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The Effect of Utilizing Kepok Banana Peel on the Sensory Quality of Steamed Sponge Cake as an Alternative Food Product

Al Fajri [1*], Riani Prihatini Ishak [2]
[1,2] *Hospitality Study Program, Bogor Tourism College*

Abstract

Banana peel waste, especially from the kepok variety, is often discarded despite containing fiber, vitamins, minerals, and antioxidants that are beneficial for health. This study aims to evaluate the potential use of kepok banana peel as an alternative raw material in making steamed sponge cake through organoleptic tests and statistical analysis. This study used an experimental approach with 25 trained and untrained panelists to assess sensory parameters such as color, texture, aroma, and taste. The results showed that steamed sponge cake made from kepok banana peel had a higher level of preference than sponge cake made from kepok banana flesh, especially in the aspects of color (5.84), texture (5.48), and aroma (5.64). These findings indicate that kepok banana peel is worthy of being used as an alternative food ingredient, not only from a technological and nutritional perspective, but also in supporting sustainable consumption practices. This study provides strategic implications for the development of local food products based on organic waste and the empowerment of MSMEs in the food industry.

Keywords : Kepok banana peel, steamed cake, organoleptic test, alternative food, sustainability

Abstract

Banana peels, particularly from the kepok variety, are often discarded despite being rich in fiber, vitamins, minerals, and antioxidants beneficial to human health. This study aims to evaluate the potential utilization of kepok banana peel as an alternative ingredient in steamed sponge cake (bolu steamed) production through organoleptic testing and statistical analysis. An experimental approach was employed with 25 trained and untrained panelists to assess sensory parameters including color, texture, aroma, and taste. The findings reveal that steamed sponge cakes made with kepok banana peel received higher preference scores compared to those made with banana pulp, particularly in terms of color (5.84), texture (5.48), and aroma (5.64). These results indicate that kepok banana peel is feasible as an alternative food ingredient, not only from a technological and nutritional perspective but also in supporting sustainable consumption practices. The study provides strategic implications for the development of local food products based on organic waste as well as for empowering small and medium-sized enterprises (SMEs) in the food industry.

Keywords: *kepok banana peel, steamed sponge cake, organoleptic test, alternative food, sustainability*

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✉ Corresponding author:
Email Address: ajialfajri27@gmail.com

INTRODUCTION

Repurposing unused raw materials into high-value products is an effective strategy to minimize waste and provide additional benefits to the community. One material often considered waste is banana peel, particularly the peel of the kepok banana (Musa balbisiana), which is generally discarded immediately after the fruit is consumed. However, kepok banana peel contains various bioactive compounds and important nutrients such as fiber, flavonoids, tannins, and vitamins C and E, which are beneficial for health. Therefore, processing kepok banana peel into food products such as steamed sponge cake can be a solution to reduce organic waste while creating functional food innovations. Based on research by Pangestika and Srimiati (2020), substituting banana peel flour up to 50% in making steamed sponge cake produces a product with a protein content of 10.97%, fiber 1.91%, and fat content 5.97%, indicating a significant increase in nutritional content.

Data from the Indonesian Ministry of Agriculture indicates that national banana production reaches approximately 3 million tons per year, of which approximately 30% is discarded as underutilized waste—primarily in the form of banana peels. Indonesia, as the country with the highest banana consumption in Southeast Asia, has the potential to generate large amounts of banana peel waste, which poses a risk of environmental pollution if not managed optimally. Research by Putri et al. (2022) revealed that banana peels contain high levels of antioxidants such as flavonoids and tannins, which play a crucial role in combating free radicals and boosting immunity. Therefore, utilizing banana peels as a food additive, such as in steamed sponge cakes, represents an innovative approach to developing healthy foods based on local ingredients. Steamed sponge cakes, a traditional Indonesian food, have high potential for public acceptance, especially if enriched with the nutritional content of banana peels.

Kepok banana peels are also known to have a high fiber content, which is beneficial for the digestive system and plays a role in preventing chronic diseases such as diabetes and heart disease. Soedrajad and Hartono (2019) stated that the fiber in kepok banana peels can lower the glycemic index of foods, making them safe for diabetics. Furthermore, antioxidants such as tannins and flavonoids can also maintain skin health, prevent premature aging, and ward off oxidative stress. The natural antimicrobial properties of banana peels are also believed to extend the shelf life of products. Therefore, banana peels not only provide added value from a nutritional perspective, but also from a functional and healthy perspective.

However, the use of banana peel as the main ingredient in steamed sponge cake is still rare. Existing research generally focuses on processing banana peel into flour or other processed products such as chips and jam. Hidayat et al. (2023) found that adding banana peel to steamed sponge cake dough can increase fiber and antioxidant content without reducing sensory quality. In organoleptic tests in the study, steamed sponge cake with a 30% banana peel substitution still received a "like" rating from panelists, proving that the quality of taste, aroma, and texture was not significantly affected. This indicates the potential for commercial development of steamed sponge cake made from banana peel.

In line with the trend of healthy food consumption and increasing public awareness of the importance of nutrition, steamed sponge cake made from kepok banana peel can be an alternative snack that combines elements of sustainability and health. Research by Sofiyatinreni (2023) shows that a mixture of kepok banana peel flour and wheat flour in a 40:60 ratio in biscuit products produces a product that is preferred by consumers, with increased fiber content compared to conventional products. This confirms that kepok banana peel can be widely used in various types of food preparations. In addition to providing health benefits, this innovation is also in line with the principles of the modern food industry, namely the comprehensive use of food ingredients to reduce waste and increase efficiency. Based on this background, this study aims to examine the most effective method of processing kepok banana peel in making steamed sponge cake, which not only has a delicious taste but also has high nutritional value and is favored by consumers.

The research focused on organoleptic analysis and nutritional content, to find the best formulation in processing kepok banana peel as the main ingredient of steamed sponge cake. With a *zero waste approach* , this innovation is expected to not only provide scientific contributions, but also practical solutions in overcoming food waste and creating new opportunities in the local culinary industry. Based on this background, this study aims to answer two main things, namely: how does the proportion of kepok banana peel affect the texture, taste, and sensory acceptability of steamed sponge cake, and how is the SWOT analysis of steamed sponge cake made from kepok banana peel as a food innovation based on organic waste. This study is limited to the use of kepok banana peel (*Musa paradisiaca*) as the main substitution ingredient in making steamed sponge cake. Organoleptic tests were carried out by semi-trained panelists with parameters of color, aroma, taste, and texture according to SNI 01-3932-2008, with a focus on finding the best formulation that is preferred by consumers.

The purpose of this study was to determine the effect of substituting kepok banana peel on the sensory quality of steamed sponge cake and to analyze the potential strengths, weaknesses, opportunities, and threats (SWOT) of the product. The benefits of this research include academic, economic, and environmental aspects. Academically, this research enriches the literature on the use of organic waste in food innovation. From an economic perspective, the results can open up business opportunities based on more affordable local ingredients. Meanwhile, from an environmental perspective, this research supports the reduction of organic waste and promotes the principle of sustainability. Expected outputs include a scientific report, a healthy and environmentally friendly alternative steamed sponge cake product, and policy recommendations to support local and sustainable food development.

RESEARCH METHODS

This study used a quantitative approach with an experimental design to determine the effect of certain treatments on product quality and consumer acceptance levels through organoleptic and sensory tests. According to Sugiyono (2017) and Ary (2010), a quantitative approach aims to statistically test hypotheses based on measured data with standard instruments. Experimental methods were applied to evaluate food quality attributes such as taste, aroma, color, and texture. The study was conducted at BLV *Coffee and Space* , Palembang, in February 2025. A total of 25 panelists were

involved, consisting of 10 trained panelists and 15 untrained panelists, to obtain objective and subjective assessment results of the product. Data were collected through an organoleptic evaluation sheet, then analyzed statistically using descriptive and inferential tests, such as ANOVA or Kruskal-Wallis, to determine significant differences between treatments. The results of this study are expected to provide a clear picture of product quality and consumer preferences based on the treatments given.

RESULTS AND DISCUSSION

A. Composition and Tools for Making Banana Peel Steamed Sponge Cake

Steamed sponge cake is generally made from wheat flour, eggs, sugar, and a leavening agent. Flour provides structure, eggs act as a binder and softener, sugar adds sweetness and texture, and the leavening agent helps the dough rise (Raffi Ananta, 2021). An innovation is the addition of kepok banana peel as a substitute for some of the basic ingredients.

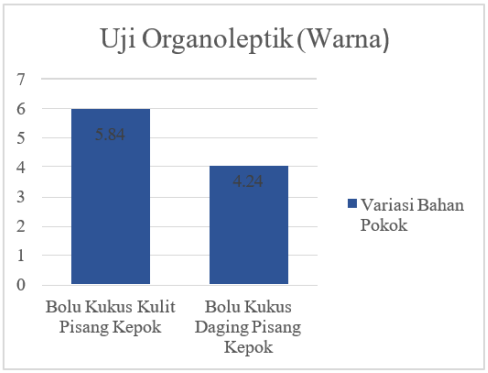
No.	Name Material	The number of	
		P1	P2
1.	Banana peel Kepok	-	100g
2.	Fruit Banana Kepok	100g	-
3.	Sugar Sand	70g	70g
4.	Flour Wheat	160g	160g
5.	Milk powder	30g	30g
6.	Soda Cake	5g	5g
7.	Salt	2g	2g
8.	Egg	80g	80g
9.	Oil Vegetable	150ml	150ml

Source: processed researchers, 2025

B. Data Description

Organoleptic testing of steamed sponge cakes with various main ingredients was conducted by 25 panelists. The organoleptic parameters assessed included color, aroma, texture, and taste. Each panelist provided two replicate assessments. Organoleptic testing was conducted using an eight-point descriptive scale, where each number represents the panelist's level of preference for the sample being tested. This scale consists of the following assessments: number 1 indicates 'dislike very much', number 2 means 'dislike very much', number 3 indicates 'dislike', number 4 means 'dislike somewhat', number 5 indicates 'neutral', number 6 means 'like somewhat', number 7 indicates 'like', and number 8 indicates that the panelist 'very much likes' the sample being assessed.

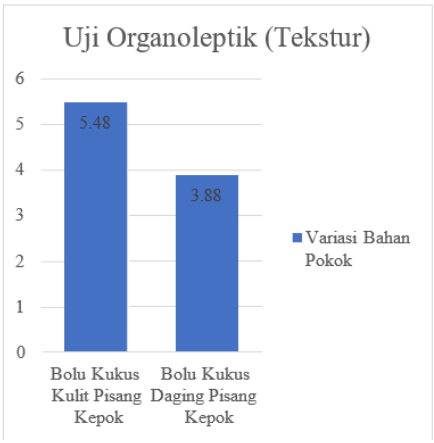
Figure 1. Average Organoleptic Test Results (Color)



Source: exercise SPSS data v20, 2025

Based on the average panelist assessment, the steamed sponge cake made with kepok banana peel received an average score of 5.84, higher than the one made with kepok banana flesh, which received a score of 4.24. This indicates that visually, the panelists preferred the color of the sponge cake made with kepok banana peel.

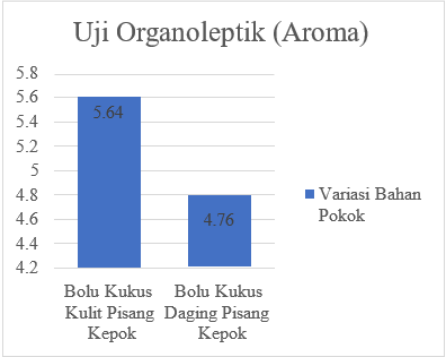
***Figure* 2.** Average Organoleptic Test Results (Texture)



Source: exercise SPSS data v20, 2025

The assessment results showed that the average texture of the sponge cake made from kepok banana peel was 5.48, higher than the average texture of the sponge cake made from kepok banana flesh, which was 3.88. This significant difference indicates a better texture acceptance of the sponge cake made from kepok banana peel.

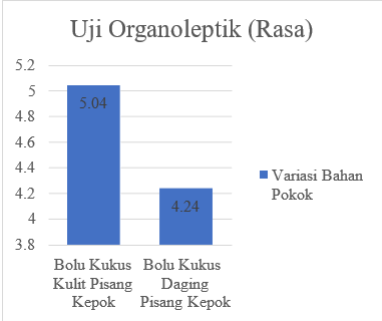
Figure 3. Average Organoleptic (Aroma) Test Results



Source: SPSS v20 data processing, 2025

The steamed sponge cake made from kepok banana peel received an average aroma score of 5.64, while the kepok banana flesh received a score of 4.76. While there was a difference, the difference was not significant, indicating that the aroma acceptance of both products was relatively similar.

Figure 4. Average Organoleptic (Taste) Test Results



Source: SPSS v20 data processing, 2025

The steamed sponge cake made from kepok banana peel had an average taste score of 5.04, while the banana flesh had a score of 4.24. While there were differences, they were not significant, so the panelists still found the flavors of both types of steamed sponge cake to be relatively balanced.

Overall, organoleptic test results showed that steamed sponge cakes made from kepok banana peels had a higher acceptance rate than those made from kepok banana flesh, particularly in terms of color, texture, and aroma. These results suggest that kepok banana peels have the potential to be used as an alternative ingredient in steamed sponge cake-based food products.

C. Research result

1. Kruskal-Wallis Test Results

This analysis uses SPSS version 25 software with the Kruskal-Wallis Test, which is used to test the significance of differences between two treatment groups. If the test results indicate a statistically significant difference, a *post hoc test* using the Mann-Whitney U Test is performed to determine which group exhibits the most significant difference.

a. Color Parameters

Kruskal-Wallis H	11,244
df	1
Asymp. Sig.	.001

Source: exercise SPSS data v20, 2025

The Kruskal-Wallis test results showed a significant difference in color perception between steamed sponge cake with banana peel (F1_550) and without banana peel (F2_419). Formula F1 obtained a higher average rating value (32.28) than F2 (18.72), indicating that panelists preferred the appearance of the sponge cake with banana peel. A significance value of 0.001 (<0.05) indicates a statistically significant difference. This difference is thought to be due to the addition of banana peel giving the dough a more visually appealing color.

b. Texture Parameters

Kruskal-Wallis H	14,412
df	1
Asymp. Sig.	.000

Source: exercise SPSS data v20, 2025

The Kruskal-Wallis test showed a significance value of 0.000 (<0.05), indicating a significant difference in texture perception between steamed sponge cake F1 (with banana peel) and F2 (without banana peel). Thus, H_0 was rejected, and the addition of banana peel was proven to have a significant effect on product texture. A further Mann-Whitney test was conducted to determine which treatments were significantly different.

c. Aroma Parameters

Kruskal-Wallis H	3,985
df	1
Asymp. Sig.	.046

Source: exercise SPSS data v20, 2025

The Kruskal-Wallis test showed a significance value of 0.046 (> 0.05), indicating that there was no significant difference in aroma perception between steamed sponge cakes F1 and F2. This means that the null hypothesis (H_0) is accepted and the addition of kepok banana peel has no significant effect on aroma. Therefore, a further Mann-Whitney test is not necessary.

d. Taste Parameters

Kruskal-Wallis H	4,170
df	1
Asymp. Sig.	.041

Source: exercise SPSS data v20, 2025

The Kruskal-Wallis test results showed a significance value of 0.041 (> 0.05), so there was no significant difference in taste perception between steamed sponge cakes F1 and F2. Thus, H_0 was accepted and the addition of kepok banana peel had no significant effect on taste. Further Mann-Whitney testing was not necessary.

2. Mann-Whitney Test Results

The Mann-Whitney test was used as a follow-up analysis after Kruskal-Wallis showed significant differences in color parameters. This test aims to specifically identify differences between two treatments: F1 (with kepok

banana peel) and F2 (without kepok banana peel). The results of the analysis are presented in the following table.

Mann-Whitney Test

Ranks

	Treatment	N	Mean Rank	Sum of Ranks
Color	F1_550	25	32.28	807.00
	F2_419	25	18.72	468.00
	Total	50		

Source: exercise SPSS data v20, 2025

The Mann-Whitney test results showed that steamed sponge cake F1_550 (with kepok banana peel) had a higher mean rank (32.28) than F2_419 (18.72), indicating panelists' preference for the color of F1. The U value of 143,000 with a significance of 0.001 (<0.05) confirmed a statistically significant difference. Thus, the addition of kepok banana peel was proven to have a significant effect on the appearance of the color of the steamed sponge cake.

3. SWOT Analysis Results: Potential of Kepok Banana Peel Steamed Sponge Cake

The results of the organoleptic test show that the steamed cake made from kepok banana peel superior sensory, especially in **color** (5.84), texture (5.48), aroma (5.64) **,** and taste (5.04) **,** compared to sponge cake made from banana flesh. Although the color is darker, the denser texture is still preferred. The aroma and taste are also considered pleasant and acceptable to panelists. In addition to sensory aspects, banana peel has added value in terms of sustainability, **nutritional content** , and economic potential for MSMEs. To map the strengths and challenges, the following SWOT analysis was conducted:

Quadrant	SWOT Condition	Types of Strategy	Strategic Action Plan
Quadrant I	*Strength* (+) + *Opportunity* (+)	Progressive Strategy	- Mass production of steamed cakes with a sustainable healthy food label - Educate consumers through social media campaigns about nutritional and environmental benefits - Collaboration with MSMEs and distribution to *eco-*

			food based cafes/schools
Quadrant II	*Strength* (+) + *Threat* (-)	Diversification Strategy	- Product diversification (*cookies, brownies* , granola bars) - Development of packaging variants and durable products - Further research into the use of banana peels as ready-to-use flour
Quadrant III	*Weakness* (-) + *Opportunity* (+)	Change Strategy	- Visual improvement of the product with a mixture of natural dyes (pumpkin/carrot) - *Rebranding* through eco-friendly & antioxidant-rich product narrative - Processing efficiency: flour production ready-to-use instant banana peel
Quadrant IV	*Weakness* (-) + *Threat* (-)	Survival Strategy	- Guard quality And consistency product - Test Power save And packaging vacuum - Educational approach to consumers through free testers, cooking demonstrations, or environmental CSR

Source: processed researchers 2025

Kepok banana skin steamed cake has proven to be edible, nutritious, and environmentally friendly. This product addresses the need for healthy, *zero-waste food* while creating local business opportunities. Challenges such as

negative perceptions of waste materials and a short shelf life can be overcome through innovative strategies, market education, and *branding* . With an integrated SWOT strategy approach, this product has the potential to become a competitive alternative food that supports a circular economy and sustainable development in Indonesia.

CONCLUSION

This study proves that kepok banana peel has high potential as an alternative raw material in making steamed sponge cake, with organoleptic test results showing that products made from banana peel are preferred by panelists compared to those using banana flesh. Aspects of color, texture, and aroma obtained higher average scores, indicating that banana peel waste is not only technically feasible, but also sensorially superior. These findings confirm that the utilization of banana peel waste can support the principle of *zero-waste- based food innovation* , which is not only environmentally friendly but also has promising economic and nutritional value. Therefore, the development of this product is very feasible, especially in the Micro, Small, and Medium Enterprises (MSMEs) sector. However, for this product to develop optimally, strategic steps are needed starting from standardization of raw material processing processes such as efficient cleaning, boiling, and drying, to the use of simple technologies such as dehydrator ovens to maintain quality consistency.

Consumer education is also crucial, given the ongoing negative perception of waste as a food ingredient. Informative campaigns about the nutritional content of banana peels and the environmental benefits of using this material need to be intensified. Furthermore, product diversification into other processed foods such as *brownies, cookies* , and high-fiber snacks in various flavors can increase market interest. Further research is needed to evaluate the best formulations and explore natural preservation techniques and environmentally friendly packaging. Product development must also be accompanied by business legality, such as PIRT (Permit for Food Production), halal certification, and nutritional labeling, to ensure competitiveness in the formal market. Synergy between academics, business actors, government, and the community is key to creating a sustainable local food innovation ecosystem.

Thus, steamed sponge cake made from kepok banana peel is not only an innovative food product with superior sensory and nutritional value, but also a symbol of a circular economy that supports the achievement of the Sustainable Development Goals (SDGs), particularly in terms of responsible consumption and production (SDG 12). This innovation opens up new opportunities in processing organic waste into value-added products that can improve community welfare and local food security in a sustainable manner.

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