02

Here the mean values are not significantly different ($P < 0.05$).

3.2. *Minerals composition in the dried flesh of molluscs species*

The species *Melania tuberculata* is the richest in minerals, contains the highest amount of phosphorus, iron, sodium and potassium among the species. The highest amount of calcium was recorded from the flesh of *Pila globosa* (304.427 mg/100 g) again followed by the species *Melania tuberculata.*

The analysis of the minerals in flesh of different molluscan species results that molluscs are good sources of minerals; contains in average 571 mg/100 g of different kinds of minerals. There is a large quantity of calcium in molluscan flesh. The mean calcium content in molluscan flesh is 217.356 mg per 100 g dried sample. Iron and

phosphorus are also present in a moderate quantity; the average amount is 138.772 mg of phosphorus and 102.50 mg of iron per 100 g sample. The mean sodium and potassium content of molluscan fauna is 64.966 mg and 47.658 mg per 100 g sample respectively. Among the studied species *Melania tuberculata* contains the highest amount of minerals whereas *Helix sp*. contains a very small quantity of minerals (Table 2).

Table 2. Comparative minerals content in the dried flesh of different molluscs species (mg/100 g).

Species	Calcium	Phosphorus	Iron	Sodium	Potassium
Pila globosa	304.427	133.356	99.147	43.485	31.889
Bellamya bengalensis	166.404	128.849	100.717	53.687	39.370
Helix sp	80.757	60.447	19.181	83.954	60.447
Melania tuberculata	289.120	243.84	162.473	91.439	63.499
Lamellidens marginalis	210.219	62.037	94.333	39.478	32.428
Anisus convexiusculus	253.210	204.107	139.201	77.755	58.316

3.3. *Nutrient composition in molluscs shells*

The analysis of the minerals in the shell of different molluscan species proves that molluscs are a good quality source of minerals; contains 2.596 g (in average) of different kinds of minerals in per 100 g of their shells. There is a large quantity of calcium in molluscan shells and the mean value is 729.453 mg per 100 g sample. There is a very large quantity of phosphorus in molluscan shells. It is 1400.495 mg/100 g in average. A moderate quantity of Iron and sodium are present in molluscan shells. The mean sodium and iron content of molluscan fauna are 217.163 mg/100 g and 200.525 mg/100 g respectively. Molluscan shells are not a good source of potassium as in average 48.843 mg/100 g potassium is present there. Among the studied species *Bellamya bengalensis* contained the highest amount of minerals. *Helix sp*. contained the least quantity of minerals. But the deviation of these two species is not so great. Comparative contents of minerals in the shells of different molluscs species have been presented in Table 3.

Table 3. Comparative content of minerals in the shell of different molluscs species (mg/100 g).

Species	Calcium	Phosphorus	Iron	Sodium	Potassium
Pila globosa	721.44	1360.23	60.56	200.67	60.55
Bellamya bengalensis	705.40	1680.56	300.10	200.89	40.83
Helix sp	737.47	1240.61	108.84	250.41	40.27
Melania tuberculata	737.47	1440.98	280.38	230.08	50.72
Lamellidens marginalis	753.50	1160.47	216.94	200.73	60.16
Anisus convexiusculus	721.44	1520.12	236.33	220.20	40.53

4. Discussion

During the field study period six species were selected as commercially important and their nutrient values were analyzed. The nutritional values of snails got less emphasis in Bangladesh and are not well studied. This is perhaps the first work on molluscan nutrient content and showed significant result for their use in both agro-industry and human consumption.

The moisture content recorded (76.56% to 78.68%) by Fagbuaro *et al.* [17] supported the findings of the present study. In the present study the recorded amounts of moisture in the samples were ranging from 74.6% to 85.9%. The amount of proteins in the flesh of four snails species recorded by Fagbuaro *et al.* [17] ranged from 18.66% to 20.56%. In this study the amount of protein is 6.464 % to 12.927%. We have found 2.902% to 7.566% carbohydrates while Fagbuaro *et al.* [17] recorded only 0.007% to 0.42%. This is the most significant difference between these two studies and the most possible explanation for the difference in protein and carbohydrate content may be due to differences in species, region, diet and environment. Specially the study area, Chanda Beel, is unique for its dense and diversified aquatic vegetation which may have affected the protein value of the studied samples. A little ash was detected in the study of Fagbuaro *et al.* [17] whereas in the present study the ash content was found to be from 1.036% to 4.607%.

The mineral composition of the flesh of four species of giant land snails studied by Fagbuaro *et al.* [17] supports the findings of the present study, specifically for the proportion of calcium, phosphorus and sodium.

5. Conclusion

Molluscs are used widely for various purposes like human consumption, poultry feed, fish feed, lime fisheries etc. In the studied wetland (Chanda Beel) *Pila globosa* and *Bellamya bengalensis* are harvested commercially as fish feed to the shrimp farm of Bagerhat areas. Some other species are also collected and used as feed to ducks and local fish farms including catfish farms and fishponds. Highly nutritious flesh and shells of molluscs should be used more vastly throughout the country, as those are abundant here.

In Bangladash, tribal people like Bawm, Chakma, Garo, Hajong, Marma, Monipuri, Murang, Rajbangshi, Santal, Tanchanga, Tripura and others consume some molluscs species [18].

In the study area over harvesting of above mentioned two species are interrupting species assemblage and also disappearing at a faster rate from the Beel ecosystem. The present work reveals that other available molluscs could be used effectively for the same purpose. Popularization of molluscs as human food can also supplement the protein requirement of the poor inhabitants of that locality.

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References

1. R. T. Abbott, Bull. Mus. Comp. Zppl. Harvard **100**, 245 (1948).
2. S. K. Rau and A. Biswas, Basteria **53**, 105 (1989).
3. N. V. Subba Rao and A. Dey, Freshwater Molluscs in Aquaculture (Zool. Surv. India, Calcutta, 1989) pp. 225-232.
4. A. Garcia-Cabus, J. Med. Appl. Malac. **1** (Supplement), 63 (Abstract) (1989).
5. A. Valdes-Gonzalez, Med. Appl. Malac. **1** (Supplement), 56 (1989).
6. W. L. Wu, J. Med. Appl. Malac. **2** (Suppliment), 62 (1989).
7. F. Talavera and A. L. Faustino, J. Sci. **50 (1)**, 1 (1933).
8. I. F. Pagulayan and B. U. Cruz, J. Med. Appl. Malac.**1**, 65 (1989).
9. R. Kaewajam, Malac. Rev. **19**, 61 (1986).
10. M. B. Zaman and M. S. Jahan, Pak. J. Biol. Sci. **6** (6), 571 (2003). doi:10.3923/pjbs.2003.571.574
11. R. Mallick, Biochemical Ecology of *Stenothyra* sp. (Gastropoda:mollusca) in relation to *Penaeus monodon* (Crustacea: Arthropoda) Culture of Bangladesh, M.Sc. Microthesis (unpublished), University of Rajshahi. (1996) pp. 1-31.
12. T. R. Chakraborty, A. Adrika, and M. B. Hussain, Fish and wildlife of the Chanda Beel Area (IUCN Bangladesh Country Office, Dhaka, Bangladesh, 2005).
13. N. V. Subba Rao, Handbook of freshwater molluscs of India. Zoological survey of India (1998).
14. AOAC (Association of Official Analytical Chemists). Official Methods of Analysis, 15th Ed. (Washington DC, 1990).
15. D. Pearson, Chemical Analysis of Foods. 7th Ed. (J & A Churchill, London, 1976).
16. E. G. Bligh and W. J. Dyer, Can J. Biochem Physiol. **37**, 911 (1959).
17. O. Fagbuaro, J. A. Oso, J. B. Edward, and R. F. Ogunleye, J Zhejiang Univ. Sci B. **7** (9), 686 (2006). doi:10.1631/jzus.2006.B0686
18. B. K. Shaha, M. A. Hossain, and S. Jahan, J. Asiat. Soc. Bangladesh **29** (2), 1 (2003).