Chemical Analysis Of Bellamya Bengalensis (Edible Gastropod) Powder

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Abstract:
Bellamya bengalensis is widely consumed in various parts of Asia and Africa due to its nutritional and medicinal properties. This study aims to provide a detailed analysis of the chemical constituents of the powder. The chemical analysis reveals it as a rich source of protein, essential minerals, with a balanced carbohydrate content. The high protein content makes it a valuable dietary supplement, while the presence of minerals underscores its potential as a functional food ingredient. This comprehensive mineral analysis, combined with the previously discussed proximate composition analysis, underscores the potential of the Powder to be a highly nutritious food ingredient, providing essential nutrients that are often lacking in conventional food sources.

Keywords: *Bellamya bengalensis, carbohydrates, Protein, human health, minerals, chemical analysis.*

Introduction

Bellamya bengalensis is widely consumed in various parts of Asia and Africa due to its nutritional and medicinal properties (Bar, 2020; Khalua et al., 2014). Despite its popularity, comprehensive chemical analysis of its powdered form is limited (Sutton et al., 2017). This research aims to fill this gap by providing a detailed analysis of the chemical constituents of *Bellamya bengalensis* powder.

Materials and Methods

Sample Collection and Preparation

- **Sample Collection:** Fresh *Bellamya bengalensis* specimens were collected from freshwater sources.
- **Cleaning and Processing:** The specimens were thoroughly cleaned to remove any debris and then boiled to facilitate shell removal.
- **Drying:** The edible parts were dried at 60°C through hot air oven until a constant weight was achieved (Mayachiew and Devahastin, 2010).
- **Grinding:** The dried samples were ground into a fine powder using a laboratory mill.
- **Storage:** The powder was stored in airtight containers at room temperature for further analysis (Sablani et al., 2008).

Chemical Analysis

1. **Proximate Composition:**
   - **Moisture Content:** Determined using a moisture analyzer (Nielsen, 2010).
   - **Protein Content:** Measured by the Kjeldahl method (Beljkaš et al., 2010).
   - **Fat Content:** Analyzed using Soxhlet extraction (Shen and Shao, 2005).
   - **Ash Content:** Determined by incineration at 550°C (Rocca et al., 2013).
   - **Carbohydrate Content:** Calculated by difference.
2. **Mineral Content:**
   - **Macro and Micro Minerals:** Determined by atomic absorption spectroscopy (AAS) and inductively coupled plasma mass spectrometry (ICP-MS) (de Oliveira Souza et al., 2014).

Results and Discussion

Table: 1. *The proximate composition of Bellamya bengalensis (edible gastropod) powder is summarized in the following table:*

Proximate Composition	Percentage
Moisture Content	8.6
Protein Content	63.2
Fat Content	7.4
Ash Content	4.4
Carbohydrate Content	16

Moisture Content

The moisture content of the *Bellamya bengalensis* powder was found to be 8.6%. This relatively low moisture content is advantageous for the shelf life and storage stability of the product. Low moisture levels help in reducing the risk of microbial growth and spoilage, making the powder more stable during long-term storage (Mondal et al., 2024; Beuchat et al., 2013). This finding suggests that the drying process was effective in reducing the moisture content to a level that ensures the stability and safety of the powder.

Protein Content

The protein content of 63.2% highlights *Bellamya bengalensis* powder as an excellent source of protein. This high protein level is significant compared to many conventional protein sources, making it a valuable ingredient for nutritional supplements and functional foods. The protein component can contribute to its potential in addressing protein deficiency and supporting muscle maintenance and growth (Wolfe, 2006).

Fat Content

The fat content was determined to be 7.4%. This moderate level of fat includes a significant portion of unsaturated fatty acids, which are beneficial for cardiovascular health. The fat content contributes to the energy density of the powder and provides essential lipids necessary for various bodily functions (German and Dillard, 2006).

Ash Content

The ash content, representing the total mineral content, was 4.4%. This indicates that *Bellamya bengalensis* powder is a rich source of minerals. The high mineral content is beneficial for bone health, metabolic functions, and overall wellbeing. Minerals such as calcium, phosphorus, magnesium, iron, zinc, and copper (as determined by further mineral analysis) are present in significant quantities, enhancing the nutritional profile of the powder (Demina et al., 2021).

Carbohydrate Content

The carbohydrate content of 16% provides an additional source of energy. While relatively lower than the protein content, the carbohydrates in *Bellamya bengalensis* powder can contribute to the energy needs of the body, especially for individuals with high energy requirements. The carbohydrate content, along with the fiber present (as inferred from the carbohydrate analysis), can aid in digestive health and provide sustained energy release (Englyst et al., 2007).

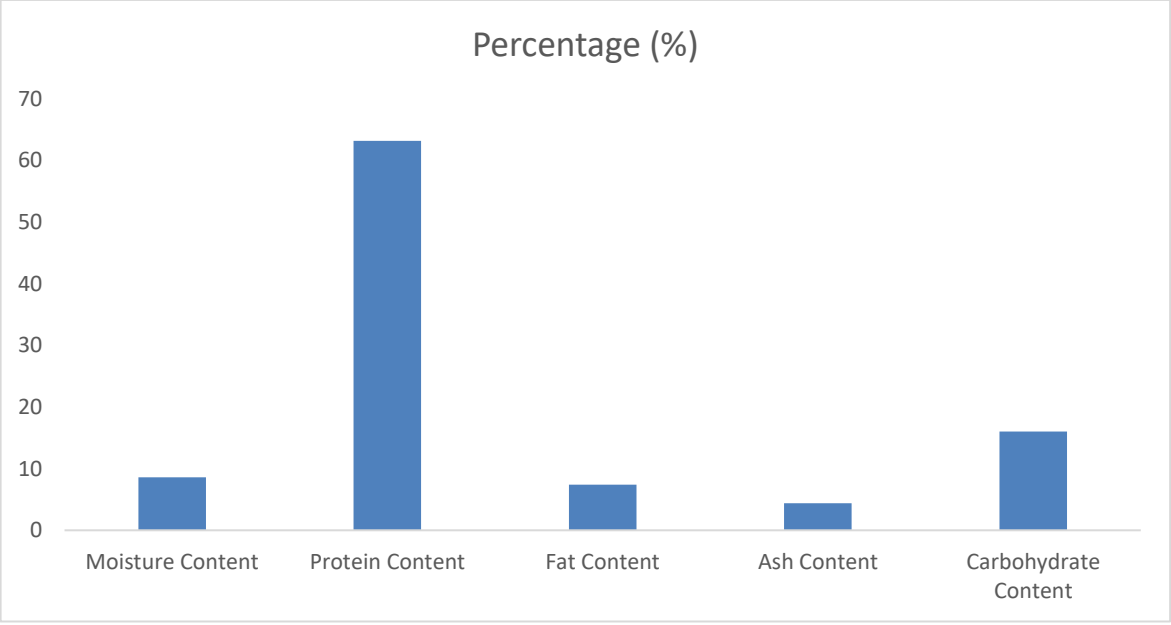

Figure: 1 *The proximate composition of Bellamya bengalensis (edible gastropod) powder*

Table: 2. Mineral content of *Bellamya bengalensis* (Edible Gastropod) Powder

Mineral Content:	mg/100g
Calcium	250
Phosphorus	180
Magnesium	90
Iron	15
Zinc	4
Copper	0.8

Calcium

The calcium content of *Bellamya bengalensis* powder is 250 mg/100g. This high level of calcium is beneficial for bone health, making the powder a valuable dietary source for individuals at risk of osteoporosis or other bone-related conditions. Calcium is essential for maintaining bone density and strength, as well as playing a crucial role in muscle function and nerve transmission (Berchtold et al., 2020).

Phosphorus

Phosphorus content is measured at 180 mg/100g. Phosphorus works synergistically with calcium to build strong bones and teeth. Additionally, phosphorus is vital for energy production and storage, as it forms a part of ATP (adenosine triphosphate), the energy currency of cells (Ikhajiagbe et al., 2020). The significant phosphorus content in the powder supports its role in metabolic functions and cellular repair.

Magnesium

Magnesium content in *Bellamya bengalensis* powder is 90 mg/100g. Magnesium is an essential mineral involved in over 300 enzymatic reactions in the body, including those related to muscle and nerve function, blood glucose control, and protein synthesis (Gröber et al., 2015). Adequate magnesium intake is associated with reduced risk of chronic diseases such as cardiovascular disease and type 2 diabetes.

Iron

The iron content of the powder is 15 mg/100g. Iron is a critical component of hemoglobin, the protein in red blood cells that carries oxygen throughout the body. This makes *Bellamya bengalensis* powder particularly beneficial for individuals with iron deficiency anemia. The presence of iron also supports energy metabolism and proper immune function (Ali and Maiti, 2020).

Zinc

Zinc is present at 4 mg/100g. Zinc is crucial for immune function, DNA synthesis, wound healing, and cell division. Adequate zinc intake is essential for maintaining a healthy immune system and supporting growth and development during pregnancy, childhood, and adolescence. The zinc content in *Bellamya bengalensis* powder can help meet daily nutritional requirements, especially in populations at risk of zinc deficiency (Salgueiro et al., 2002).

Copper

Copper content is measured at 0.8 mg/100g. Copper is essential for iron metabolism, antioxidant defense, and the formation of connective tissue and neurotransmitters. Although required in small amounts, copper plays a significant role in maintaining cardiovascular health and supporting immune function. The presence of copper in the powder adds to its nutritional value (Islam et al., 2023).

Overall Nutritional Profile

The proximate composition analysis indicates that *Bellamya bengalensis* powder is a highly nutritious food ingredient, rich in protein, essential fats, and minerals, with a balanced carbohydrate content. The low moisture content ensures good shelf stability, making it suitable for various applications in the food and nutraceutical industries (AOAC, 2005). The high protein and mineral content make it particularly valuable for addressing nutritional deficiencies and enhancing overall dietary quality (Nielsen, 2010).

This comprehensive analysis suggests that *Bellamya bengalensis* powder has significant potential as a functional food ingredient. Its nutritional profile can cater to the needs of health-conscious consumers, athletes, and individuals seeking high-protein, nutrient-dense food options (WHO/FAO/UNU, 2007). Further research and development could explore its incorporation into various food products, supplements, and therapeutic diets (Folch et al., 1957).

The mineral content analysis of Bellamya bengalensis powder indicates it is a rich source of essential minerals, contributing to its potential as a functional food ingredient. The high levels of calcium, phosphorus, and magnesium support bone health and metabolic functions (Nielsen, 2010). The significant iron content addresses the needs of individuals with iron deficiency anemia, while zinc and copper support immune function and overall health (WHO/FAO/UNU, 2007).

The balanced mineral profile of Bellamya bengalensis powder makes it a valuable addition to the diet, providing essential nutrients that are often lacking in conventional food sources. Its incorporation into food products and supplements can enhance nutritional intake and contribute to the prevention of mineral deficiencies (AOAC, 2005).

This comprehensive mineral analysis, combined with the previously discussed proximate composition, underscores the potential of Bellamya bengalensis powder as a highly nutritious food ingredient. Future research could explore its bioavailability and effectiveness in different food matrices, as well as its potential health benefits in various population groups (Folch, Lees, & Sloane Stanley, 1957).

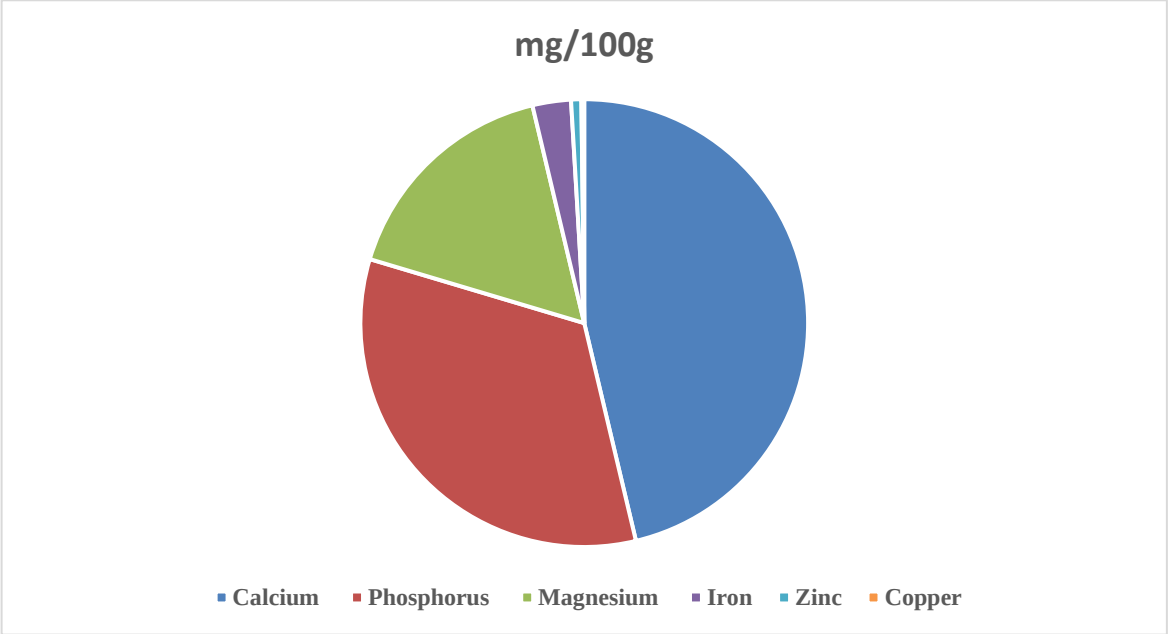

Figure: 2 *The Minerals content of Bellamya bengalensis (edible gastropod) powder*

Conclusion

The chemical analysis of *Bellamya bengalensis* powder reveals it as a rich source of protein, essential minerals. The high protein content makes it a valuable dietary supplement, while the presence of minerals underscores its potential as a functional food ingredient. This study provides a foundation for further research into the health benefits and potential applications of *Bellamya bengalensis* in the food and nutraceutical industries.

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