ISSN 3063-9484
Journal of Rural Tourism

ORIGINAL ARTICLE Open Access

Jackfruit seed and dragon fruit peel in swiss roll: Enhancing local culinary tourism through waste valorization

Enita Rahayu[1*], Maria Veronika Simanjutak, Praseptia Gardiarini[1], Firda Rahmayanti[1]

Abstract

Purpose – This study develops a Swiss roll by incorporating jackfruit seed powder into the batter and dragon fruit peel into the filling, with the aim of valorizing underutilized local food resources and examining their potential contribution to local culinary product development.

Methodology/Design/Approach – A quantitative product-development approach was used. Three Swiss roll formulations were prepared with 20% (F1), 30% (F2), and 40% (F3) jackfruit seed powder. Thirty fifth-semester Culinary Arts students at Balikpapan State Polytechnic, who had previously received training in food quality control and hedonic testing, participated as panelists. After preliminary product trials, a five-point hedonic test was conducted to assess aroma acceptance.

Findings – The second product trial produced softer Swiss rolls after the mixing procedure was adjusted. The mean aroma scores were 4.23 for F1, 4.07 for F2, and 3.57 for F3 on a five-point hedonic scale. All three formulations were within the 'like' category, while F1 obtained the highest mean score. The results indicate that a moderate level of jackfruit seed powder was more favorably accepted in terms of aroma than the higher substitution levels tested.

Originality/value – The study combines two underutilized fruit-derived materials jackfruit seed powder and dragon fruit peel within a familiar pastry product. Its contribution to culinary tourism is prospective: the product provides a locally sourced, waste-valorized food concept that may be further developed as a culinary tourism offering, although tourist acceptance was not directly tested in this study.

Keywords: Swiss Roll, Jackfruit Seeds, Dragon Fruit Peel, Tourism Product, Culinary

Introduction

Indonesia has substantial biodiversity and a wide range of locally available food resources that can be developed into innovative food products and tourism experiences. Jackfruit (Artocarpus heterophyllus Lam.) is widely cultivated in Indonesia and is commonly consumed as fresh fruit or incorporated into various culinary preparations (Mukprasirt & Sajjaanantakul, 2004; Widarti, 2013). National production data cited in the original study indicate substantial jackfruit production, highlighting the availability of the raw material (Badan Pusat Statistik, 2024).

Although jackfruit is widely consumed, its seeds are comparatively underutilized. They may be boiled, roasted, processed as food ingredients, or used for other purposes, but their application in value-added food products remains limited. Previous research has demonstrated the potential of jackfruit seeds as a food ingredient and reported their carbohydrate, protein, mineral, and other nutritional components (Nurhayati et al., 2020; Nizori et al., 2020). This creates an opportunity to convert a commonly discarded or underused part of the fruit into a functional ingredient for bakery products.

*Correspondence:
Enita Rahayu
enita.rahayu@poltekba.ac.id
Department of Tourism, Balikpapan State Polytechnic, Balikpapan, East Kalimantan 76126, Indonesia

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Dragon fruit (Hylocereus polyrhizus) is another locally available commodity with potential for food-product development. Previous studies have reported bioactive compounds and antioxidant-related properties in red dragon fruit and its peel (Jaafar et al., 2009; Wu et al., 2006; Stintzing et al., 2002). Dragon fruit peel is frequently discarded after the edible flesh is consumed, creating a potential waste stream that can be valorized through food innovation (Sindi Cristina et al., 2022). The use of the peel in food products can therefore contribute to a circular approach to ingredient utilization, provided that appropriate processing and food-safety procedures are applied.

Swiss roll is a familiar rolled sponge cake that can be modified through the incorporation of alternative local ingredients. Previous studies have explored the substitution of conventional ingredients in roll-cake products, demonstrating the potential of the format for product innovation (Kandoli et al., 2022; U. Yuyun et al., 2022). In the present study, jackfruit seed powder was incorporated into the batter, while dragon fruit peel was used as the filling. The combination is intended to transform two underutilized fruit materials into a recognizable and potentially marketable culinary product.

The tourism relevance of this innovation lies in the relationship between local food and destination experience. Culinary tourism provides opportunities for destinations to present local resources, food practices, and distinctive products to visitors (Putra et al., 2014). However, a product should not be described as a tourism attraction solely on the basis of sensory acceptance by a non-tourist panel. Accordingly, this study treats culinary tourism as a potential application of the developed product rather than as an outcome directly demonstrated by tourist testing.

Based on this rationale, the study aims to develop three Swiss roll formulations containing different levels of jackfruit seed powder and to determine panelists' aroma preferences through a five-point hedonic test. The study also discusses how the resulting product may contribute to local culinary product development and, prospectively, culinary tourism.

Method

Research design and panelists

The study used a quantitative product-development approach combined with a hedonic sensory test. Thirty panelists participated in the evaluation. The panelists were fifth-semester students of the Culinary Arts Program at Balikpapan State Polytechnic who had completed coursework in food quality control and had received training in hedonic testing. The panelists were therefore treated as trained student panelists rather than as a representative sample of tourists or the general consumer population.

Product development

Product development was conducted in two stages. First, a reference recipe was tested and preliminary trials were conducted to determine workable formulations (Table 1). Three formulations were developed by varying the proportion of jackfruit seed powder in the Swiss roll batter: F1 (20%), F2 (30%), and F3 (40%). Dragon fruit peel was used as the filling across the formulations.

Table 1. Experimental formulations

Formulation	Jackfruit seed powder	Dragon fruit peel filling
F1	20%	Used
F2	30%	Used
F3	40%	Used

Source: Author’s field work, 2025

Preliminary trials

The first trial produced differences in color, aroma, flavor, and texture among the formulations. In particular, F2 and F3 showed more noticeable jackfruit-seed characteristics and denser textures. The researchers identified the mixing procedure as an important process factor. Prolonged folding was associated with a runny batter and reduced expansion during baking.

A second trial was therefore conducted using the same formulation levels but a revised mixing procedure. Eggs, sugar, and emulsifier were beaten until fluffy; dry ingredients—including jackfruit seed powder, wheat flour, powdered milk, and cornstarch—were then incorporated together with melted butter, followed by brief mixing until homogeneous. The revised procedure produced softer products and was used before the hedonic evaluation.

Hedonic test and data analysis

After the second product trial, the three formulations were evaluated for aroma using a five-point hedonic scale: 1 = very dislike, 2 = dislike, 3 = slightly like, 4 = like, and 5 = very like. Each formulation was evaluated by the same 30 panelists. The analysis was descriptive and included frequency, percentage, mean, median, mode, and total score. Because the reported analysis is descriptive and no inferential test is presented in the manuscript, differences among formulations are interpreted as differences in observed preference rather than as statistically significant differences.

The present article reports the aroma evaluation quantitatively. Although color, flavor, and texture were observed during the preliminary trials, corresponding quantitative hedonic results are not reported in the available dataset.

Findings and discussion

Preliminary product trials

The first trial indicated that processing technique was important to product quality. Prolonged folding caused the batter to become excessively fluid and reduced its ability to expand during baking, producing a dense and relatively flat sponge. This observation is consistent with the importance of controlled mixing in sponge-cake preparation described by Susanto (2002).

In the first trial, F1 showed a yellow color, buttery aroma, no noticeable jackfruit-seed aroma or flavor, and a soft texture. F2 was slightly brownish and showed slight jackfruit-seed aroma and flavor, while its texture was dense. F3 was brownish, had a pronounced jackfruit-seed aroma and flavor, and was also very dense. These observations suggested that increasing the level of jackfruit seed powder affected the sensory characteristics of the product.

The second trial retained the three formulation levels but changed the mixing procedure. The revised procedure produced softer products across all formulations. F1 remained yellow with a buttery aroma and no noticeable jackfruit-seed flavor; F2 was slightly brownish with a slight jackfruit-seed aroma and flavor; and F3 was brown with a more pronounced jackfruit-seed aroma and flavor. The improved texture enabled the products to proceed to the hedonic evaluation.

Hedonic Test Results for Aroma

After the second trial succeeded, the products were subjected to hedonic testing to evaluate panelist preferences regarding **aroma**, using 30 panelists. The Swiss roll samples used jackfruit seed powder in the batter and dragon fruit peel as filling. The results are as follows:

F1 Aroma with 20% jackfruit seed powder

Table 2 shows the results of the hedonic aroma test for Formula 1 in Swiss roll making using jackfruit seed powder in the Swiss roll dough with dragon fruit skin as the filling. On a scale of "very dislike" (1) and "dislike" (2), no panelists chose "dislike" (3), 4 panelists chose "somewhat like" (3) with a percentage of 13.3%, 15 panelists chose "like" (4) with a percentage of 50%, and 11 panelists chose "very like" (5) with a percentage of 36.7%.

Aroma of F2 (30% jackfruit seed powder)

Table 3 shows the results of the hedonic test on the aroma of formula 2 in making Swiss rolls by using jackfruit seed powder in the Swiss roll dough with dragon fruit skin as a filling on a scale of very dislike (1) and dislike (2) no panelists chose, there were 7 panelists who chose to like somewhat (3) with a percentage of 23.3%,

there were 14 panelists who chose to like (4) with a percentage of 46.7%, and 9 panelists chose to like very much (5) with a percentage of 30%.

Table 3. Frequency of Hedonic Test of F1 Aroma

		Frequency	*Percent*	*Valid percent*	*Cumulative percent*
Valid	Very Dislike	0	0.0	0.0	0.0
	Dislike	0	0.0	0.0	0.0
	Slightly Like	4	13.3	13.3	13.3
	Like	15	50.0	50.0	63.3
	Very Like	11	36.7	36.7	100.0
	Total	30	100.0	100.0	

Source: Author's field work, 2025

Table 4. Frequency of Hedonic Aroma Test F2

		Frequency	*Percent*	*Valid Percent*	*Cumulative Percent*
Valid	Very Dislike	0	0.0	0.0	0.0
	Dislike	0	0.0	0.0	0.0
	Slightly Like	7	23.3	23.3	23.3
	Like	14	46.7	46.7	70.0
	Very Like	9	30.0	30.0	100.0
	Total	30	100.0	100.0	

Source: Author's field work, 2025

Aroma of F3 (40% jackfruit seed powder)

Table 4 shows the results of the hedonic test on the aroma of formula 3 in making Swiss rolls using jackfruit seed powder in the Swiss roll dough with dragon fruit skin as a filling on a scale of very dislike (1) no panelists chose, there were 2 panelists who chose dislike (2) with a percentage of 6.7%, there were 12 panelists who chose somewhat like (3) with a percentage of 40%, there were 13 panelists who chose like (4) with a percentage of 43.3%, and 3 panelists chose very like (5) with a percentage of 10%. In the hedonic test, the author can conclude that from 30 panelists regarding the level of panelists' preference for the aroma of Swiss rolls using jackfruit seed powder in the Swiss roll dough with dragon fruit skin as a filling in several formulas, namely F1, F2, F3. Then the results are found in the following table.

Table 4. Average Hedonic Test Results for Aromas F1, F2, F3

		F1_aroma	F2_aroma	F3_aroma
N	Valid	30	30	30
	Missing	0	0	0
Mean		4.23	4.07	3.57
Median		4.00	4.00	4.00
Mode		4	4	4
Sum		127	122	107

Source: Author's field work, 2025

Based on the table above shows the results of the average value of the aroma of Swiss roll products with the use of jackfruit seed powder in the Swiss roll dough with dragon fruit skin as a filling. It can be concluded that the aroma in F1 has an average value of 4.23, in F2 the average value is 4.07 and in F3 has an average value of 3.57. Which means the values of F1, F2, F3 are included in the Likert scale of 4, namely like. And it can

be concluded that F1 has the best value with an average value of 4.23.cations for Culinary Tourism and Local Food Innovation.

The data confirms that developing Swiss roll products using jackfruit seed and dragon fruit peel as alternative local food ingredients is well-accepted by consumers, especially in terms of aroma. This innovation can contribute to diversifying Indonesian culinary products and support culinary tourism by offering unique, locally inspired flavors. According to Cohen and Avieli (2004) in Safar et al. (2022), local food plays a vital role in tourism by attracting tourists and fulfilling their needs during their stay at a destination, directly influencing their satisfaction. Tourists often cannot avoid eating and drinking in new destinations, even if the foods are unfamiliar.

Indonesian culinary diversity has gained global recognition, with eight Indonesian cities ranked among the Top 100 cities with the best local and national cuisines in the 2023/2024 Taste Atlas Awards (Khan, 2019). As Prakoso (2018) notes, culinary development as a tourism attraction has a significant economic impact, contributing to job creation and business opportunities in local communities. Moreover, Kurniansyah (2023) asserts that culinary experiences offer insight into a region's culture, history, and values. Consuming iconic foods like Italian pasta or Japanese sushi allows travelers to not only enjoy flavors but also immerse themselves in the local culture. Culinary tourism can also promote sustainability by emphasizing local, organic, and environmentally friendly foods, allowing tourists to engage in sustainable practices while enjoying authentic cuisine.

Conclusion

This study developed Swiss roll formulations using jackfruit seed powder in the batter and dragon fruit peel as the filling. Three levels of jackfruit seed powder were tested: 20% (F1), 30% (F2), and 40% (F3). After adjustment of the mixing procedure, the products achieved acceptable aroma scores among the 30 trained student panelists. The mean aroma scores were 4.23 for F1, 4.07 for F2, and 3.57 for F3, all within the 'like' category of the five-point hedonic scale.

Within the formulations tested, F1 obtained the highest observed aroma acceptance. The findings indicate that incorporating jackfruit seed powder at a moderate level can produce an acceptable aroma profile while contributing to the utilization of an underused food material. The use of dragon fruit peel as a filling further supports the waste-valorization concept.

The product has potential for further development as a locally inspired culinary product that could be incorporated into culinary-tourism offerings. However, the present study does not directly test tourists or tourism outcomes. Further research is therefore needed to evaluate overall sensory quality, nutritional composition, food safety, consumer acceptance, willingness to pay, and tourist perceptions before the product is positioned as a culinary-tourism attraction.

Acknowledgments

The authors thank the lecturers and students of the Culinary Arts Program at Balikpapan State Polytechnic who supported the product-development and sensory-evaluation process. The authors also thank the editorial team of the Journal of Rural Tourism for their consideration of the manuscript.

Declaration

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data and materials

The data supporting the findings of this study are available upon request.

Competing interests

The authors declare that there is no conflict of interest regarding this work.

Declaration of generative AI and AI-assisted technologies

During the preparation of this work the author used Grammarly in order to correct spelling mistakes and help me make better sentences. After using this tool/service, the author reviewed and edited the content as needed and takes full responsibility for the content of the published article.

Author contributions

ER Conceptualization, Methodology, Writing – Original Draft, Supervision. MVS Data Curation, Formal Analysis, Writing – Review & Editing. PG Investigation, Resources, Validation. TRN Methodology, Visualization, Software. FR Data Curation, Writing – Review & Editing, Project Administration.

Funding

Not applicable.

Author detail

[1]Department of Tourism, Balikpapan State Polytechnic, East Kalimantan 76126, Indonesia

Received: 09 October 2025 Accepted: 30 January 2025

Published online: 30 January 2025

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