



Optimizing the Use of Banana Fruit and Peels in Making Torched Banana Tart

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Received: July 28, 2026	Revised: July 31, 2026	Accepted: August 11, 2026	Published: Agustus 17, 2026
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ABSTRACT

Banana is one of the fruits with high production and consumption levels in Indonesia, resulting in large amounts of banana peel waste that has not been optimally utilized, even though banana peel contains fiber and bioactive compounds that have the potential to be used as food ingredients. This study aims to develop a pastry product in the form of torched banana tart by utilizing processed banana peels in the form of banana peel powder and candied banana peel, and to determine the level of consumer acceptance of the experimental product. The study used a quantitative method with an experimental approach. Data collection was carried out through organoleptic and hedonic tests on 59 panelists consisting of untrained panelists, academics, and culinary practitioners. Data were analyzed using Microsoft Excel and IBM SPSS Statistics with normality, homogeneity, and One-Way ANOVA test features. The results showed that *torched banana tart* obtained a good level of acceptance in the aspects of taste, aroma, texture, color, appearance, and hedonic with an overall average of 4.33. The results of the One-Way ANOVA test showed a significance value greater than 0.05 (Sig. 0.409), so there was no significant difference between *the torched banana tart* and *custard banana tart* as comparison products. Thus, the utilization of processed banana peels can produce pastry products that are acceptable to consumers while also supporting *food waste reduction*.

Keywords: *Banana, banana peel, banana peel processing, food waste, banana tart.*

Background

Indonesia is a tropical country with an abundance of fruit varieties, one of which is bananas. Based on data from the Central Statistics Agency (BPS) in 2025, in 2024 bananas were recorded as the fruit with the largest production value, reaching 9.68 million tons, making them the most frequently cultivated and most consumed commodity by the public [1]. Bananas are popular because they are affordable, readily available, and contain fiber,

potassium, vitamin C, and vitamin B6 which are beneficial for health [2].

The variety of banana-based products, from fried foods and traditional cakes to modern *desserts*, has increased banana consumption in various sectors, including households, MSMEs, and the culinary industry. However, this high banana consumption also results in the large amount of organic waste produced, particularly banana peels. In practice, most people only consume the banana flesh, while the peels are immediately discarded and considered to have no use value [3]. Waste that is not managed properly can cause pollution, unpleasant odors, and the potential for the growth of harmful microorganisms [4].

In fact, banana peels contain nutrients that are no less than the fruit flesh, such as dietary fiber, carbohydrates, potassium, and bioactive compounds that act as antioxidants [5]. Several previous studies have explored the use of banana peel waste. Putri et al. [3] showed that banana peels can be processed into fertilizer, animal feed, and food products. Tan et al. [6] processed banana peels into functional powder as a prebiotic ingredient, while Krisnanda et al. [7] substituted kapok banana peel flour in banana strudel products. These studies generally still focus on one form of processed banana peel in one type of product.

This research is different because it develops a torched banana tart by combining Cavendish bananas as the main ingredient and two forms of processed banana peels at once, namely banana peel powder and candied banana peel, in one pastry product. Torched banana tart is a banana-based tart combined with a torching technique on the top to produce a caramelization effect and an attractive appearance [8]. The use of all parts of the banana, both flesh and skin, is in line with the concept of sustainability and zero waste cooking which emphasizes the efficient use



of food ingredients and reducing food waste [9] .

The changing trend of downward consumption is driving the development of this product. Consumers now consider not only taste, but also the health, nutritional value, and environmental impact of the products they consume [10] . The pastry sector has a great opportunity to respond to this trend by exploring alternative raw materials that are not widely utilized, such as banana peels. However, banana peels cannot be used directly without proper processing to ensure they are safe to consume, have the appropriate texture, and do not produce undesirable flavors.

Based on the description, the formulation of the problem of this research is how to formulate an effective torched banana tart to utilize banana peels as a safe and functional raw material, and how is the consumer acceptance of the product in an effort to reduce food waste. In line with the formulation of the problem, this study aims to develop and evaluate the formulation of banana peels as a substitute raw material for torched banana tarts, as well as identify consumer acceptance of the product. This research is expected to provide theoretical contributions to the development of food technology and pastry science, especially in the utilization of fruit peel waste, as well as practical benefits for industry players and the community as an alternative food product and pastry, especially in the utilization of fruit peel waste, as well as practical benefits for industry players and the community as an alternative food product that is innovative, nutritious, and environmentally friendly.

Literatur Review

A. Pastries and Desserts

Pastry comes from the French word *pâtisserie* which means cakes, namely the knowledge of processing and serving various cakes from the preparation of ingredients to the final presentation [11] . In the modern culinary industry, pastry is not only seen as a cooking process, but also as a culinary art that prioritizes creativity, precision, and innovation of alternative raw materials that are healthier and more environmentally friendly [9] , [12] . One branch of pastry is pastry, namely a product made from flour, fat, and liquid which is processed through mixing, folding, molding, and baking to produce a light, crispy, or layered texture, such as puff pastry, pie, tart [13] .

Dessert is a dessert that is synonymous with a sweet taste and is generally served after the main meal [14] . Desserts can be grouped into hot desserts, which are served

warm through baking, boiling, or frying so that they maintain their distinctive aroma and texture [13] ; and cold desserts which are served cold after a cooling process so that after the cooling process they produce a more stable texture, such as pudding, mousse, and various tarts filled with custard or pastry cream [13] . Consumer preferences for modern desserts are now shifting towards healthier, more nutritious, and more sustainable products through the use of alternative ingredients [15] .

B. Tart

Tart is a pastry product in the form of a baked dish consisting of a thin dough made from flour filled with fruit, custard, cream, or other ingredients [8] . The main characteristic of tart lies in the combination of a crispy skin texture with a soft filling, so that texture becomes an important aspect that influences sensory quality and consumer acceptance [16] . Modern tart innovation is not only oriented towards visual appearance, but also begins to move towards the use of healthier alternative ingredients to support the concept of sustainable food products, one of which is through the use of banana peels that contain fiber and bioactive compounds [3] .

C. Bananas and Banana Peels

Bananas are a tropical fruit with high production and consumption levels in Indonesia, containing fiber, carbohydrates, potassium, vitamin B6, vitamin C which play an important role in body health [2] , [17] . Among the various types of bananas in Indonesia, such as kapok, ambon, raja, and cavendish bananas, cavendish bananas were chosen in this study because they have a sweet taste, soft flesh texture, attractive color when ripe, and a high level of consumer acceptance [18] , [19] .

Banana peel is the outermost part of the banana fruit which is generally considered organic waste after the fruit flesh is consumed, even though it still contains dietary fiber, carbohydrates, potassium, and bioactive compounds such as antioxidants which are beneficial for health [5] , [20] . The use of banana peel in the food industry can be done through various forms of processing, such as powder, chips, jam, candy, to mixed ingredients for pastry products, which aims to increase the utility value of waste while reducing food waste [3] , [4] .

D. Torched Banana Tart With Banana Peel Substitution

Torched banana tart is a pastry-based dessert product that combines tart dough, pastry cream filling, and banana topping that is torched on top to produce a caramelization effect as well as a distinctive aroma and taste resulting from



heating the sugar [21] . In this study, innovation was carried out through the substitution of processed banana peel in the form of banana peel powder in chocolate pastry cream and yogurt, as well as candied banana peel as an additional topping.

Banana peel powder is obtained by boiling, drying, and grinding banana peels to produce a powder with a fairly high fiber content, and can be used as a substitute ingredient in bread, cake, cookies, and other pastry products [22] . Candied banana peel is obtained through the process of boiling banana peels with sugar solution to produce a softer and chewier texture and a sweet taste, so that it is more easily accepted by consumers as a topping or snack [23], [24] . The use of these two processed products is expected to increase the value of banana peel waste, provide unique taste and texture characteristics, and create innovative pastry products that are environmentally friendly and have economic value

Research Method

The object of this research is banana fruit and peel, with a focus on the utilization of banana peel which is generally not used as a substitute ingredient in making banana tart. The research uses a quantitative method with an experimental approach to identify the potential of banana fruit and peel in reducing food waste and producing alternative nutritious food products. The first stage of the research is a product development experiment that begins with recipe analysis to obtain a reference recipe, followed by a series of trials until a suitable recipe is obtained, then the product is tested through organoleptic and hedonic tests (liking).

The sampling technique used was purposive sampling, a technique based on considerations and criteria consistent with the research objectives. The study involved 59 panelists across three strata: academic panelists, culinary industry panelists, and untrained panelists, as outlined in Table 1.

TABLE 1
QUESTIONNAIRE PARTICIPANTS

Participants	Amount
Academic panelists	3
Culinary industry panelists	6
Untrained panelists	50
total	59

Source: Author's Modification Results, 2026

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Results and Discussion

A. Torched Banana Tart Formulation with Banana Peel Substitution

The torched banana tart developed consists of a crispy tart crust, chocolate and yogurt-flavored pastry cream, a torched banana topping with a sugar coating, and processed banana peels in the form of candied banana peel and banana peel powder. The recipe formulation was developed through ingredient analysis to understand the function and contribution of each ingredient to the taste, color, aroma, texture, and stability of the final product, before being compiled into a complete formulation as presented in Table 2.

TABLE 2
TORCHED BANANA TART FORMULATION



Torched Banana Tart with Banana Peel Processed Product Substitution

Ingredients	Unit	Qty
Tart Shell		
High-protein flour	Gram	375
Medium-protein flour	Gram	375
Icing sugar	Gram	270
Margarine	Gram	450
Egg	Gram	25
Vanilla	Gram	3

Filling

Whipping cream	ML	200
Fresh milk	ML	500
Maizena	Gram	32
Sugar	Gram	100
Egg	Pcs	4
Yogurt	Gram	400
Chocolate	Gram	100

Topping

Banana	Pcs	2
Banana peel	Pcs	2
Sugar	Gram	100
Water	ML	200
Lime	ML	5

Source: Author's Modification Results, 2026

The process of making candied banana peel begins with cutting the banana peel into small pieces, boiling it in boiling water for five minutes to remove the sap, draining and rinsing it, then boiling it again with water, sugar, and lime juice until the texture becomes soft, chewy, and the sugar crystallizes. Banana peel powder is made through similar steps at the beginning of the process, namely cutting and boiling the banana peel, followed by drying it in an oven until it is completely dry, then ground using a blender to form a powder.

The tart shell is made by mixing all the ingredients until smooth, shaping the dough, resting it in the refrigerator for 30 minutes, then baking it at 170°C for approximately 20 minutes. Pastry cream is made by boiling fresh milk, whipping cream, and sugar, then adding cornstarch solution and egg yolks until thickened, then divided into two parts and given chocolate and yogurt flavors. The final stage is

arranging banana slices on top of the pastry cream, sprinkling sugar, torching using a torch, then adding candied banana peel and banana peel powder as a topping so that the torched banana tart product is ready to be served.

B. Consumer Acceptance

Consumer acceptability was identified through organoleptic and hedonic tests involving 59 panelists, consisting of untrained panelists, academics, and culinary practitioners. Consumers were given two products—a banana custard tart as a comparison product and a torched banana tart as an innovation product—to assess aspects of taste, aroma, texture, appearance, color, and hedonic aspects. A summary of the assessment results is presented in Table 3.

TABLE 3
SUMMARY OF CONSUMER ACCEPTANCE

Indicator	Average Score
Taste	4.37
Aroma	4.19
Texture	4.22
Color	4.41
Appearance	4.39
Hedonic	4.42
Overall Total	4.33

Source: Author's Modification Results, 2026

In terms of taste, 48% of panelists rated it “Very Tasty,” 42% “Tasty,” and 10% “Quite Tasty,” with no negative ratings, indicating that the addition of processed banana peel did not reduce the product’s flavor. In terms of aroma, 42% of panelists rated it “Very Fragrant,” 41% “Fragrant,” 10% “Quite Fragrant,” and 7% “Not Fragrant,” indicating that the product’s aroma was generally acceptable, although a small percentage of respondents rated it less than their preference.

In terms of texture, 42% of panelists rated it as “Very Soft”, 41% as “Soft”, 14% as “Quite Soft”, and 3% as “Not Soft”, with no rating of “Very Not Soft”. In terms of appearance, 51% of panelists rated it as “Very Appealing”, 39% as “Appealing”, 8% as “Quite Appealing”, and 2% as “Not Appealing”. A similar pattern was seen in terms of color, with 51% rating it as “Very Appealing”, 39% as “Appealing”, 8% as “Quite Appealing”, and 2% as less attractive, indicating that the



product color was well accepted by most panelists.

In the hedonic aspect, 56% of panelists stated “Very Like”, 32% “Like”, 10% “Quite Like”, and 2% “Dislike”. Overall, the highest average value was obtained in the hedonic aspect (4.42), followed by color (4.41), appearance (4.39), taste (4.37), texture (4.22), and aroma (4.19), with a total average of 4.33 which is included in the very good acceptance category. These results indicate that the substitution of processed banana peels in the form of banana peel powder and candied banana peel is well accepted without reducing the sensory quality of the banana tart product.

C. ANOVA Test Results

ANOVA testing was conducted to determine whether there was a significant difference between the torched banana tart innovation product and the original banana custard tart product in the overall hedonic aspect. Before the ANOVA test was conducted, the assumptions of normality and homogeneity of the data were tested first. The results of the Shapiro-Wilk normality test showed a significance value of 0.039 for the torched banana tart group and 0.104 for the banana custard tart group, while the results of the Levene homogeneity test showed a significance value of 0.574 (Sig. > 0.05), so that the data in both groups were declared normally distributed and had homogeneous variance, as summarized in Table 4.

Testing	Statistics	Sig. Value
Normality (Shapiro-Wilk) – Torched banana tart	—	0.039
Normality (Shapiro-Wilk) – Banana custard tart	—	0.104
Homogeneity (Levene's Test)	—	0.574
One-Way ANOVA	F = 0.409	0.528

Source: Author's Modification Results, 2026

Based on the results of the One-Way ANOVA test, an F value of 0.409 was obtained with a significance of 0.528. Because the significance value is greater than 0.05 (0.528 > 0.05), H₀ is accepted and H₁ is rejected, which means there is no significant difference in the average between torched banana tart and banana custard tart at a 95% confidence level. This finding strengthens the results of the organoleptic and hedonic tests which show that the substitution of processed banana peels does not reduce the sensory quality of the product compared to the comparison product without substitution.

Overall, the results of this study indicate that the use of

Cavendish bananas as the main ingredient and processed banana peels in the form of banana peel powder and candied banana peel as substitutes can produce pastry products that are equivalent to conventional products in terms of consumer acceptance. This finding is consistent with the research of Tan et al. [6] and Krisnanda et al. [7] which also showed that processed banana peels can be substituted into food products without significantly reducing sensory quality, while strengthening the potential of banana peels as a functional raw material in supporting food waste reduction in the pastry industry.

Conclusion

The formulation of torched banana tart by utilizing processed banana peel in the form of banana peel powder and candied banana peel successfully produces a safe and functional pastry product. Processing banana peel through boiling, drying, and further processing is able to reduce the characteristics of banana peel that are less desirable, so it can be used as an additional ingredient without reducing product quality while providing added value to food waste and supporting the concept of sustainability. The results of organoleptic and hedonic tests showed that torched banana tart obtained a good level of acceptance in all tested attributes, with an overall average of 4.33, while the results of the One-Way ANOVA test showed a significance value of 0.528 (Sig. > 0.05), which means there is no significant difference between torched banana tart and banana custard tart as a comparison product. Thus, the research objective has been achieved, namely producing a torched banana tart formulation based on the use of banana fruit and peel that is proven to be acceptable to consumers, as well as having the potential to be an alternative pastry product that is more environmentally friendly and economically valuable. Further research is recommended to develop variations in the concentration of banana peel powder and candied banana peel to obtain the most optimal composition, supplemented with nutritional content analysis, shelf life testing, microbiological testing, and production cost analysis, and involving a larger and more diverse number of panelists for more representative assessment results. Business actors in the fields of pastry, bakery, hotel, and MSMEs are also expected to utilize processed banana peel as an alternative additional ingredient in the development of pastry products.

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