

Biochemical Characterization of Indigenous Molluscs Consumed by the Santal Tribe

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Abstract

The Santal tribe consumes indigenous molluscs as a protein source found in local wetlands and rivers. However, there is little information available on the nutritional value of these indigenous molluscs among this tribal community. This study investigated the nutrient composition of three indigenous mollusc species consumed by the Santal tribe in the Dumka district of Jharkhand, India. The molluscan species examined were *Pila globosa*, *Bellamya bengalensis*, and *Lamellidens marginalis*. The research aimed to analyze their proximate and mineral content to assess their nutritional value based on dry weight. The analysis of the dried flesh revealed that protein levels ranged from 55.33% in *Pila globosa* to 49.24% in *Lamellidens marginalis*, while carbohydrate content varied from 25.98% in *Pila globosa* to 23.99% in *Bellamya bengalensis*. All species demonstrated relatively low fat content. Additionally, the study quantified the presence of minerals such as sodium, potassium, iron, zinc, calcium, and phosphorus in the dried molluscs flesh. The findings indicate that these native molluscs are rich in protein, providing an affordable protein source for the Santal tribal community, thereby enhancing their food security.

Keywords: Molluscs, Nutrition, Proximate analysis, Santal tribe.

I. INTRODUCTION

The Santal tribe, alternatively spelled as Santhal, represents one of the largest indigenous tribal communities in India. This community primarily inhabits the states of Jharkhand, West Bengal, Odisha, Bihar, and Assam, with further populations located in Bangladesh and Nepal. Their history is extensive and intricately intertwined with their unique cultural, social, and economic practices. Traditionally, they have sustained an agrarian lifestyle, engaging in shifting cultivation and residing in forested and hilly regions.

The Santals collect wild fruits, tubers, roots, and leafy greens from the forest to supplement their diet and provide essential nutrients. Their protein intake primarily comes from pulses, lentils, and seasonal vegetables. Additionally, their meat consumption includes domesticated animals such as goats and feral chickens, as well as wild animals, contingent upon availability.

In freshwater ecosystems, molluscs are essential for maintaining trophic dynamics. Globally, their diversity is estimated to encompass approximately 5,000 species. Within India, freshwater habitats are documented to host 217 species, comprising 150 species of gastropods and 67 species of bivalves (Dimri et al., 2025). In several countries, including India, Mexico, Taiwan, Formosa, the Philippines, and Thailand, freshwater molluscs are commonly consumed as a protein-rich food source (Baby et al., 2010).

Researchers in Keonjhar (Orissa), Ghatshila (Jharkhand), and Bolpur (Bihar) examined the prevalence of undernutrition, specifically focusing on underweight and stunting, among adult Santal males and children, finding it to be significantly high (Bose et al., 2006; Ghosh et al., 2008).

The significance of indigenous molluscs in addressing nutrient deficiencies within the Santal tribe is substantial. This study aims to explore the potential utilization of freshwater edible molluscs as an alternative source of protein for the Santal tribe. The findings of this study may facilitate the selection of specific indigenous molluscs as an alternative, cost-effective protein source for the Santal tribe. Understanding the nutritional status allows

for the selection of suitable species to cultivate in the local wetland ecosystem. This approach may contribute to the conservation of the wetland ecosystem, which is of urgent necessity in contemporary times.

II. MATERIALS AND METHODS

Collection and Preservation

Rivers from various regions of the Dumka district, such as the Brahmani River in Kathikund and the Mayurakshi River in Jama, were selected for the collection of samples of indigenous mollusc species. Additionally, wetland areas near the Masanjore Dam in the Dumka district, Jharkhand, were chosen for sample collection. The Santal tribal community in the area depends significantly on these natural resources for their sustenance, with a particular emphasis on fish, fisheries, and molluscs.

Sampling was conducted during the summer season, a period characterized by lower water levels in these natural resources, utilizing a random free-hand collection method. After collection from the study site, the samples were rinsed with clean water and then stored in a freezer. Forceps and scalpels were carefully employed to extract the shells, allowing for the separation of the edible parts. The flesh was subsequently oven-dried, crushed, and pulverized into a powder. This powdered form was utilized for analysis. The vials containing the powdered samples were stored in a desiccator.

Procedure of nutrient analysis

The moisture and mineral content of the flesh were assessed using the IS-12711:2012 method. The protein content was evaluated according to the IS-7219:2012 method. The fat content was also determined using the IS-12711:2012 method. Carbohydrate content was measured by the IS-1656:2007 method. The energy content was calculated using the FAO(UN):2009 method. Sodium and potassium levels were determined by the IS 9497(1980) method. Calcium and iron content were assessed using the FSSAI LAB MANUAL 2016 method. Zinc and phosphorus content were determined using the FSSAI LAB MANUAL 9 (2015) and IS 7874-2(1975) methods, respectively.

III. RESULTS

Nutrient content in dried flesh of mollusc species

The flesh of *Pila globosa* contains 5.38% moisture, while *Bellamya bengalensis* exhibits a moisture content of 5.79%. Among the molluscs studied, *Lamellidens marginalis* recorded the highest moisture content at 6.95%. This analysis identified *Bellamya bengalensis* as having the highest mineral content. In terms of protein content, *Pila globosa* demonstrated the highest level at 55.33%, followed by *Bellamya bengalensis* at 54.48%. *Lamellidens marginalis* was identified as the species with the highest fat content. Conversely, *Bellamya bengalensis* exhibited the lowest carbohydrate content, at only 23.99%.

The examination of nutrient content in the flesh of diverse molluscan species reveals that molluscs serve as excellent sources of protein. Additionally, they can be considered a source of carbohydrates. Notably, *Pila globosa* contains a significant carbohydrate content of approximately 25.98%. The current study indicates that these molluscs contribute minimally to fat content. In this study, *Lamellidens marginalis* exhibited the highest fat content at 7.98%, with *Bellamya bengalensis* following at 2.35%. The results of the analysis are presented in Table 1.

Table 1. Proximate composition found in the dried flesh of various mollusc species.

Species	Moisture (%)	Mineral Content (%)	Protein (%)	Fat (%)	Carbohydrate (%)	Energy (Kcal/100 g)
<i>Pila globosa</i>	5.38	11.11	55.33	2.20	25.98	345.04
<i>Bellamya bengalensis</i>	5.79	13.39	54.48	2.35	23.99	335.03
<i>Lamellidens marginalis</i>	6.95	10.34	49.24	7.98	25.49	370.74

Minerals content in the dried flesh of mollusc species

Molluscan flesh contains substantial amounts of sodium and potassium. *Bellamya bengalensis* contains the highest amount sodium (131.36 mg/100g) and *Pila globosa* contains the highest amount of potassium (254.35 mg/100g). The average sodium content in molluscan fauna is 102.84 mg per 100 g sample, while the potassium content is 174.39 mg per 100 g sample.

The flesh of *Lamellidens marginalis* exhibited the highest iron content, measuring 45.45 mg per 100 g, followed by the species *Bellamya bengalensis*. The average iron content in molluscan flesh is 29.48 mg per 100 g of dried sample. Additionally, calcium and phosphorus are present in moderate quantities, with mean concentrations of 4.27% for calcium and 2.20% for phosphorus. Among the species examined, *Bellamya bengalensis* contains the highest concentration of minerals. The results of the analysis are presented in Table 2.

Table 2. Minerals content comparison in the dried flesh of various mollusc species.

Species	Sodium (mg/100 g)	Potassium (mg/100 g)	Iron (mg/100 g)	Zinc (mg/100 g)	Calcium (%)	Phosphorus (%)
<i>Pila globosa</i>	100.07	254.35	18.00	5.30	4.13	2.13
<i>Bellamya bengalensis</i>	131.36	171.72	25.00	4.90	4.54	2.34
<i>Lamellidens marginalis</i>	77.09	97.10	45.45	4.21	4.16	2.15

IV. DISCUSSION

In the course of the field study, three species were identified as indigenous, and their nutrient values underwent analysis. The nutritional significance of indigenous molluscs in the food security of the Santal tribe has been underemphasized and remains insufficiently studied. This study is likely the first to examine the nutrient content of native molluscs for the Santal tribe, revealing significant findings regarding their potential as an affordable protein source to enhance food security.

(Baby et al., 2010) reported a protein content of 6.46% to 8.96% in the same mollusc species. In contrast, this study identified a protein content ranging from 49.24% to 55.33%. Additionally, our findings indicate a carbohydrate content of 23.99% to 25.98%, whereas (Baby et al., 2010) documented a range of only 2.902% to 4.943%. The principal difference between these two studies is the protein and carbohydrate content, which is likely attributable to regional, dietary, and environmental variations.

(Baby et al., 2010) reported higher amounts of sodium and lower amounts of potassium in the same species. However, in the present study, we found that potassium was highly present in the mollusc species, followed by sodium, iron, and zinc.

(Moniruzzaman et al., 2021) conducted a study on the protein content in the flesh of *Pila globosa* and *Lamellidens marginalis*. Their findings corroborate the current study's conclusion that molluscs possess a substantial proportion of protein.

V. CONCLUSION

The findings of this study demonstrate that the indigenous freshwater molluscs consumed by the Santal tribe are abundant in minerals and contain approximately 53% protein. These molluscs represent a cost-effective protein source that could address undernutrition within the Santal community. Therefore, initiatives aimed at raising awareness and implementing protective measures should focus on preserving the wetlands that support these species to thrive.

Raising public awareness is essential to promote the cultivation of these indigenous mollusc species alongside fish in their native wetland habitats. This practice can secure both the nutritional and livelihood needs of the Santal tribe.

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