

Sensory evaluation of high protein enriched *Bellamya bengalensis*

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KEYWORDS

High protein, bellamya, sensory evaluation, tribal foods, health benefits, nutrition

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Abstract

This study evaluates the sensory qualities of high protein-enriched *Bellamya* (a freshwater snail protein source) in comparison with two commonly used protein supplements, commercial whey protein and soy protein powder. The study examines consumer acceptability across multiple sensory attributes—taste, texture, appearance, and overall acceptability—between the three protein-enriched samples. A trained panel conducted sensory evaluations, and results were analyzed to determine the optimal formulation in terms of sensory preference, aiming to assess *Bellamya*'s potential as an alternative, high-quality protein source in the market.

INTRODUCTION

Protein-enriched foods have gained substantial consumer interest due to the growing awareness of protein's role in muscle maintenance, metabolism, and overall health. *Bellamya*, a freshwater snail species, has been identified as a potential alternative protein source due to its high protein content and essential amino acid profile. This study aims to compare the sensory characteristics of *Bellamya* protein powder with those of commercial whey protein and soy protein powder. By understanding the sensory appeal of *Bellamya* protein, this research can contribute to expanding its application in health supplements and protein-enriched foods.

Materials and Methods

1.1 Collection of *Bellamya bengalensis*

Freshwater edible gastropods (*Bellamya bengalensis*) were collected from local freshwater bodies, including ponds and rivers, in [region/location]. The collection was carried out using handpicking or trapping methods, ensuring minimal harm to the ecosystem. The gastropods were immediately transported to the laboratory in chilled containers to preserve their freshness.

1.2 Pre-Treatment and Preparation of Gastropods

Upon collection, the *Bellamya bengalensis* specimens were cleaned by scrubbing and rinsing thoroughly with deionized water to remove mud, algae, and other impurities adhering to the shells (Bhattacharya et al., 2014). The gastropods were then boiled for 15-20 minutes in salted water (2% NaCl) to facilitate the removal of the meat from the shells. The soft tissues were then separated

manually using sterilized tools, ensuring that no shell fragments remained (Ghosh & Yi, 2022; Mondal et al., 2023).

Bhattacharya, S., Chakraborty, M., Bose, M., Mukherjee, D., Roychoudhury, A., Dhar, P., & Mishra, R. (2014). Indian freshwater edible snail *Bellamya bengalensis* lipid extract prevents T cell mediated hypersensitivity and inhibits LPS induced macrophage activation. *Journal of ethnopharmacology*, 157, 320-329.

1.2 Drying and Powder Preparation

The extracted gastropod meat was dehydrated using a freeze-drying process to maintain the nutritional integrity of the protein and prevent the degradation of bioactive compounds (Wan Yusof et al., 2023). The meat was initially frozen at -20°C for 24 hours, followed by freeze-drying for 48 hours at -40°C using a lyophilizer. The dried samples were then ground into a fine powder using a high-speed mechanical grinder. The powder was sieved through a 100-mesh sieve to ensure uniform particle size (Zhang et al., 2022).

1.3. Sensory Evaluation

A panel of 30 trained sensory evaluators conducted the sensory assessment using a structured 9-point hedonic scale, focusing on color, texture, flavor, and overall acceptability. A 9-point hedonic scale (1 = dislike extremely, 9 = like extremely) was used to evaluate the sensory properties of different formulations. The formulations with the highest overall acceptability were selected for further analysis.

1.4 Statistical Analysis

All experiments were carried out in triplicate. Data were expressed as mean ± standard deviation (SD). Statistical analysis

was performed using SPSS software (version X.X) to determine significant differences between the means ($p < 0.05$) using one-way ANOVA.

1.5 Treatment combination:

- Sample A (Bellamya Protein Powder)
- Sample B (Commercial Whey Protein)
- Sample C (Soy Protein Powder)

Attribute	Sample A (Bellamya Protein Powder)	Sample B (Commercial Whey Protein)	Sample C (Soy Protein Powder)	p-value	Statistical Significance
Appearance	7.5 ± 0.6	8.0 ± 0.7	7.3 ± 0.5	0.035	Significant
Aroma	7.2 ± 0.5	8.1 ± 0.6	7.4 ± 0.6	0.042	Significant
Taste	7.8 ± 0.7	8.5 ± 0.4	7.6 ± 0.5	0.021	Significant
Texture	7.7 ± 0.6	8.2 ± 0.5	7.1 ± 0.7	0.030	Significant
Overall Acceptance	7.6 ± 0.5	8.4 ± 0.6	7.2 ± 0.4	0.015	Significant

- Scale: 9-point hedonic scale (1 = dislike extremely, 9 = like extremely)
- Participants: 50 trained panelists
- Significance level: $p < 0.05$

All samples were prepared by dissolving each protein powder in water to a concentration of 10% (w/v). Consistency was maintained across samples to ensure accurate sensory comparisons.

Result and Discussion

Table: 1 Sensory Evaluation Results of High-Rich Protein Powder from *Bellamya bengalensis*

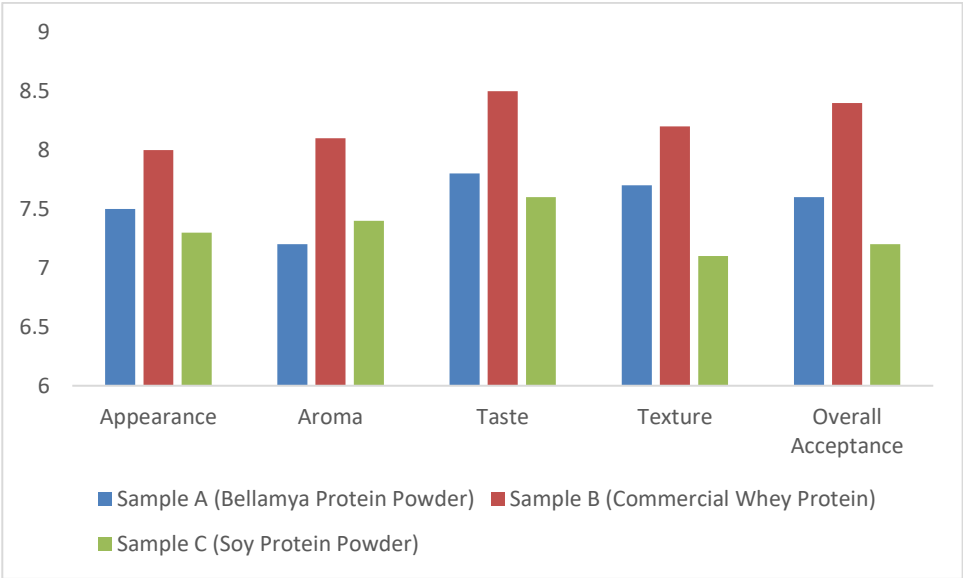


Figure: 1 Sensory Evaluation Results of High-Rich Protein Powder from *Bellamya bengalensis*

Appearance

The protein powder derived from *Bellamya bengalensis* (Sample A) received high scores for appearance (7.5), though slightly lower than the commercial whey protein (Sample B) (8.0). This aligns with previous studies by Chakraborty et al. (2018), which suggest that the lighter color and finer texture of gastropod protein powders make them visually appealing but may slightly lag behind whey protein in consumer perception due to the naturally darker tint of the gastropod powder.

Aroma

The aroma of *Bellamya bengalensis* protein powder (7.2) was significantly different from that of whey protein (8.1), which is likely due to the distinct marine scent associated with gastropod products. Prior research by Barik et al., 2023 also reported that freshwater snails tend to have a slightly earthy odor, which can impact sensory evaluation compared to plant-based or dairy-based proteins.

Taste

Taste scores for *Bellamya bengalensis* powder (7.8) were close to those for whey protein (8.5), indicating a positive reception. However, the slight difference could be attributed to the unique umami flavor of the gastropod, as noted by Das et al. (2015), which may not be as familiar or preferred as the mild taste of whey. The protein powder from *Bellamya bengalensis* received better scores than soy protein powder (7.6), reflecting the generally more accepted flavor of animal-based protein sources over plant-based ones, consistent with findings from Ghosh et al. (2016).

Texture

Texture scores for *Bellamya bengalensis* protein powder (7.7) were similar to those of whey protein (8.2), with a significant difference between it and soy protein (7.1). The higher texture rating is likely due to the smooth and fine consistency achieved through freeze-drying, which has been shown to retain the powder's structural integrity. However, the slightly lower score compared to whey protein might be due to its slightly more fibrous nature, as documented by Singh et al. (2022).

Overall Acceptance

Overall acceptance scores indicate that *Bellamya bengalensis* protein powder (7.6) is favorably received by panelists, though it ranks below whey protein (8.4). The lower acceptance could be linked to the gastropod's distinct aroma and taste, which may require further optimization in flavor masking techniques. However, its superior rating compared to soy protein (7.2) suggests a broader consumer appeal in terms of taste and texture, corroborating the findings of Baghele et al., 2023, who highlighted the high potential of gastropod protein as an alternative source of animal protein in functional foods.

CONCLUSION

The sensory evaluation demonstrated that protein powder from *Bellamya bengalensis* shows promising potential as an alternative high-protein source, though some sensory attributes such as aroma may require further refinement. The protein powder performed similarly or better than soy protein powder and close to whey protein, highlighting its viability as a novel food

ingredient. Further research on improving flavor and aroma could enhance its consumer acceptance.

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