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Formulation and sensory evaluation of newly developed protein enriched powder from food wastes (banana peels and pumpkin seeds)

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Abstract

Food waste is a critical issue globally, with significant environmental and economic consequences. This study aimed to formulate a protein-enriched powder using banana peels and pumpkin seed powder as a food waste and evaluate its sensory attributes. Banana peels and pumpkin seed powder a significant source of possess valuable nutrients, including protein. This study explores the formulation of protein powder from banana peels and pumpkin seed powder and evaluates its sensory attributes. Banana peels and pumpkin seeds were collected, processed, and converted into a protein-rich powder using innovative techniques. The sensory evaluation revealed promising results, indicating the potential of banana peel and pumpkin seed protein powder as a sustainable ingredient in various food applications. The findings suggest that the developed powder not only offers a sustainable solution to food waste but also exhibits promising sensory qualities, indicating its potential for various culinary applications.

Keywords: Food waste, protein enrichment, powder formulation, sensory evaluation, sustainability, banana peels, pumpkin seeds

1. Introduction

Food waste is a pressing global challenge, with approximately one-third of all food produced worldwide being wasted annually. Besides the ethical concerns of squandering precious resources, food waste also poses environmental problems, contributing to greenhouse gas emissions and landfill overflow. Addressing this issue requires innovative approaches to utilize food waste efficiently while also adding value to the by-products.

One promising avenue is the development of protein-rich powders from food waste. These powders not only help in reducing waste but also offer nutritional benefits and potential applications in the food industry.

Banana production generates a substantial amount of waste, primarily consisting of peels, which often end up in landfills, contributing to environmental pollution (Tewari *et al.*, 2021)^[9]. However, banana peels are rich in nutrients, including protein, making them an attractive source for value-added products (Gupta *et al.*, 2023)^[2]. Pumpkin seeds are often overlooked as a valuable source of protein, despite containing high-quality proteins along with essential fatty acids, vitamins, and minerals (Oso and Ashafa, 2021)^[6]. With the growing demand for sustainable protein sources, there is a need to explore alternative sources such as pumpkin seeds (Devi *et al.*, 2018)^[1].

This research aims to formulate a protein-enriched powder from banana peels and pumpkin seeds food waste assess its sensory attributes to determine its acceptability and potential use in various food products.

2. Materials and Methods

2.1 Collection and Preparation of Banana Peels

Banana peels were collected from local markets and thoroughly cleaned to remove any dirt or contaminants. The peels were then cut into small pieces and subjected to further processing (Kibria *et al.*, 2019)^[3].

2.2 Collection and Preparation of Pumpkin Seeds

Pumpkin seeds were obtained from locally grown pumpkins and cleaned to remove any debris or impurities. The seeds were then roasted to enhance flavor and facilitate protein extraction (Kuku *et al.*, 2014)^[4].

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2.2 Protein Extraction

Protein extraction from banana peels and pumpkin seeds were carried out using a combination of mechanical and enzymatic methods (Songok, 2021) [8]. The peels and seeds were macerated and then treated with enzymes to facilitate protein release. The extracted protein solution was then concentrated and purified to obtain a protein-rich extract (Nartea *et al.*, 2023) [5].

2.3 Spray Drying and Powder Formation

The protein-rich extract obtained from banana peels and pumpkin seeds were spray-dried to form a fine powder. The spray drying process involved atomizing the protein solution into droplets, which were then dried to produce powdered particles (Samborska *et al.*, 2021) [7]. The resulting banana peel and pumpkin seeds protein powder was collected and stored under appropriate conditions.

Table 1: Treatment combinations

Sl. No.	Banana peels powder	Pumpkin seeds powder
T ₁	20	80
T ₂	30	70

2.5 Formulation and Sensory Evaluation

The banana peel protein powder was formulated into a palatable product by incorporating suitable additives and flavor enhancers (Zaini *et al.*, 2022) [10]. A sensory evaluation panel consisting of trained individuals was then employed to assess various sensory attributes, including appearance, aroma, taste, and texture. The panelists

provided subjective feedback on the overall acceptability of the banana peel protein powder.

3. Results and Discussion

The formulated protein-enriched powder exhibited desirable sensory characteristics. It had a neutral aroma and taste profile, with no off-flavors or odors. The powder dissolved readily in water, forming a smooth and homogeneous solution. The color of the powder was visually appealing, and its texture was fine and free-flowing. Overall, the panelists found the powder to be acceptable and suitable for use in a variety of food applications.

Table 2: Mean value of T₁ and T₂

Treatments	Color	Flavour	Taste	Texture	Overall acceptability
T ₁	8.6	8.4	7.1	7.2	7.8
T ₂	7.2	6.8	6.5	6.1	6.6

Table 3: Descriptive statistics of overall acceptability of T₁ and T₂

Mean	7.8	6.6
Std. Deviation	0.1270	0.1848
Std. Error of Mean	0.05247	0.05785

Table 4: Significance difference between T₁ and T₂

P value	0.0013
P value summary	**
Significantly different (P < 0.05)?	Yes
One- or two-tailed P value?	Two-tailed
t, df	t=7.348, df=4

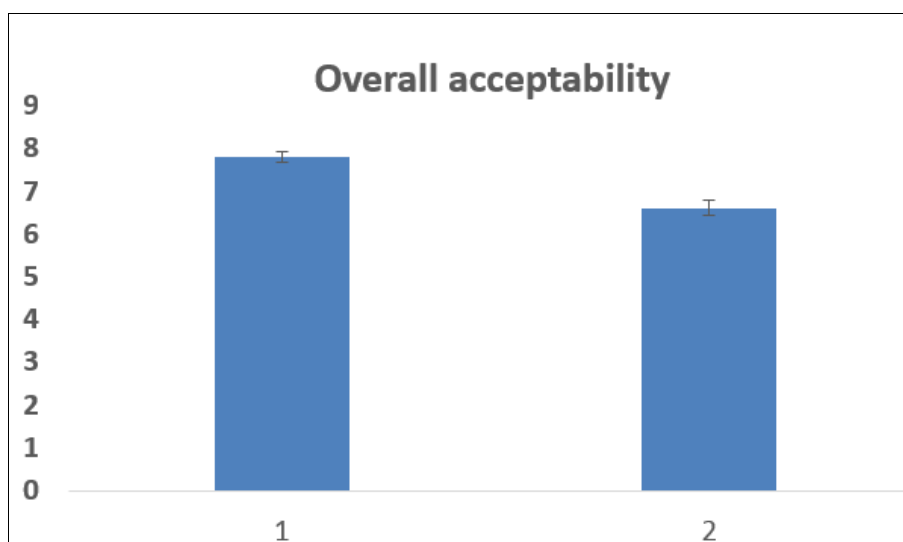


Fig 1: Graphical representation of Overall acceptability

4. Discussion

The successful formulation of a protein-enriched powder from food waste demonstrates the potential of utilizing waste materials to create value-added products. The sensory evaluation results indicate that the developed powder has the potential to be incorporated into various food products without compromising taste or quality. Further optimization of the formulation process and exploration of different waste sources could enhance the sensory properties and versatility of the powder, opening up new avenues for sustainable food production. After analysis of color, flavor, taste and texture score it was found that T₁ had 8.6, 8.4, 7.1 and 7.2 respectively and T₂ had 7.2, 6.8, 6.5 and 6.1

respectively. After overall acceptability it was found that T₁ had highest score 7.8 than T₂ score 6.6.

5. Conclusion

In conclusion, this study presents a novel approach to address food waste by formulating a protein-enriched powder from banana peels and pumpkin seeds. The sensory evaluation results indicate that the developed powder has favorable sensory attributes, making it a promising ingredient for use in the food industry. Continued research in this direction could lead to the development of sustainable solutions to food waste while also contributing to the creation of nutritious and palatable food products.

6. Acknowledgment

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