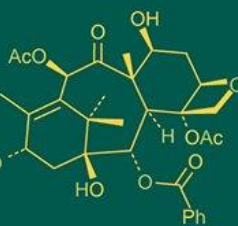
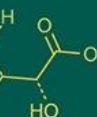
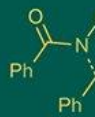


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Nutritional profile of the edible tissue of freshwater mollusc *Bellamya bengalensis* from Tripura, India

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Abstract

The nutritional potential of *Bellamya bengalensis* edible muscle tissue was estimated by proximate composition and amino acid profile. The muscle had high moisture ($73.88 \pm 7.19\%$), moderate protein ($13.91 \pm 1.73\%$), low fat ($0.98 \pm 0.06\%$), carbohydrate ($8.52 \pm 0.64\%$) and ash ($4.55 \pm 0.76\%$) contents. Seventeen amino acids, including seven essential amino acids and flavor and antioxidative amino acids, such as histidine, tyrosine, cysteine, and methionine were found. The excellent proximate profile and balanced amino acid composition suggest *B. bengalensis* as a nutritious, low-fat protein source with potential uses in functional meals.

Keywords: *Bellamya bengalensis*, freshwater mollusc, northeast, functional food, antioxidant

Introduction

Bellamya bengalensis is a freshwater mollusc or river snail widely known as “Ghongha”. It is an important but rarely investigated biological resource of the aquatic ecosystems of the Indian subcontinent (Mondal et al., 2023; Bhowmik et al., 2025) [13, 6]. Non-traditional food resources like freshwater gastropods are emerging as potential low-cost nutritional supplements due to the increasing concerns to global food security caused by population pressure and depletion of conventional protein sources (Vaishnav et al., 2025; Rout et al., 2023) [27, 23]. In India, particularly in the ethnically diverse Northeast area, these molluscs have ecological and cultural importance as they are fundamental to the traditional nutritional and medical practices of various ethnic groups (Rout et al., 2022; Baby et al., 2010) [22, 5]. *Bellamya bengalensis* is commonly gathered from rivers, streams and ponds in states like Tripura and Assam and is an important source of animal protein for rural and tribal people who have little access to costly commercial meats (Nath et al., 2023) [15]. Besides being a source of macronutrients, this species is also acknowledged for its rich mineral constitution and its medicinal use in traditional medicine, where it is widely taken for the treatment of various maladies from arthritis to vision impairment (Mondal et al., 2023) [13]. As a primary source of food in Tripura, the proximate composition and detailed micronutrient profiles of edible tissue of *Bellamya bengalensis* from this particular region are not well studied and location-specific. The nutritional quality and biochemical composition of these species are greatly influenced by the environmental parameters such as water quality and habitat features of the distinct riverine systems of Tripura (Chutia et al., 2021) [8]. An urgent necessity exists to scientifically substantiate the nutritional assertions of these indigenous groups, to promote their acceptance as a potential nutraceutical and as a means to combat malnutrition. The present study is an attempt to provide a general analysis of the nutritional profile of the edible tissue of *Bellamya bengalensis* from Tripura, India. Baseline data are necessary for the sustainable use and potential commercialization of this species as a high quality and bioavailable food resource.

Material and Methods

Collection of raw material

The experimental freshwater mollusc *B. bengalensis* employed in the present study were sourced from the Lake Chowmuhan market in Agartala city, Tripura, India. The snails were transported in live condition in polythene bag and transferred to a tub filled with clean water

for depuration for a period of 48 hours. The average morphometric dimensions recorded were 4.1 cm in shell length and 2.9 cm in width, with a corresponding mean body weight of 10.68 g.

b. Analysis of proximate composition

The proximate composition of edible tissue of *B. bengalensis* were analyzed to determine its moisture, crude protein, crude fat, carbohydrate and ash content using standard methods prescribed by the Association of Official Analytical Chemists (AOAC, 2016) [4].

c. Amino acid analysis

Samples were hydrolyzed in 6 N hydrochloric acid (HCl) in sealed hydrolysis tubes at 110°C for 24 h to ensure complete cleavage of the peptide bonds and liberation of the free amino acids. Samples were cooled, neutralized and appropriately diluted for chromatographic analysis. The released amino acids were derivatized with o-phthalaldehyde (OPA) to increase detectability prior to high performance liquid chromatography (HPLC). The analysis was carried out on a Waters HPLC system with a Symmetry® C18 column (4.6 × 150mm). The mobile phase was delivered at a constant flow rate of 1 mL/min. Detection was carried out using a photodiode array (PDA) detector. The method, adapted from Nguyen et al. (2022) [16] to determine the presence and profile of the amino acids in the samples based on their retention time and characteristic chromatographic behavior.

Results and Discussion

a. Proximate Composition of edible tissue of *B. bengalensis*

The moisture content was 73.88±7.19 %, which is higher than that reported for some freshwater molluscs such as *B. costula* (71.20%) (Rout et al., 2022) [22] and *B. dissimilis* (67.73%) (Debnath et al., 2016) [9], as well as certain marine molluscs including *Lunella torquata* (68.50%) (Ab Lah et al., 2017) [1] and *Rapana venosa* (70.75%) (Luo et al., 2017) [12]. However, it was lower than that of other freshwater and terrestrial species such as *P. canaliculata* (78.10%) (Pratama and Andriani, 2018) [20] and *Achatina fulica* (90.27%) (Adegoke et al., 2010) [2]. The crude protein content was 13.91±1.73 %, comparable to *B. costula* (13.83%) (Rout et al., 2022) but lower than that of *Achatina marginata* (19.53%) (Fagbua et al., 2006) [11] and *R. venosa* (19.15%) (Luo et al., 2017) [12], possibly due to habitat-driven dietary differences (Ab Lah et al., 2017; Luo et al., 2017) [1, 12]. Notably, the protein content exceeds that of several common protein sources such as catfish (10.76%), carp (11.88%), chicken (11.83%), and beef (12.94%) (Bar, 2022). The fat content of *B. bengalensis* was 0.98±0.06 %,

consistent with other freshwater snails but lower than many terrestrial and marine species (Ab Lah et al., 2017) [1], with reported variations ranging from 0.82% in *B. costula* to 1.15% in *P. globosa* (Debnath et al., 2016) [9]. The carbohydrate content was 8.52±0.64 %, higher than some terrestrial and marine molluscs but comparable within freshwater species (Rout et al., 2022; Debnath et al., 2016; Fagbua et al., 2006; Ab Lah et al., 2017) [23, 9, 11, 1], possibly reflecting metabolic demands associated with reproduction during the rainy season (Debnath et al., 2016) [9]. The ash content was 4.55±0.76 %, indicating moderate mineral composition; this value is lower than that of *Pila ampullacea* (5.54%) and *B. costula* (5.17%) (Obande et al., 2013; Rout et al., 2022) [17], but higher than *B. dissimilis* (3.82%) (Debnath et al., 2016) [9] and *Haliotis discus hanna* (3.6%) (Zou et al., 2023) [29]. These findings highlight that *B. bengalensis* edible muscle tissue is a nutritionally valuable, low-fat, moderate-protein food source with appreciable mineral content.

b. Amino acid profiling

A total of 17 amino acids were identified in the edible muscle of *Bellamya bengalensis*, as presented in Table 1. These comprised essential amino acids (EAAs), amino acids associated with desirable taste attributes, and those known for their antioxidant properties, indicating a nutritionally rich and functionally diverse profile. The edible tissue was particularly characterized by a strong presence of tyrosine and histidine, which were also reported in other freshwater molluscs such as *Lamellidens marginalis* (Ahirwal et al., 2022) [3]. The presence of these amino acids is noteworthy, as tyrosine plays a role in neurotransmitter synthesis, while histidine contributes to buffering capacity and exhibits antioxidant potential, thereby enhancing the functional importance of the edible tissue. In addition to these, the presence of essential amino acids such as lysine, methionine, valine, isoleucine, leucine, phenylalanine, and histidine reflects the high nutritional quality of *B. bengalensis* muscle protein. Amino acids including glycine, alanine, and proline are known to contribute to characteristic taste properties such as sweetness and umami, which may improve consumer acceptability (Puspitasari et al., 2022; Sonowal & Kardong, 2020) [21, 25]. Furthermore, the occurrence of antioxidative amino acids, particularly cysteine, histidine, and tyrosine, suggests potential health-promoting benefits associated with oxidative stress mitigation (Dey et al., 2021) [10]. Compared to marine molluscs, *B. bengalensis* exhibits a relatively balanced amino acid profile, highlighting its potential as a sustainable and nutritionally valuable protein source for human consumption and functional food applications (Moniruzzaman et al., 2021; Vaishnav et al., 2025) [14, 27].

Table 1: Classification of amino acids identified in *Bellamya bengalensis* edible muscle tissue

Category	Amino acids
Essential amino acids (EAAs)	Histidine, Lysine, Methionine, Valine, Isoleucine, Leucine, Phenylalanine
Non-essential amino acids (NEAAs)	Arginine, Glycine, Aspartic acid, Glutamic acid, Alanine, Proline, Serine, Tyrosine, Cysteine
Taste-related amino acids	Glycine, Alanine, Proline, Glutamic acid, Aspartic acid, Arginine
Antioxidative amino acids	Histidine, Tyrosine, Cysteine, Methionine

Conclusion

The edible muscle tissue of *Bellamya bengalensis* exhibits a nutritionally desirable profile with high moisture, moderate protein, low fat, and notable mineral content. Its balanced

composition of essential, taste-related, and antioxidative amino acids highlights its functional and health-promoting potential. These findings support its suitability as a

sustainable alternative protein source for human nutrition and functional food applications.

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Author contributions

Anand Vaishnav: Investigation, writing original draft preparation; **Naresh Kumar Mehta:** Conceptualization, methodology, writing review and editing and visualization, supervision and validation; **Mocherla Bhargavi Priyadarshini:** formal analysis, writing review.

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Ethics approval and consent to participate

This article does not contain any studies with human participants performed by any of the authors.

Data availability statement

The original contributions presented in the study are included in the article. Further inquiries can be directed to the corresponding authors.

Declaration of interest

The authors declare that there are no conflicts of interest related to this research.

References

1. Ab Lah R, Smith J, Savins D, Dowell A, Bucher DJ, Benkendorff K. Investigation of nutritional properties of three species of marine turban snails for human consumption. *Food Sci Nutr*. 2017;5(1):14-30.
2. Adegoke AA, Adebayo-Tayo CB, Inyang UC, Aiyegoro OA, Komolafe OA. Snails as Meat Source: Epidemiological and Nutritional Perspectives. *J Microbiol Antimicrob*. 2010;12(7):1-5.
3. Ahirwal SK, Sarma K, Kumar A, Narayan D. Biological parameters, culture potential and nutritional quality of freshwater mussel *Lamellidens marginalis* (Lamarck, 1819). *Indian J Fish*. 2022;69(3):51-58.
4. AOAC. Official Methods of Analysis of AOAC International. 20th ed. AOAC International; 2016.
5. Baby RL, Hasan I, Kabir KA, Naser MN. Nutrient analysis of some commercially important molluscs of Bangladesh. *J Sci Res*. 2010;2(2):390-396.
6. Bhowmik B, Dey B, Das S, Barman GD, Chanda S, Mondal R. Morphological, ultrastructure and molecular characterization of *Unionicola chelata* (Acari: Hydrachnida: Unionicolidae) isolated from *Bellamya bengalensis*, West Bengal, India. *J Parasit Dis*. 2025;49(1):37-44.
7. Chatterjee R, Dey TK, Roychoudhury A, Choudhury P. Enzymatically excised oligopeptides from *Bellamya bengalensis* shows potent antioxidative and anti-hypertensive activity. *J Food Sci Technol*. 2020;57(7):2586-2601.
8. Chutia J, Sonowal J, Pegu BK, Kardong D. Evaluation of proximate and heavy metals in twelve edible freshwater macroinvertebrates of Poba Reserve Forest, Assam, India. *Biosci Biotech Res Asia*. 2021;17(4):819-829.
9. Debnath C, Sahoo L, Haldar A, Datta M, Yadav GS, Singha A, Bhattacharjee J. Proximate and Mineral Composition of Freshwater Snails of Tripura, North-East India. *Fishery Technology*. 2016;53:307-312.
10. Dey TK, Chatterjee R, Mandal RS, Roychoudhury A, Paul D, Roy S, Pateiro M, Das AK, Lorenzo JM, Dhar P. ACE Inhibitory Peptides from *Bellamya bengalensis* Protein Hydrolysates: *In Vitro* and *In Silico* Molecular Assessment. *Processes*. 2021;9(8):1316.
11. Fagbua O, Oso JA, Edward JB, Ogunleye RF. Nutritional status of four species of giant land snails in Nigeria. *J Zhejiang Univ Sci B*. 2006;7(9):686-689.
12. Luo F, Xing R, Wang X, Peng Q, Li P. Proximate composition, amino acid and fatty acid profiles of marine snail *Rapana venosa* meat, visceral mass and operculum. *J Sci Food Agric*. 2017;97(15):5361-5368.
13. Mondal BM. Bio-Chemistry and Nutritional Health Benefits of *Bellamya bengalensis* (Edible Gastropod): A Review. *Afr J Biol Sci*. 2023;5(4):112-118.
14. Moniruzzaman M, Sku S, Chowdhury P, Hossen MN, et al. Nutritional evaluation of some economically important marine and freshwater mollusc species of Bangladesh. *Heliyon*. 2021;7(5):e07088.
15. Nath K, Munilkumar S, Patel AB, Pandey PK, Sawant PB. Filtration capabilities of freshwater mussel and apple snail and their potential impacts on freshwater integrated multitrophic aquaculture systems. *J Environ Biol*. 2023;44:367-372.
16. Nguyen HT, Bao HND, Dang HTT, Tómasson T, Arason S, Gudjónsdóttir M. Protein characteristics and bioactivity of fish protein hydrolysates from Tra catfish (*Pangasius hypophthalmus*) side stream isolates. *Foods*. 2022;11(24):4102.
17. Obande RA, Omeji S, Isiguzo I. Proximate composition and mineral content of the freshwater snail (*Pila ampullacea*) from River Benue, Nigeria. *J Environ Sci Toxicol Food Technol*. 2013;2(6):43-46.
18. Ozawa H, Miyazawa T, Burdeos GC, Alfon SS, Yamaguchi T, Matsuoka K. Biological functions of antioxidant dipeptides. *J Nutr Sci Vitaminol (Tokyo)*. 2022;68(3):162-171.
19. Pessione E, Cirrincione S. Bioactive molecules released in food by lactic acid bacteria: encrypted peptides and biogenic amines. *Front Microbiol*. 2016;7:876.
20. Pratama RI, Rostini I, Rochima E. Amino acid profile and volatile flavour compounds of raw and steamed Patin catfish (*Pangasius hypophthalmus*) and narrow-barred Spanish mackerel (*Scomberomorus commerson*). *IOP Conf Ser Earth Environ Sci*. 2018;116(1):012056.
21. Puspitasari E, Rosida D, Priyanto AD. Physicochemical Properties of Apple Snail Protein Hydrolysate (*Pila ampullacea*) and Its Potential as Flavor Enhancer. *Int J Food Agric Nat Resour*. 2022;3(1).
22. Rout B, Mehta NK, Tripathi HH, Sharma S, Majumdar RK, Priyadarshini MB. Preliminary investigations on antimicrobial, antioxidant and nutritional properties of freshwater snail *Brotia costula* (Rafinesque, 1833). *Indian J Fish*. 2022;69(2):100-110.

23. Rout S, Rath SK, Kumar S. Food and medicinal aspects of freshwater snail *Filopaludina bengalensis* (Lamarck, 1822). *Asian J Biol.* 2023;18(2):11-14.
24. Song J, Luo C, Lim LS, Cheong KL, Farhadi A, Tan K. Protein quality of commercially important edible bivalves. *Crit Rev Food Sci Nutr.* 2025;65(10):1950-1961.
25. Sonowal J, Kardong D. Nutritional evaluation of freshwater bivalve, *Lamellidens* spp. from the upper Brahmaputra basin, Assam, with special reference to dietary essential amino acids, omega fatty acids and minerals. *J Environ Biol.* 2020;41(4):931-941.
26. Tanase R, Senda R, Matsunaga Y, Narukawa M. Taste characteristics of various amino acid derivatives. *J Nutr Sci Vitaminol (Tokyo).* 2022;68(5):475-480.
27. Vaishnav A, Mehta NK, Hussain SA, Acharya PC, Biswal S, Nath H, Priyadarshini MB, Thangarani AJ, Pal P, Singh SK, Singh NS. Bromelain excised hydrolysates with potent bioactivity from *Bellamya bengalensis* soft tissues: Process optimization and characterization. *J Agric Food Res.* 2025;19:101595.
28. Xu N, Chen G, Liu H. Antioxidative categorization of twenty amino acids based on experimental evaluation. *Molecules.* 2017;22(12):2066.
29. Zou W, Hong J, Yu W, Ma Y, Gan J, Liu Y, Luo X, You W, Ke C. Comprehensive comparison of effects of antioxidant (astaxanthin) supplementation from different sources in *Halotis discus hannai* diet. *Antioxidants.* 2023;12(8):1641.