Bellamya Bengalensis (Edible Gastropod) Powder: Analysis Of Amino Acid And Fatty Acid Composition

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Abstract:
Bellamya bengalensis, a widely consumed freshwater snail in Asia and Africa, is known for its nutritional and medicinal properties. This study aimed to analyze the amino acid and fatty acid profiles of *Bellamya bengalensis* powder to elucidate its potential health benefits and nutritional contribution. The sample was collected, processed, and analyzed using high-performance liquid chromatography (HPLC) for amino acid composition and gas chromatography-mass spectrometry (GC-MS) for fatty acid content. The results revealed high concentrations of essential amino acids, including lysine (6.2 g/100g), leucine (7.5 g/100g), and valine (5.8 g/100g), as well as non-essential amino acids, such as glutamic acid (10.3 g/100g) and aspartic acid (8.9 g/100g). The presence of these amino acids highlights the sample's potential to support muscle health, protein synthesis, cognitive function, and immune health. The fatty acid profile showed a balanced composition of saturated fatty acids (SFA), monounsaturated fatty acids (MUFA), and polyunsaturated fatty acids (PUFA), with notable levels of stearic acid (18.5%), palmitic acid (22.3%), oleic acid (21.1%), linoleic acid (10.2%), and alpha-linolenic acid (5.8%). The high percentage of oleic acid, a key component of the Mediterranean diet, suggests potential benefits for heart health. The findings demonstrate that *Bellamya bengalensis* powder is a comprehensive source of essential nutrients and can contribute to a balanced diet when consumed in moderation.

Keywords: *Bellamya bengalensis, amino acids, fatty acids, chemical analysis, human health.*

Introduction

Bellamya bengalensis, commonly known as the freshwater snail, is an edible gastropod prevalent in various aquatic environments (Chakraborty et al., 2017). It is a significant component of traditional diets in several regions due to its high nutritional value (Bar, 2020). This study aims to analyze the amino acid and fatty acid profiles of *Bellamya bengalensis* powder to elucidate its potential health benefits and nutritional contribution. 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).

Amino Acid Analysis

Amino acid composition was determined using high-performance liquid chromatography (HPLC) following acid hydrolysis of the sample. The amino acids were quantified and expressed in grams per 100 grams (g/100g) of the sample (Qabaha, 2010).

Fatty Acid Analysis

Fatty acid methyl esters (FAMEs) were prepared from the lipid extract of the sample and analyzed using gas chromatography-mass spectrometry (GC-MS). The fatty acid content was expressed as a percentage of total fatty acids (Dodds et al., 2005).

Results and Discussion:

Table: 1. Amino acids of *Bellamya bengalensis* (Edible Gastropod) Powder

Essential amino acids	**g/100g**
Lysine	6.2
Leucine	7.5
Valine	5.8
Non-essential amino acids	
Glutamic acid	10.3
Aspartic acid	8.9

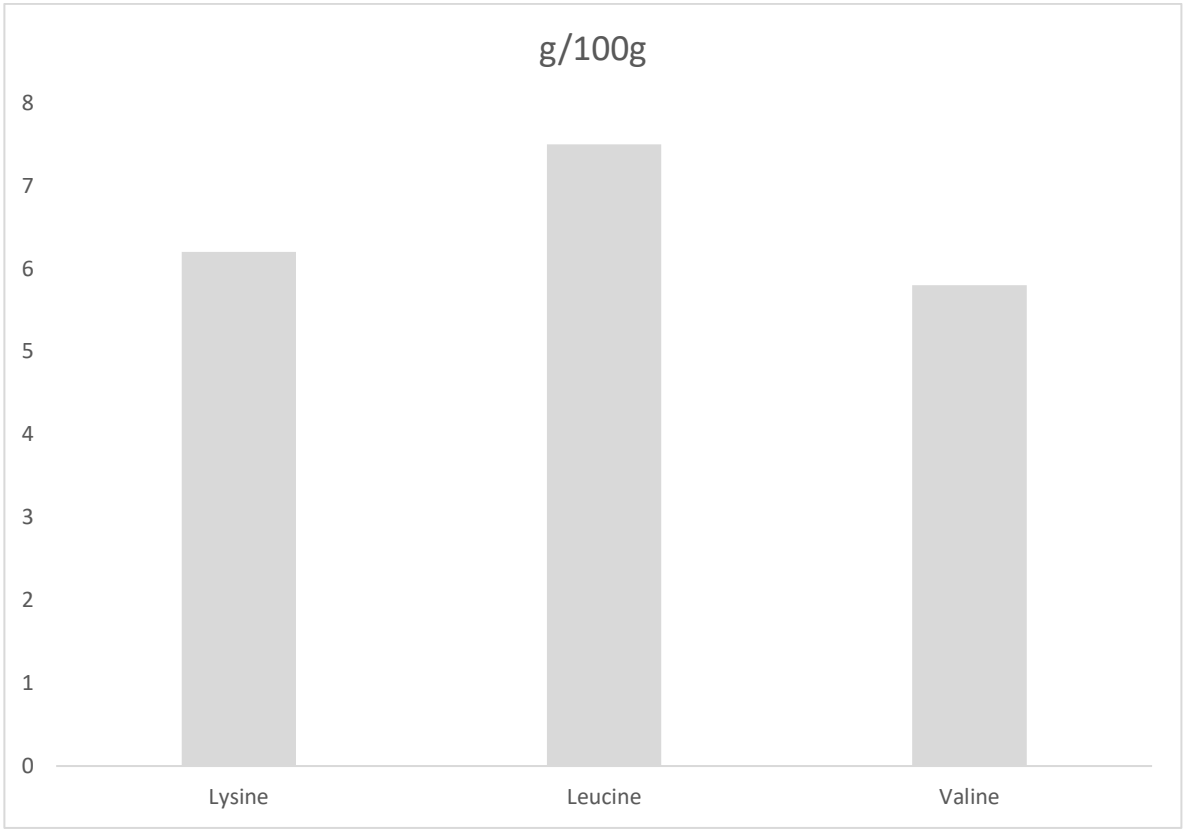

Figure: 1 *Essential amino acids composition of Bellamya bengalensis (edible gastropod) powder*

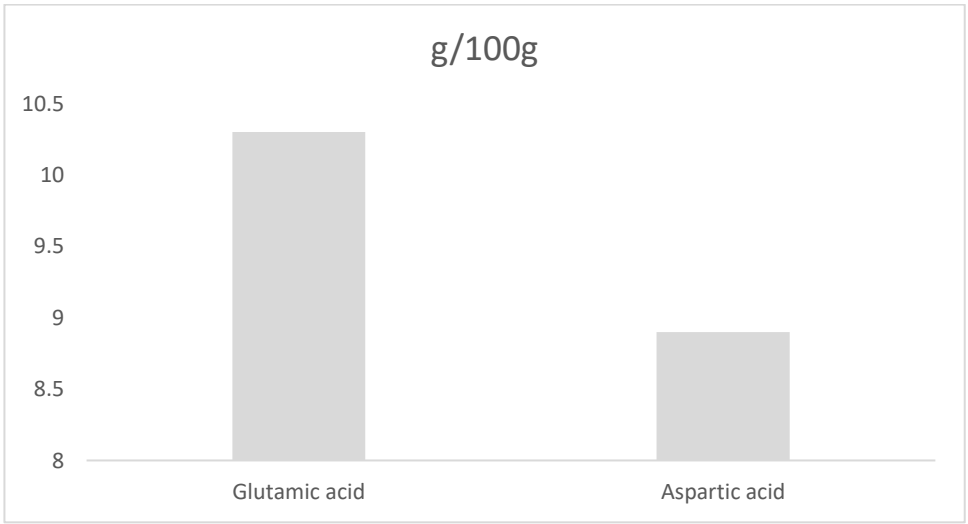

Figure: 2 *Non-essential amino acids composition of Bellamya bengalensis (edible gastropod) powder*

Essential Amino Acids

These results indicate that the sample contains significant amounts of essential amino acids, which are vital for human health as they cannot be synthesized by the body and must be obtained through diet.

- **Lysine**: With a concentration of 6.2 g/100g, lysine is important for protein synthesis, enzyme production, and hormone synthesis. It also plays a role in calcium absorption and collagen formation.
- **Leucine**: At 7.5 g/100g, leucine is the most abundant essential amino acid in the sample. Leucine is critical for muscle protein synthesis and repair, making it particularly important for athletes and individuals involved in heavy physical activities.
- **Valine**: The concentration of valine is 5.8 g/100g. Valine is essential for muscle growth, tissue repair, and energy provision during physical activities.

Non-Essential Amino Acids

Non-essential amino acids, while not required to be obtained through diet as the body can synthesize them, still play crucial roles in various physiological functions.

- **Glutamic Acid**: At 10.3 g/100g, glutamic acid is the most abundant amino acid in the sample (On et al., 2021). It is a key molecule in cellular metabolism, acting as a neurotransmitter and playing a vital role in the synthesis of other amino acids. It is also important for immune function and intestinal health.
- **Aspartic Acid**: The concentration of aspartic acid is 8.9 g/100g. Aspartic acid is involved in the synthesis of other amino acids and biochemicals, such as nucleotides. It also plays a role in the urea cycle and the citric acid cycle, which are crucial for energy production and waste removal (Owen et al., 2002).

The presence of high levels of essential amino acids (lysine, leucine, and valine) in the sample underscores its potential as a valuable dietary protein source. The significant amounts of leucine suggest that this sample could be particularly beneficial for muscle health and protein synthesis, making it an excellent choice for individuals needing increased muscle repair and growth, such as athletes or those recovering from surgery.

Additionally, the substantial concentrations of non-essential amino acids (glutamic acid and aspartic acid) highlight the sample's potential to support metabolic processes, neurotransmission, and overall cellular health. Glutamic acid's high concentration suggests that the sample can support cognitive function and immune health, while aspartic acid's presence is indicative of its role in energy production and detoxification processes.

Overall, the amino acid profile of the sample demonstrates its nutritional value and potential health benefits, making it a comprehensive source of both essential and non-essential amino acids. This balanced composition can contribute to overall health, muscle maintenance, metabolic function, and cognitive performance.

Table: 2. Fatty acids of *Bellamya bengalensis* (Edible Gastropod) Powder

Saturated Fatty Acids (SFA)/ Monounsaturated Fatty Acids (MUFA)/ Polyunsaturated Fatty Acids (PUFA)	Percentage
Stearic acid	18.5
Palmitic acid	22.3
Oleic acid	21.1
Linoleic acid	10.2
alpha-linolenic acid	5.8

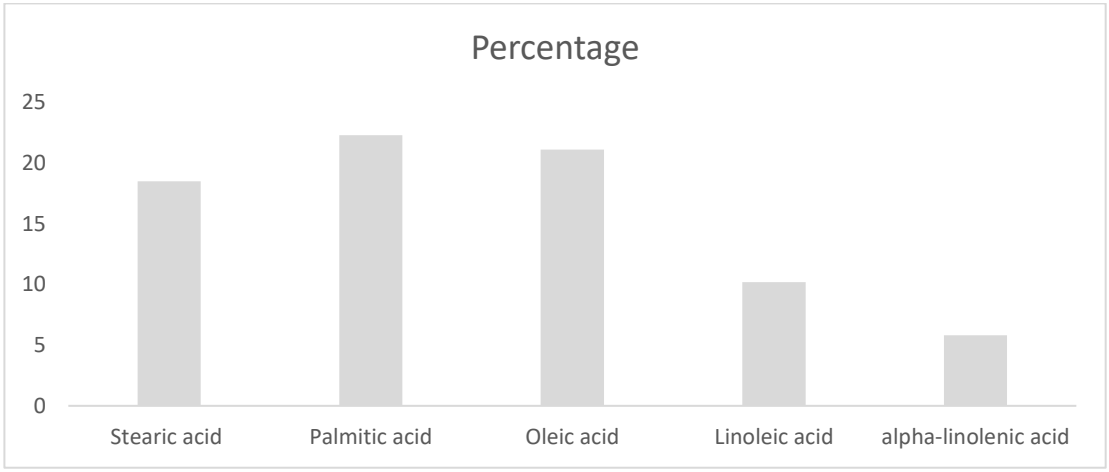

Figure: 3 *Fatty Acid Composition of Bellamya bengalensis (edible gastropod) powder*

Fatty Acid Composition

Saturated Fatty Acids (SFA)

- **Stearic Acid (18.5%)**: Stearic acid is a long-chain saturated fatty acid. It is unique among saturated fatty acids because it does not raise LDL cholesterol levels in the blood, unlike other saturated fatty acids. This makes stearic acid a relatively heart-friendly saturated fat.

• **Palmitic Acid (22.3%)**: Palmitic acid is another common saturated fatty acid. While it is the most prevalent saturated fatty acid in many diets, excessive intake has been associated with increased cholesterol levels and potential cardiovascular risk. However, it also plays essential roles in the body, including in cell membrane structure and as a precursor for other lipid molecules.

Monounsaturated Fatty Acids (MUFA)

• **Oleic Acid (21.1%)**: Oleic acid is the most abundant monounsaturated fatty acid in this sample. It is known for its beneficial effects on heart health, including reducing inflammation and improving cholesterol levels by lowering LDL and potentially raising HDL cholesterol. Oleic acid is a key component of the Mediterranean diet, which is associated with numerous health benefits.

Polyunsaturated Fatty Acids (PUFA)

• **Linoleic Acid (10.2%)**: Linoleic acid is an omega-6 fatty acid and is essential for human health. It is necessary for the growth and development of the body, as well as for maintaining healthy skin and cell membranes. However, a balance with omega-3 fatty acids is important, as an excess of omega-6 relative to omega-3 can promote inflammation.

• **Alpha-linolenic Acid (5.8%)**: Alpha-linolenic acid is an omega-3 fatty acid and is also essential for human health. It plays a crucial role in reducing inflammation, supporting brain health, and reducing the risk of chronic diseases such as heart disease. Alpha-linolenic acid can be converted in the body to other omega-3 fatty acids like EPA and DHA, which have further health benefits.

Overall Fatty Acid Profile

The sample contains a balanced mixture of saturated, monounsaturated, and polyunsaturated fatty acids. The percentages of each type of fatty acid suggest that the sample can contribute to a balanced diet when consumed in moderation.

• **Health Implications**:

o The significant presence of oleic acid (MUFA) suggests potential benefits for cardiovascular health.

o The presence of both linoleic acid and alpha-linolenic acid indicates the sample's contribution to essential fatty acid intake, supporting overall health and reducing inflammation.

o While the sample contains notable levels of saturated fatty acids, the presence of stearic acid, which is neutral in terms of cardiovascular risk, is a positive aspect.

Conclusion:

Bellamya bengalensis is widely consumed in Asia and Africa due to its nutritional and medicinal properties. The sample contains a high concentration of essential amino acids (lysine, leucine, and valine) and non-essential amino acids, including glutamic acid, aspartic acid, and glutamic acid. The percentages of saturated fatty acids (SFA)/monounsaturated fatty acid (MUFA) and oleic acid (PUFA) suggest that the sample can contribute to a balanced diet when consumed in moderation. MUFA is a key component of the Mediterranean diet, which is associated with numerous health benefits.

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