Majalah Kedoteran Sriwijaya
Th. 56 Nomor 3, July 2024

ORGANOLEPTIC PROPERTIES ANALYSIS OF COOKIES WITH BANANA BLOSSOM FLOUR SUBSTITUTION AS A HEALTHY SNACK ALTERNATIVE

Wiwi Febriani[1*], Ramadhana Komala[2], Dian Isti Angraini[3], Eka Putri Rahmadhani[4]

[1.2,3,4] Department of Community Medicine and Public Health, Faculty of Medicine, University of Lampung, Bandar Lampung

Email: wiwi.febriani@fk.unila.ac.id

ABSTRACT

The consumption of healthy snacks has become increasingly important as public awareness of health rises. Banana blossom, rich in fiber, vitamins, and antioxidant compounds, is expected to enhance the nutritional value of cookies while supporting the sustainability of local food sources. This study aims to explore the potential of banana blossom flour as a substitute ingredient in cookie production. The research employs a Completely Randomized Design (CRD) with four cookie formulas that compare wheat flour and banana blossom flour ratios (F0=100:0; F1=85:15; F2=70:30; F3=55:45), and it conducts hedonic testing to evaluate organoleptic attributes such as color, aroma, taste, texture, and overall assessment. The organoleptic evaluation was performed on a panel of 30 semi-trained judges. The results indicate that formula F0 achieved the highest scores across all parameters, while F1 and F3 received lower ratings, particularly in taste and aroma. Overall, the panelists showed good acceptance (scores > 5.5) for the formulas substituted with banana blossom flour, with F2 achieving the best score. Although F2 demonstrated significant potential as a healthy snack alternative, the aroma aspect still requires improvement. A significant effect was found between the substitution of banana blossom flour and the parameters of taste and aroma ($p < 0.05$). These findings suggest that substituting banana blossom flour not only creates a healthier product but also contributes to the more optimal utilization of local food sources.This research is expected to serve as a guide for the development of more varied and sustainable healthy snack products.

Keywords: banana blossom flour, local food, snack, organoleptic.

1. INTRODUCTION

The consumption of snacks has increased significantly alongside the modern lifestyle that demands convenience. However, many snack products available in the market contain excessive amounts of sugar, fat, and preservatives, which can trigger health issues such as obesity, diabetes, and cardiovascular diseases (1,2). Therefore, there is a growing need for healthy snacks that are not only convenient but also rich in nutrition and safe for regular consumption. Innovations in the development of alternative raw materials are a crucial step toward creating healthy food products that are acceptable to consumers (3,4)

Banana blossom is a local food ingredient rich in nutrients; however, its utilization in the food industry remains highly limited (5). It is known to contain various nutrients such as fiber, vitamins, minerals, and antioxidant compounds that can be beneficial for health. Despite this, its application in processed food products like cookies has not been extensively explored, even though this ingredient can provide significant nutritional value (6,7). Processing banana blossom into flour is one method to enhance its nutritional value, utility, and shelf life (8,9). The nutrient composition of banana blossom flour includes 15.32% protein, 7.50% fat, 26.03% dietary fiber, 28.29% carbohydrates, 9.14% moisture, and 13.73% ash content (10).

The use of banana blossom flour as a substitute ingredient in cookie production offers significant potential as a healthy snack alternative. Banana blossom flour is characterized by being high in fiber, low in calories, and gluten-free, making it suitable for

supporting a healthy lifestyle. Furthermore, the antioxidant content and bioactive compounds in banana blossom provide additional benefits that can enhance the nutritional quality of the product (6). Utilizing this local food ingredient also supports sustainability and diversification of food resources while reducing dependence on imported raw materials like wheat (11).

However, in the development of food products such as cookies, organoleptic aspects become crucial factors influencing consumer acceptance. Organoleptic properties include taste, aroma, texture, and color, which will affect the consumers' first impression of the product. Healthy cookies that lack favored flavors or textures will likely struggle to compete in the market (12,13). Therefore, in-depth analysis is required to understand how the substitution of banana blossom flour impacts the organoleptic properties of cookies and whether these changes are accepted by consumers or detract from the product's appeal.

This study on the substitution of banana blossom flour in cookie production aims to provide innovative solutions for creating healthy snacks that retain sensory appeal. The research will not only evaluate the nutritional potential of banana blossom flour but also examine the extent to which modifying this raw material influences the sensory quality of the product, including its taste, texture, and appearance. This approach is expected to offer practical guidance for the development of healthy food products based on local food sources.

Consequently, this research aims to analyze the organoleptic properties of cookies made with banana blossom flour substitution, while also exploring the potential of banana blossom as a high-nutritional-value alternative raw material. The findings of this study are anticipated to contribute to the development of more diverse healthy snack products and enhance the utilization of local food resources that have been under-optimized in the processed food industry.

2. METHOD

This study employs a Completely Randomized Design (CRD) with two replications to evaluate the comparison between wheat flour and banana blossom flour substitutions, with the tested ratios being F0 (100:0), F1 (85:15), F2 (70:30), and F3 (55:45). The research stages include the development of cookies using various formulas, testing respondents' preferences for organoleptic attributes (hedonic), and determining the selected formula. The organoleptic evaluation was conducted on a panel of 30 semi-trained judges. Hedonic testing was carried out to assess the attributes of color, aroma, taste, and texture using a scale of 1 to 9, where panelists are considered to accept the product if the score given is greater than 5.5. The selected formula is determined based on the proportion of overall attribute ratings, specifically taste (60%), texture (25%), aroma (10%), and color (5%).

Data processing was conducted using Microsoft Excel and SPSS, encompassing both descriptive and statistical analyses. Descriptive analysis was utilized to calculate the average acceptance of panelists in the organoleptic test, represented by radar diagrams. Statistical analysis was performed using the Kruskal-Wallis test to evaluate the effect of adding banana blossom flour on the organoleptic properties of cookies. The Mann-Whitney post hoc test was employed to identify which formulas significantly influenced the organoleptic attributes. The margin of error established in this study is set at 5%.

3. RESULTS

In the results section of this research, we present images of cookies produced from four different formulas with variations in the substitution of wheat flour and banana blossom flour. Each formula, namely F0 (100:0), F1 (85:15), F2 (70:30), and F3 (55:45), yields cookies with unique visual characteristics, reflecting differences in color, shape, and texture. These images illustrate the impact of substituting banana blossom flour on the final appearance of the product. The product images of cookies for each formula with two replications are displayed in Figure 1.

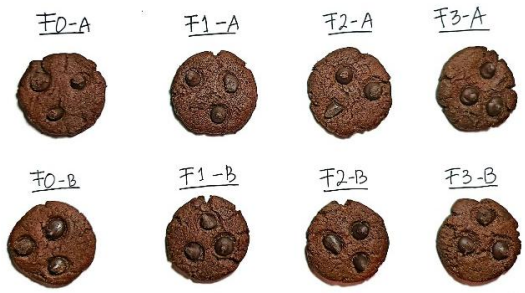

Figure 1. Cookie products from formulas F0, F1, F2, and F3; A = First replication and B = Second replication

The organoleptic test was conducted through two types of evaluations: a hedonic test and a hedonic quality test. In the hedonic test, the parameters assessed include color, aroma, taste, texture, and overall product of the cookies. This evaluation provides a general overview of the panelists' preference levels for the various cookie formulations. Based on the results of the organoleptic test, an analysis was conducted on the average panelist ratings for each cookie formulation. The results of the hedonic test for the cookies are presented in Figure 2.

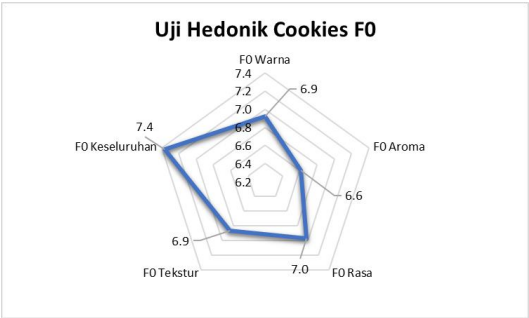

Figure 2. The radar chart of the hedonic test for F0 cookies.

The results of the hedonic test on F0 cookies with banana blossom flour substitution indicate a fairly good acceptance by the panelists, particularly in terms of color, which received a score of 7.2, and taste, which scored 7.0, indicating both aspects were well-liked. The texture of the cookies was also positively evaluated, with a score of 6.9, although the aroma received a lower score of 6.6, suggesting this aspect could be improved, likely due to the distinctive aroma of banana blossom flour. Overall, the F0 cookies achieved the highest overall score of 7.4, indicating that despite some shortcomings in aroma, the product was well received by the panelists in terms of color, taste, texture, and overall impression.

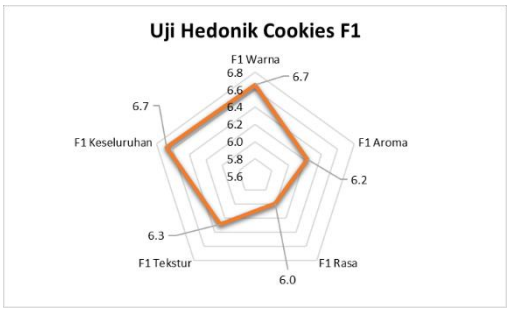

Figure 2. The radar chart of the hedonic test for F1 cookies.

Figure 3 presents the results of the hedonic test for the F1 formula. The findings indicate variations in panelists' acceptance. The color aspect received a score of 6.8, which was relatively well-liked; however, the aroma only scored 6.2, and taste received a score of 6.0, suggesting that these two aspects require further improvement. The

texture of F1 cookies was rated fairly well with a score of 6.3, though there is still room for enhancement. Overall, F1 cookies received a score of 6.7, indicating general acceptance, though aroma and taste were the most significant factors affecting the overall assessment. Compared to F0, F1 cookies tended to score lower in several key aspects.

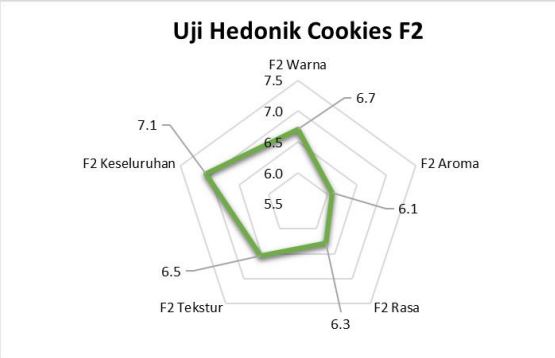

Figure 3. The radar chart of the hedonic test for F2 cookies.

Figure 4 illustrates the results of the hedonic test for F2 cookies. The test results show that the color aspect received the highest score of 7.5, indicating that the cookies' color was highly favored by the panelists. The taste and aroma aspects scored 6.3 and 6.1, respectively, suggesting that these aspects could still be improved, especially the relatively lower aroma. The texture of F2 cookies was rated fairly well with a score of 6.5, and the overall rating stood at 7.1, indicating that, in general, the cookies were well-received by the panelists, although improvements in taste and aroma are needed to enhance overall acceptance of the product.

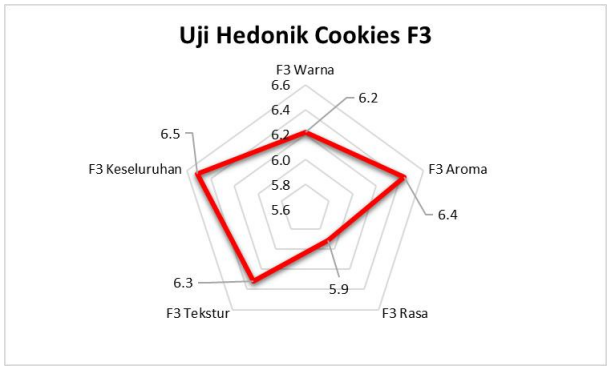

Figure 2. The radar chart of the hedonic test for F3 cookies.

Figure 5 presents the results of the hedonic test for formula F3. The results indicate that the panelists assigned the highest rating to the color parameter, with an average score of 6.6. The aroma and overall product received scores of 6.4 and 6.5, respectively. Meanwhile, the texture was rated at 6.3, and the taste obtained the lowest score of 5.9 in this test.

Overall, F0 emerged as the most favored formula among the panelists, followed by F2, which showed potential as an alternative with the substitution of banana blossom flour. F1 and F3 received lower acceptance levels, particularly in the attributes of taste and aroma. Nevertheless, the panelists were still able to accept the products substituted with banana blossom flour, as evidenced by the scores of each attribute being above 5.5.

Table 1. Results of the Analysis on the Effect of Banana Blossom Flour Substitution on Organoleptic Parameters

Parameters	Formula Type				*p-value*
	F0 (100:0)	**F1 (85:15)**	**F2 (70:30)**	**F3 (55:45)**	
Color	6.92 ± 1.36[a]	6.65 ± 1.44 [a]	6.70 ± 1.28 [a]	6.21 ± 1.49 [a]	0.269
Aroma	6.61 ± 1.59[a]	6.23 ± 1.60 [a]	6.07 ± 1.36 [a]	6.43 ± 1.55 [a]	0.414
Taste	6.97 ± 1.25 [a]	5.99 ± 1.23 [ab]	6.27 ± 1.79 [b]	5.90 ± 1.73 [ab]	0.021*
Texture	6.86 ± 1.43[a]	6.28 ± 1.55 [a]	6.54 ± 1.48 [a]	6.31 ± 1.88 [a]	0.464
Overall	7.36 ± 1.10 [a]	6.68 ± 1.10 [ab]	7.06 ± 1.08 [ab]	6.51 ± 1.43 [a]	0.022*

Notes:
* : Significant effect ($p<0.05$)
a,b : Similar letter notation indicates no significant difference at the 5% level in the Mann-Whitney test.

The results of the analysis of the effect of banana blossom flour substitution on the organoleptic parameters of cookies are presented in Table 1. The analysis reveals a significant effect between the type of formula and the parameters of taste and overall assessment ($p < 0.05$). The highest scores for all aspects are found in formula F0. The lowest score for the color parameter is recorded in F3 (6.21), for aroma in F2 (6.07), for taste in F1 and F3 (5.99 and 5.90, respectively), for texture in F1 (6.28), and for overall assessment in F3 (6.51). Among the formulas with banana blossom flour substitution, it is noted that F2 has a better acceptance compared to F1 and F3.

These results indicate that the substitution of banana blossom flour impacts the taste and overall evaluation of the product, while the aspects of color, aroma, and texture remain consistent across all formulas. This finding suggests that the use of local ingredients such as banana blossom flour can influence the organoleptic characteristics of processed products.

4. DISCUSSION

The nutritional potential of banana blossom flour as a substitute for wheat flour offers significant nutritional benefits, such as a high content of fiber, vitamins, minerals, and antioxidant compounds. In the context of developing healthy snacks, banana blossom flour is a relevant choice as it can enhance fiber content and reduce the caloric value of cookies. Previous studies have also indicated that flour made from local ingredients, such as banana blossoms, can improve the nutritional content of processed foods while supporting local food sustainability. This is also consistent with other findings suggesting the use of local ingredients in formulating healthy snack products as a strategy for food diversification (5,14).

The substitution of banana blossom flour in cookie products results in significant variations in organoleptic properties such as color, taste, aroma, and texture. In formulations with a higher proportion of banana blossom, panelists tend to provide positive evaluations regarding color and texture aspects. However, some challenges arise concerning aroma and taste, particularly related to the distinctive scent of banana blossom flour, which consumers may not be accustomed to. Similar research on the substitution of flour from alternative ingredients, such as bean or cassava flour, indicates that changes in texture and flavor due to the substitution of local ingredients often require adjustments (15).

The results of the organoleptic tests show that cookies with banana blossom flour substitution are generally still

acceptable to panelists, although there is a decline in certain aspects such as taste and aroma. Cookies with formula F0 (100% wheat flour) received the highest scores in terms of taste and overall acceptance; however, formulas with a 30% to 45% substitution of banana blossom flour (F2 and F3) also demonstrated good acceptance, particularly in terms of texture and color. Other studies have also indicated that consumer acceptance of products containing alternative ingredient flours heavily depends on the balance between nutritional benefits and sensory properties (16).

Regarding texture, the substitution of banana blossom flour tends to increase the hardness of the cookies, which was rated fairly positively by the panelists. The color of the products also emerged as one of the most favored aspects in formulas with higher substitution levels, where darker cookie colors were considered appealing by the panelists. This is consistent with previous research indicating that wheat flour substitutes, such as cassava or banana flour, often yield end products with more natural colors and richer textures (16,17).

The use of banana blossom flour in the processed food industry not only provides health benefits but also supports the utilization of local food sources. Banana blossoms, as an alternative raw material, offer significant opportunities for developing healthier and more sustainable products. Research into other local food sources, such as the use of green bean flour and sweet potatoes, shows that local ingredients are often underutilized in large-scale industries but possess considerable potential for development (18).

The use of banana blossom flour in the processed food industry not only provides health benefits but also supports the utilization of local food sources. Banana blossoms, as an alternative raw material, offer significant opportunities for developing healthier and more sustainable products. Research into other local food sources, such as the use of green bean flour and sweet potatoes, shows that local ingredients are often underutilized in large-scale industries but possess considerable potential for development.

5. CONCLUSION

The substitution of banana blossom flour in cookie formulations significantly affects the organoleptic parameters, particularly regarding taste and overall assessment. Formula F0 received the highest scores across all aspects, while formulas F1 and F3 exhibited lower scores, especially in the parameters of taste and aroma. Although formula F2 demonstrated good potential as an alternative with the substitution of banana blossom flour, panelists' evaluations regarding aroma and taste still require improvement. These findings indicate that the use of banana blossom flour not only creates healthier products but also positively impacts the organoleptic characteristics of cookies, while supporting the sustainable utilization of local food sources.

REFERENCES

1. Chen Z, Khandpur N, Desjardins C, Wang L, Monteiro CA, Rossato SL, et al. Ultra-Processed Food Consumption and Risk of Type 2 Diabetes: Three Large Prospective U.S. Cohort Studies. Diabetes Care. 2023 Jul 1;46(7):1335–44.
2. Sigala DM, Stanhope KL. An Exploration of the Role of Sugar-Sweetened Beverage in Promoting Obesity and Health Disparities. Curr Obes Rep. 2021 Jan 7;10(1):39–52.
3. Rabadán A, Nieto R, Bernabéu R. Food Innovation as a Means of

Developing Healthier and More Sustainable Foods. Foods. 2021 Sep 1;10(9):2069.
4. Tachie C, Nwachukwu ID, Aryee ANA. Trends and innovations in the formulation of plant-based foods. Food Prod Process Nutr. 2023 Mar 2;5(1):16.
5. Kukreja N, Sharma P. Composition and Pharmacological Benefits of Banana Blossom: A Brief Review. Agric Rev. 2024 Sep 9;(Of).
6. Shekhara Naik R, Kavya M H, Manasa R, Deepika M, Shivananjappa M. A review on banana flower: Nutritional composition, processed products and health benefits. IP J Nutr Metab Heal Sci. 2023 Sep 28;6(3):110–5.
7. Thagunna B. BANANA BLOSSOM: NUTRITIONAL VALUE, HEALTH BENEFITS AND ITS UTILIZATION. Rev Food Agric. 2023 May 17;4(2):66–70.
8. Fathima Zehla P, Vijayalakshmi D, Suvarna VC, Yatnatti S. Processing of Banana Blossom and its Application in Food Product. Int J Curr Microbiol Appl Sci. 2018 Aug 20;7(08):1243–50.
9. C.P. Ambrose D, Sumithra V, Vijay K, Vinodhini K. Techniques to Improve the Shelf Life of Freshly Harvested Banana Blossoms. Curr Agric Res J. 2018 Aug 28;6(2):141–9.
10. Febriani W, Komala R, Yunianto AE, Fadly D. Proximate analysis of fresh Banana Blossoms and Banana Blossoms Flours in two cultivars of Kepok Banana (Musa Acuminata×Balbisiana) and Janten Banana (Musa Paradisiaca Sapientum). Int J Chem Biochem Sci. 2024 May 18;25(19).
11. Lassi ZS, Padhani ZA, Rabbani A, Rind F, Salam RA, Bhutta ZA. Effects of nutritional interventions during pregnancy on birth, child health and development outcomes: A systematic review of evidence from low- and middle-income countries. Campbell Syst Rev. 2021 Jun 21;17(2).
12. Huey SL, Bhargava A, Friesen VM, Konieczynski EM, Krisher JT, Mbuya MNN, et al. Sensory acceptability of biofortified foods and food products: a systematic review. Nutr Rev. 2024 Jun 10;82(7):892–912.
13. Dourado Gomes Machado TA, Pacheco MTB, do Egypto Queiroga R de CR, Cavalcante LM, Bezerril FF, Ormenese R de CSC, et al. Nutritional, physicochemical and sensorial acceptance of functional cookies enriched with xiquexique (Pilosocereus gounellei) flour. PLoS One. 2021 Aug 10;16(8):e0255287.
14. Shekhara Naik R, Kavya M H, Manasa R, Deepika M, Shivananjappa M. A review on banana flower: Nutritional composition, processed products and health benefits. IP J Nutr Metab Heal Sci. 2023 Sep 28;6(3):110–5.
15. Evanson Inyang U. Physical Properties, Nutritional Composition and Sensory Evaluation of Cookies Prepared from Rice, Unripe Banana and Sprouted Soybean Flour Blends. Int J Food Sci Biotechnol. 2018;3(2):70.
16. Oguntoyinbo OO, Olumurewab J, Omobab O. Physico-Chemical and Sensory Properties of Cookies Produced from Composite Flours of Wheat and Banana Peel Flours. J Food Stab. 2021;4(3):1–21.
17. Nopriantini N, Marudut M, Purba SR, Novia D, Waliyo E, Gambir J. Alkaloid, Protein, Dietary Fiber Content, and

Acceptability of Lacto Cookies Substituted with Banana Blossom (Musa Paradisiaca Linn.) and Fish Flour (Rasbora Argyrotaenia). Amerta Nutr. 2023 Jun 22;7(2):217–23.

18. Mengstu A, Bachheti A, Abate L, Bachheti RK, Husen A. Health-Promoting Benefits, Value-Added Products, and Other Uses of Banana. In: Non-Timber Forest Products. Cham: Springer International Publishing; 2021. p. 339–64.