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# DEVELOPMENT OF CUSTARD CREAM BASED ON BANANA PEELS (MUSA PARADISIACA) AND TARO FLOUR (COLOCASIA ESCULENTA L) APPLIED TO HORN PASTRY AS A SNACK SOURCE OF FIBER FOR SCHOOL-AGE CHILDREN

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## ABSTRACT

The prevalence of obese school-age children (5-12 years old) in Jakarta is higher than the national prevalence, which is 14.0%. Children who are at risk of becoming obese are those who frequently snack excessively, resulting in a reduced intake of dietary fiber. Consumption of fiber-based foods is one of the solutions in overcoming obesity in school-age children by innovating a product by utilizing banana peels and taro flour as local food ingredients. This study aimed to assess the potential and nutritional benefits of incorporating banana peels and taro flour into the production of custard cream used in horn pastries as an innovative approach serves as a source-fiber snack option for school-age children. This type of research is an experimental study with 4 formulation with concentrations of banana peels and taro flour in four treatments. The research proceeded by evaluating sensory perceptions among school-age children using the Facial Likert, analyzing nutrients which were proximate values and analysis of dietary fiber content. All data were statistically analyzed using One-Way ANOVA followed by Duncan's test. Based on the results of all parameters (color, taste, smell, texture and overall) showed significant differences in each formulation with the F2 formulation which was preferred by the panelists. For the analysis of nutritional content, the selected formulation with the best content was obtained in F2 with the highest content of dietary fiber 4.00%. Overall, the F2 formulation which has the most favorable content, emerges as the preferred option.

Keywords: snack, dietary fiber, banana peel, taro flour

## Introduction

The problem of obesity in Indonesia is commonly observed among school-age children. The prevalence of obesity and excessive weight among school-age children in Indonesia has significantly increased[1]. The Basic Health Research (2018) revealed that the prevalence of obesity among school-age children aged 5-12 years in Indonesia is 8.0%. In DKI Jakarta, the prevalence of obesity cases is even higher than the national average, reaching 14.0%[2]. This is connected to the fact that a greater proportion of school-age children with obesity are found in urban areas, where the prevalence of obesity is higher reaching 10.5%, while in rural regions the prevalence is lower at 7.8%[3].

Various types of foods sold in schools are snacks with high sugar and calorie content and low fiber[4]. Children who have a preference for excessive snacking are 7,012 times more likely to suffer from overweight or obesity compared to children who do not have a preference for snacking[5]. Various types of foods sold in schools are snacks with high sugar and calorie content

and low fiber. Consuming fiber-rich and low-calorie foods can be a solution to address obesity in school-age children[4].

Banana peels are often discarded as waste, and their potential as a functional local food resource for creating various healthy and nutritious processed foods is underutilized due to a lack of public understanding.. Banana peels are a local food material that contains a considerable amount of fiber, with the fiber content in large banana peels being 65.2 g and in small banana peels being 62.8 g[6]. Banana peels from "kepok" bananas have higher fiber content compared to "ambon" banana peels[7]. Furthermore, taro is recognized as an additional indigenous dietary source abundant in fiber, boasting 5.3 grams of fiber per 100 grams of steamed taro. The fiber present in taro sufficiently meets 20.5% of the daily fiber requirement, contributing positively to digestive health[8]. Taro flour emerges as a potential alternative to replace wheat flour since it can be integrated into food product formulations as a substitute for conventional flour[9].

Generally, children are attracted to sweet foods with a soft, tender texture and appealing appearance[10]. Custard cream is a dairy-based cream with a sweet taste and a soft texture, commonly used for decoration, filling, or topping various types of pastries and cakes[11]. Children tend to favor light snacks consisting of a crispy outer layer and a creamy filling which orn pastry is a type of puff pastry with a horn-shaped appearance, featuring a crispy outer layer filled with cream[12].

The high prevalence of obesity among school-age children is caused by the low intake of fiber, resulting in unhealthy eating habits in children. Based on the aforementioned background, to reduce the incidence of obesity involves innovating custard cream that can be applied to snacks as a well-known alternative with high energy, sugar, and fat content, transforming it into a fiber-rich snack for school-age children. This is achieved by utilizing banana peels and taro flour in making custard cream for horn pastries. The advantage of the research it is not only determining the formulation but also enhancing the fiber content in the product. It is anticipated that the obesity rate among school-age children can be reduced through the innovation of custard cream using banana peels and taro flour as ingredients.

## Methods

The research design employed in this study is experimental, involving the modification of four formulations (F0, F1, F2, F3) with varying concentrations of banana peels and taro flour. In determining the addition of banana peels and taro flour in custard cream production, a preliminary study was conducted through trial and error. Following the product trial and error phase, four formulations (F0, F1, F2, F3) were obtained with the best treatments for the addition of banana peels to taro flour with each formulations consist of 0 g: 0 g, 120 g: 30 g, 130 g: 20 g, and 140 g: 10g. The research continued with sensory

analysis conducted on a panel of consumer participants, specifically 80 school-age children with the inclusion criteria of school children aged 10-12 years, not in a sick condition that may impair their senses (such as having the flu or a cough) for organoleptic assessment, not feeling hungry, thirsty, or overly full, not having allergies to specific food ingredients, and not being color blind.. This analysis aimed to assess the likability of each custard cream formulation applied to horn pastries. Proximate testing was carried out in the laboratory at Saraswanti Indo Genetech located in Bogor, examining proximate content and dietary fiber content of the products.

Data analysis in this study utilized Microsoft Excel 2019 and SPSS software version 25. All collected data were compiled and subjected to statistical analysis using the One Way Anova test or F-test, followed by the Duncan post hoc test to identify differences in acceptability and nutrient content among the various formulations. Ethical clearance for this study has been granted by the Research Ethics Commission of Esa Unggul University under the reference number 0923-07.007/DPKE-KEP/FINAL-EA/UEU/VII/2023.

## Results

Sensory analysis was conducted on consumer panelists, specifically 80 school-age children. Panelists performed hedonic tests on custard cream applied in horn pastries with the addition of banana peels and taro flour in the proportions of 0 g : 0 g (F0), 120 g : 30 g (F1), 130 g : 20 g (F2), and 140 g : 10 g (F3). Selection of the preferred formulation was determined by observing the highest average scores from the hedonic test. The results of the hedonic test for substituted custard cream with banana peels and taro flour can be found in Table 1.

**Table 1. Hasil Pengujian Sensoris Vla**

| Parameter | Formulation (Mean ± SD) | | | | *p* |
|---|---|---|---|---|---|
| | F0 | F1 | F2 | F3 | |
| Taste | $3.34 \pm 1.07^{c}$ | $2.28 \pm 0.90^{a}$ | $2.84 \pm 0.83^{b}$ | $2.21 \pm 0.84^{a}$ | 0.000* |
| Color | $3.31 \pm 0.74^{c}$ | $2.34 \pm 0.76^{a}$ | $2.65 \pm 0.73^{b}$ | $2.33 \pm 0.78^{a}$ | 0.000* |
| Aroma | $2.56 \pm 0.93^{b}$ | $2.18 \pm 0.73^{a}$ | $2.46 \pm 0.78^{b}$ | $2.13 \pm 0.89^{a}$ | 0.001* |
| Texture | $3.06 \pm 0.74^{b}$ | $2.56 \pm 0.85^{a}$ | $2.99 \pm 0.74^{b}$ | $2.36 \pm 0.69^{a}$ | 0.000* |
| Overall | $3.33 \pm 1.03^{b}$ | $2.46 \pm 0.99^{a}$ | $3.16 \pm 0.95^{b}$ | $2.39 \pm 0{,}80^{a}$ | 0.000* |

Note: Attribute scale is 1 = strongly dislike to 5 = very much like; Different superscript values (letters a-d) indicate significant differences between treatments within a row ($p<0.05$ or values indicated with the symbol *) based on the One Way Anova test, post hoc Duncan.

Based on Table 2, the results of the One-Way ANOVA analysis on sensory analysis for all parameters including taste, color, aroma, texture, and overall perception yielded significant values ($P<0.05$). This indicates differences in taste, color, aroma, texture, and overall perception among

the four custard cream formulations. It can be observed that the formulation with the highest or most preferred score initially is F0, followed by the second preference, F2. Furthermore, in the Duncan post hoc test, it was found that taste in formulations F0 and F2 significantly differed from all other formulations, while F1 showed no significant difference from F3. In terms of color parameter, the results indicated significant differences between the following pairs: F0 - F1, F0 - F3, F1 - F2, F2 - F3; however, F0 - F2 showed no significant difference. Similar trends were observed for aroma, texture, and overall perception of the custard cream. Significant differences were found between pairs: F0 - F1, F0 - F3, F1 - F2, F2 - F3; yet, no significant differences were observed between F0 - F2 and F1 - F3. Following the sensory evaluation, the control formula and the selected formulation underwent proximate analysis to determine the content of moisture, ash, fat, protein, carbohydrates, and dietary fiber. This analysis aimed to assess the nutritional content present in the control and selected custard cream formulations. The results of the proximate analysis are presented in Table 2.

**Tabel 2. Hasil analisis proksimat vla/100g**

| Parameter | Formulation (Mean ± SD) | | | | P |
|---|---|---|---|---|---|
| | F0 (Kontrol) | F1 | F2 | F3 | |
| Water Content (g) | 81,46 ± 0.28$^{d}$ | 72.01 ± 0.21$^{a}$ | 76,13 ± 0.18$^{b}$ | 78,47 ± 0.11$^{c}$ | 0.000 |
| Ash Content (g) | 0.79 ± 0.01$^{a}$ | 1.97 ± 0.21$^{d}$ | 1.65 ± 0.14$^{b}$ | 1.88 ± 0.14$^{c}$ | 0.000 |
| Total Energy (kcal) | 75. 18 ± 1.09$^{a}$ | 111.25 ± 0.73$^{d}$ | 96.03 ± 0.47$^{c}$ | 83.88 ± 0.40$^{b}$ | 0.000 |
| Protein (g) | 3.06 ± 0.06$^{d}$ | 2.86 ± 0.06$^{c}$ | 2.60 ± 0.07$^{b}$ | 1.88 ±0.01$^{a}$ | 0.000 |
| Total Fat (g) | 0.84 ± 0.01$^{a}$ | 1.43 ± 0.04$^{c}$ | 1.43 ± 0.04$^{c}$ | 1.06 ± 0.02$^{b}$ | 0.000 |
| Carbohdyrates (g) | 13.84 ± 0.36$^{a}$ | 21.75 ± 0.33$^{d}$ | 18.16 ± 0.21$^{c}$ | 15.97 ± 0.09$^{b}$ | 0.000 |
| Dietary Fiber (g) | 2.47 ± 0.03$^{a}$ | 3.83 ± 0.03$^{c}$ | 4.00 ± 0.14$^{c}$ | 3.36 ± 0.00$^{b}$ | 0.000 |

Note: Different superscript values (letters a-d) indicate significant differences between treatments within a row ($p<0.05$ or values indicated with the symbol *) based on the One Way Anova test, post hoc Duncan.

Based on Table 2, the results of the One-Way ANOVA test for moisture content, ash content, total energy, protein, total fat, carbohydrates, and dietary fiber content yielded significant values ($P<0.05$). This indicates differences in moisture content, ash content, total energy, protein, total fat, carbohydrates, and dietary fiber content among the four custard cream formulations. It can be observed that there are changes in nutritional content after the addition of banana peels and taro flour in each formulation.

The application of custard cream can be used in various types of food products or sweet snacks such as cream puffs, puddings, or various other products. One of the products that can be filled with custard cream is horn pastry. In Table 3, it shows that by consuming 1 serving of horn pastry consisting of 25 g of custard cream and 35 g of pastry, it provides 7% of protein, 6% of total fat, 7% of carbohydrates, and fulfills 13% of the dietary fiber needs for school-age children.

**Table 3. Nutrition Facts of Custard Cream applied to Horn Pastry**

| **Nutrition Facts** | |
|---|---|
| Serving size 2 package (60 g) | |
| Amount Per Serving | |
| Calories **1**48 | Calories from fat 44 |
| | **%Daily Value*** |
| Total fat | 7% |
| Protein | 6% |
| Carbohydrate | 7% |
| Dietary fiber | 13% |
| *Percent daily values are based on 2150 calorie diet. | |

## Discussion

Sensory evaluation is influenced by various aspects encompassing taste, color, aroma, and texture of the product. Consumer assessment of a food item is often determined by the flavor it evokes. Taste stands as a crucial factor in the organoleptic attributes of a product[13]. The selected formulation with the addition of banana peels and taro flour is obtained in F2 formulation, which tends to have a sweet taste with a noticeable banana flavor. Regarding taste, an increased addition of banana peels does not reduce the panelists' preference for custard cream, contrary to[14], who suggest that excessive banana peel addition leads to decreased liability.

Product color is a significant factor attracting consumers' attention, as it provides an impression of preference or dislike. The color of F2 formulation tends to be dark, a deep brown with a touch of gold. This aligns with another research that significant color differences emerge due to the addition of banana peels in banana skin steam cake, producing hues ranging from deep brown to golden yellow based on the amount of peel added. The brown color in the custard cream is a result of the browning effect caused by banana peels[15]. The brown color change stems from enzymatic browning in banana peels, where polyphenol oxidase enzymes react with non-enzymatic oxidative compounds, resulting in a bright brown color[16]. Aroma of a product significantly affects consumers' liking or acceptance before they consume it[17]. In this study, panelists tend to be less fond of the aroma in each formulation containing banana peels and taro flour. The dislike for stronger banana aroma with increased banana peel content corresponds one’s research, which indicates that banana skin extract formulations have the lowest preference due to a higher proportion of banana peel, leading to a dominant banana aroma[18].Texture in food is among the factors influencing consumers' acceptance of food products. Panelists tend to favor the texture of F0 and F2 formulations due to their soft and not overly dense consistency when consumed. Texture softness, influenced by the specific addition of banana peels and taro flour, aligns with another

research in which the statement is that soft texture in ice cream with added banana peels arises from pectin compounds forming gel, binding water, and stabilizing texture[19.]

In proximate analysis, determining water content plays a crucial role in assessing food quality and measuring the dry or solid part of the food as it affects the quality and shelf life of the food20. This is in contrast to other research that found an increase in water content in banana skin steam cake after adding banana peels. This difference may arise from higher water content in formulations with banana peels compared to the control formula without banana peels15. High ash content indicates a higher mineral content in food[21]. Higher ash content implies lower product quality, while lower ash content indicates better food product quality. Increased ash content could be influenced by the concentration of banana peels and taro flour. In this study, the highest ash content is found in the formulation with the most taro flour[22]. The more taro flour added, the higher the resulting ash content, a finding in line with another research where the highest ash content in mochi formulations occurs with the highest taro flour proportion, indicating an increase with greater addition[23]. Food protein content affects texture, taste, and nutritional value[24]. Analyzing protein content is essential as it serves as a significant source of nutrition for growth and tissue repair and ensures the product contains an adequate amount of protein[25]. Protein content in custard cream decreases with increased addition of banana peels. This contrasts with another research, which found higher protein content in formulations with banana peels[16]. The fat content in food products affects texture and taste. Fat serves various bodily functions. In this study, there is an increase in fat content after adding banana peels and taro flour. This increase corresponds with another research of making ice cream products, where fat content increases from 3.77% in the control formula to 4.01% after adding banana peels[16]. Carbohydrates are an essential source of energy and play a role in determining characteristics like taste, color, and texture in food items[26]. The study results indicate an increase in carbohydrate content with the addition of banana peels and taro flour. This finding aligns with a research on ice cream products, showing increased carbohydrate content after adding banana peels compared to the control formula[27].

Dietary fiber's role in nutritional analysis involves determining its presence in food products, essential to understand the importance of fiber in human health[28]. This study shows that higher addition of banana peels and taro flour increases dietary fiber content. This result is in line with another study, demonstrating varied fiber content in three ice cream formulations with added banana peels, resulting in higher fiber content compared to formulations without banana peels[29]. From the nutritional content obtained, by consuming 2 servings of custard cream applied to horn pastries, it can fulfill 24% of the fiber needs for school-age children. This is in line with (BPOM RI, 2013), which states that snacks should ideally contribute around 12-15% to meet daily needs[30].

**Conclusion**

The sensory (hedonic) test conducted on consumer panelists, namely school-age children, revealed that the preferred and most favored formulation was found in Formulation F2, with color (liked), taste (liked), aroma (disliked), texture (liked), and overall impression (liked). The nutritional analysis of the selected product, which had the best content, was found in Formulation F2 with a water content of 76.13 g, ash content of 1.65 g, energy content of 96.03 kcal, protein content of 2.60 g, fat content of 1.43 g, carbohydrate content of 18.16 g, and dietary fiber content of 4.00 g. Further research is recommended to enhance the product in terms of color by adding food coloring and improving aroma by formulating with additional ingredients that can mask the banana aroma, thereby enhancing consumer accept

ance, particularly among school-age children.

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**Conflict of Interest**

The author(s) of this study have verified that there are no conflicts of interest related to the research and its publication.

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