Precision baking: Crafting the ultimate roll cake with bôh gadông flour

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ABSTRACT

This study explores the underutilized potential of bôh gadông flour, derived from Dioscorea alata tubers, as an ingredient in roll cake production. Despite its abundance in certain regions, the use of bôh gadông in modern culinary applications remains limited. This research aims to address this gap by (1) standardizing roll cake recipes incorporating bôh gadông flour, (2) evaluating the organoleptic attributes (color, aroma, texture, and taste) of the cakes, (3) assessing consumer acceptance of bôh gadông flour roll cakes, and (4) analyzing the storage quality of the cakes over time. Conducted through experimental research at the Catering Laboratory of the Family Welfare Education Program, Universitas Syiah Kuala, the study employs quantitative methods. Observational data are analyzed using mean calculations, while consumer acceptance data undergo one-way ANOVA followed by LSD analysis. Results reveal that the second treatment (BG1) achieves superior scores in color, aroma, and taste. Additionally, bôh gadông roll cakes maintain satisfactory storage quality for up to two days when stored in airtight containers. These findings highlight the potential of bôh gadông flour in enhancing local culinary innovation. Future studies should explore its application in other snack varieties and include proximate testing to determine nutritional composition.

1. INTRODUCTION

Indonesia, a country rich in biodiversity, is home to various types of tubers commonly found in the local environment (Cleary & Devantier, 2011; Fadhilah et al., 2023). These tubers, known for their carbohydrate content, have long been recognized as alternative food sources to substitute rice (Abdullah et al., 2023; Yonathan et al., 2021). Among these, bôh gadông or *Dioscorea alata* stands out due to its nutritional and functional properties (Soeprobowati & Nafisa, 2019). Despite its potential, the utilization of bôh gadông in modern culinary applications remains underexplored, particularly in the development of innovative and health-conscious food products like rolled sponge cakes.

Bôh gadông, widely referred to as *uwi* in Java, *lament* in Sulawesi, *same* in Makassar, and *late* in Maluku, is predominantly found growing wild in forests (Pusporini & Anggraini, 2016). This tuber, with its distinctive deep purple flesh and rich nutritional profile, contains high levels of dietary fiber and amylose, making it suitable for consumers with specific dietary needs, such as individuals with diabetes or children requiring gluten-free diets (Olubobokun et al., 2013; Wireko-Manu et al., 2013). Moreover, bôh gadông flour is gluten-free and exhibits high amylose content, positioning it as a promising ingredient for health-conscious and locally sourced food innovations (Baah et al., 2009).

While rolled sponge cake, a globally favored dessert, is traditionally made with wheat flour (Sulistyo et al., 2023), the substitution of wheat flour with locally sourced ingredients like bôh gadông flour represents an opportunity to meet the growing consumer demand for healthier and more sustainable products (Dufie et al., 2013). Furthermore, this substitution aligns with the increasing trend toward local culinary innovation and the utilization of underutilized crops to enhance food security (Masters, 2021; Wanita et al., 2021).

However, despite the promising attributes of bôh gadông, there is limited research linking its application to specific food products. This study addresses this gap by investigating the potential of bôh gadông flour as a substitute ingredient in rolled sponge cake production. The research seeks to answer the following questions:

a. How can bôh gadông flour be incorporated into standardized rolled sponge cake recipes?
b. What are the sensory attributes (color, aroma, texture, and taste) of rolled sponge cakes made with bôh gadông flour?
c. What is the level of consumer acceptance for these products?
d. How does the storage quality of these cakes vary over time?

By addressing those questions, this study aims to bridge the gap between the potential of bôh gadông and its application in food products, contributing to the growing body of knowledge in sustainable food innovation. Additionally, this research seeks to highlight the relevance of bôh gadông to current market needs, particularly for locally sourced, health-oriented, and sustainable food options.

2. METHODOLOGY

This research employed an experimental design with a quantitative approach to investigate the potential of bôh gadông flour in rolled sponge cake production (Arikunto, 1998, 2010). The study aimed to analyze the effects of varying concentrations of bôh gadông flour on the sensory attributes and consumer acceptance of the resulting cakes.

The experimental procedure involved the preparation of rolled sponge cakes using three different concentrations of bôh gadông flour: 0% (control), 12.5%, and 15%. These concentrations were chosen based on preliminary trials that demonstrated their feasibility in achieving the desired texture and flavor without compromising the structural integrity of the sponge cakes. The control group (0%) used 100% wheat flour to allow direct comparison with the experimental groups.

The sensory attributes evaluated in this study included color, aroma, texture, and taste, which served as the dependent variables. These attributes were assessed by a panel of seven lecturers from the Catering Department at FKIP Universitas Syiah Kuala, selected for their expertise in food evaluation. In addition, consumer acceptance testing was conducted with 30 student panelists from the Family Welfare Education Program (PKK) at Universitas Syiah Kuala. These participants were aged 18–25 years, representing a demographic group familiar with modern and traditional food products. The panel size was selected as a preliminary study sample due to logistical constraints, with future studies recommended to involve larger and more diverse panel sizes for broader generalizability.

The data analysis consisted of both descriptive and inferential statistical methods. Descriptive statistics, such as mean and standard deviation, were used to summarize the observational data. For consumer acceptance testing, a one-way Analysis of Variance (ANOVA) was employed to determine the effect of bôh gadông flour concentrations on sensory attributes. ANOVA was chosen due to its ability to compare mean differences among multiple groups and identify statistically significant variations. A significance level of 0.05 ($p < 0.05$) was applied to assess whether the differences observed were not due to chance. When ANOVA results indicated significant differences, post-hoc testing using the Least Significant Difference (LSD) method was performed to pinpoint which specific groups differed.

The panelist demographic was primarily composed of young adults with exposure to various culinary products, providing insights into the acceptability of bôh gadông flour in modern food applications. This demographic is particularly relevant for assessing the market potential of innovative food products targeting younger consumers.

The research object, rolled sponge cake made from bôh gadông flour, was stored in airtight containers to evaluate storage quality. Observations were conducted over a two-day period, focusing on sensory changes. This duration was chosen based on the typical shelf life of similar cakes under similar storage conditions.

Observation Test (Sensory Evaluation)

The observation test for the control recipe involved seven sources, with three samples presented for each. A code number was assigned to each treatment.

Acceptability Test

The acceptance test for each treatment involved 30 consumer panelists from the Family Welfare Education Program, Syiah Kuala University students. Three samples were presented for each treatment, and a code number was assigned to each treatment. The study utilized the Hedonic Scale assessment card for acceptance testing (Pranata et al., 2020; Sufiat et al., 2017; Suhairi et al., 2022). According to Suhairi et al. (2023) and Suhairi & Gagarin (2024), the acceptance test using a hedonic scale comprises five levels, as shown in Table 1 below.

Table 1. *Hedonic Scale* (Assessment Card for Acceptance Testing)

Number	Acceptance Test	Score
1	Very Like	5
2	Like	4
3	Neutral	3
4	Dislike	2
5	Very Dislike	1

The data from the acceptance test, encompassing aspects of color, aroma, texture, and taste, were analyzed using one-way analysis of variance (ANOVA). If a significant influence is detected, further analysis is conducted through the LSD (Least Significant Difference) test at a significance level of 0.05 (Suhairi & Gagarin, 2024).

3. RESULTS AND DISCUSSION

Observation Test (Sensory Evaluation)

Based on the research results, it can be concluded that the sources assessing the organoleptic characteristics (color, aroma, texture, and taste) of bôh gadông flour rolled sponge cake rated the BG1 treatment highest, utilizing 25 g (12.5%) of bôh gadông flour, with an average value of 23.92, as depicted in Figure 1.

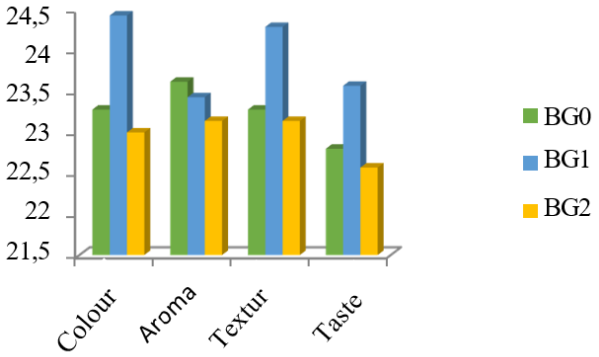

Figure 1. Average Assessment of Sources
Regarding the Overall Treatment of Rolled Bolu with the Addition of Bôh Gadông Flour
Note: BG0 = rolled sponge cake without adding bôh gadông flour (control recipe);
BG1 = rolled sponge cake with the addition of 25 grams of bôh gadông flour (12.5%);
BG2 = rolled sponge cake with the addition of 30 grams of bôh gadông flour (15%)

Acceptability Test

Based on the results of acceptance tests by consumer panelists on the organoleptic characteristics (color, aroma, texture, and taste) of bôh gadông flour rolled sponge cake, an average rating of 3.92 was obtained for the second treatment (BG1), utilizing 25 grams (12.5%) of bôh gadông flour, as shown in Figure 2.

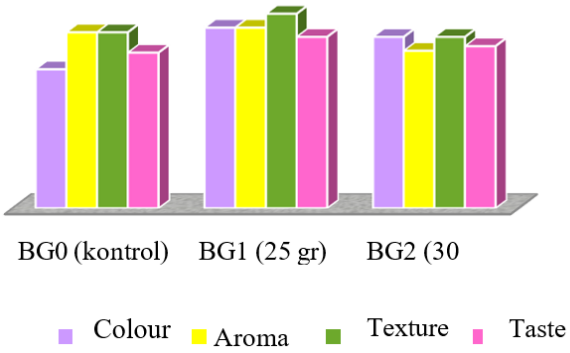

Figure 2. Consumer Acceptance of Overall Organoleptic Characteristics of Bôh Gadông Flour Rolled Sponge Cake

Note: BG0 = rolled sponge cake without adding bôh gadông flour (control recipe);
BG1 = rolled sponge cake with the addition of 25 grams of bôh gadông flour (12.5%);
BG2 = rolled sponge cake with the addition of 30 grams of bôh gadông flour (15%)

The results of this study align with the research objective, which aimed to determine the optimal concentration of bôh gadông flour in rolled sponge cake production and analyze its impact on sensory attributes. The findings indicate that the second treatment (BG1), utilizing 25 grams (12.5%) of bôh gadông flour, was the most preferred by both expert panelists and consumers, achieving the highest average sensory score of 23.92. This treatment outperformed the control group (BG0) and the third treatment (BG2), highlighting the potential of bôh gadông flour as a functional ingredient in bakery products.

The superior performance of BG1 can be attributed to several factors. First, the proportion of ingredients in BG1 strikes an optimal balance between the characteristics of bôh gadông flour and wheat flour. The 12.5% concentration of bôh gadông flour contributes to its unique attributes without overwhelming the structural integrity or sensory appeal of the sponge cake. In contrast, BG0 lacked the distinctive characteristics imparted by bôh gadông flour, while BG2 (15% concentration) may have introduced an excessive proportion of bôh gadông flour, potentially leading to a denser texture and a flavor profile less acceptable to the panelists.

The purple color of bôh gadông flour, derived from its natural anthocyanin content, significantly influenced the sensory perception of the product. As noted by (Aderibigbe & Kolade, 2003), color is a critical factor in food evaluation, shaping the initial visual impression and overall appeal. The balanced incorporation of bôh gadông flour in BG1 produced a visually appealing hue that enhanced consumer acceptability.

In terms of aroma, the distinctive scent of bôh gadông flour, characterized by its earthy and slightly nutty notes, added complexity to the aroma profile of BG1. This is consistent with (Hazrati et al., 2021), who noted that aroma is a subjective attribute shaped by individual sensitivities. The moderate concentration in BG1 likely allowed the aroma to complement rather than overpower the overall profile, contributing to its higher score compared to BG2, where a stronger aroma might have detracted from its appeal.

The texture of BG1 was noted for its lightness and sponginess, likely due to the synergistic effect of the 12.5% bôh gadông flour concentration and the emulsifying agents used. Excessive fiber content in BG2 may have disrupted the desired airy structure, leading to a denser and less desirable texture.

The taste of BG1 benefited from the moderate inclusion of bôh gadông flour, which provided a subtle earthy flavor that complemented the sweetness of the sponge cake. The balance achieved in BG1's formulation may have been less evident in BG2, where the higher concentration of bôh gadông flour could have introduced a more pronounced, potentially off-putting flavor.

These findings suggest that bôh gadông flour, when used at an optimal concentration, can enhance the sensory attributes of bakery products. This has practical implications for the development of locally-based culinary innovations. The success of BG1 highlights the potential for using bôh gadông flour in other products, such as cookies, pancakes, or muffins, to diversify food offerings while promoting the utilization of local ingredients.

Further research could explore the nutritional benefits of bôh gadông flour, such as its fiber and antioxidant content, and their contribution to the functional properties of the products. Additionally, expanding consumer panel size and demographic diversity in future studies could provide broader insights into market acceptability and help refine the formulation for commercial applications.

Proving Research Hypothesis

Based on the research results, the hypothesis is confirmed through a one-way analysis of variance (ANOVA) and a subsequent Least Significant Difference (LSD) test at a significance level of 0.05. The analysis demonstrated that $F_{Count} > F_{Table}$, indicating a statistically significant influence of the concentration of bôh gadông flour on the sensory attributes (color, aroma, texture, and taste) of the rolled sponge cake.

The acceptance of H_1 is further validated by observable differences in the sensory characteristics of bôh gadông flour rolled sponge cake compared to the control recipe. The second treatment (BG1), which incorporated 12.5% (25 grams) of bôh gadông flour, achieved the highest average score (23.92) across all sensory parameters, outperforming both the first

treatment (BG0) with 0% bôh gadông flour and the third treatment (BG2) with 15% (30 grams) bôh gadông flour.

These differences can be attributed to the unique attributes of bôh gadông flour, such as its purple color derived from anthocyanins, its earthy and nutty aroma, and its contribution to the overall texture and flavor profile of the sponge cake. The optimal proportion in BG1 balanced these characteristics effectively, enhancing sensory appeal and consumer acceptability.

The results highlight the significant role of ingredient concentration in influencing product quality and consumer preferences. This evidence strengthens the hypothesis that the inclusion of bôh gadông flour in the recipe significantly affects the sensory properties and acceptability of rolled sponge cakes.

4. CONCLUSION

The findings of this study conclude that the second treatment (BG1), incorporating 25 grams (12.5%) of bôh gadông flour, emerged as the preferred recipe for rolled sponge cake, based on evaluations from both resource persons and consumer panelists. This recipe demonstrated superior sensory attributes, including color, aroma, texture, and taste, achieving an average score of 23.93 from resource persons and 3.92 from consumer panelists. The standard recipe consists of 25 grams of bôh gadông flour, 25 grams of wheat flour, 2.5 grams of baking powder, 50 grams of granulated sugar, four eggs, 2.5 grams of cake emulsifier, and 50 grams of margarine. Disparities in preferences between resource persons and consumers, particularly regarding color, highlight the influence of demographic factors such as age and knowledge levels. Observations of the storage quality indicated that bôh gadông flour rolled sponge cakes maintain optimal quality for up to two days in a closed container, suggesting a relatively short shelf life compared to conventional products.

The study highlights the broader implications of utilizing bôh gadông flour in innovative culinary products. Its high nutritional value and unique sensory characteristics position it as a promising ingredient for expanding food diversity and promoting health benefits. Moreover, the development of bôh gadông-based products has the potential to drive socio-economic growth, particularly in local communities, by encouraging the cultivation and commercialization of *Dioscorea alata*.

Despite these promising findings, the study has several limitations. The relatively small number of consumer panelists, while adequate for preliminary research, limits the generalizability of the results. Additionally, storage quality tests were insufficiently detailed, necessitating further exploration of methods to extend shelf life. Future research should focus on proximate analyses of bôh gadông flour products to better understand their nutritional

composition, as well as investigating their potential application in various snack products. Furthermore, studies exploring the socio-economic impact of bôh gadông flour utilization, particularly for rural and local communities, would provide valuable insights into its broader benefits. By addressing these limitations and exploring new directions, future research can further establish bôh gadông flour as a sustainable and nutritious ingredient for culinary innovation.

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