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Substitutions of Purple Sweet Potato Puree and Flour in Ube Cinnamon Roll (Cinube) for Local Ingredient Utilizations

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ABSTRACT

This study developed a purple sweet potato-based cinnamon roll product "Cinube", as a healthier alternative replacing part of wheat flour to address rising bread consumption and dependence on imported flour. The objectives were to: (1) Formulate the Cinube product recipe; (2) Determine the optimal presentation and packaging for Cinube; (3) Evaluate public acceptance levels of Cinube; (4) Analyze the nutritional composition of Cinube; and (5) Calculate the selling price and Break-Even Point (BEP) for Cinube. The research employed a Research and Development (R&D) approach using the 4D model (Define, Design, Develop, Disseminate) to design and evaluate the product. Data were analyzed using descriptive statistics and subjected paired t tests to assess differences before and after the intervention. The study was conducted at three locations: (1) Private home kitchen, Bekasi; (2) the Pastry Laboratory, Applied Bachelor's Program in Culinary Arts, Vocational Faculty; and (3) the UNY Auditorium, Kulon Progo campus; (4) the SIG Laboratory, Bogor. The research spanned from September 2024 to March 2026. Key findings included: (1) The optimized Cinube recipe incorporates 20% substitution of purple sweet potato puree and flour; (2) Primary packaging consists of OPP plastic, with secondary packaging comprising a paper box with mica lid and product label; (3) Sensory evaluation during the dissemination phase (n=80 panelists) demonstrated broad acceptance, with mean scores indicating high satisfaction across attributes: taste 4.48; aroma 4.66; texture 4.47; packaging 4.58; colour 4.58; and overall acceptability 4.68; (4) Nutritional profile per 80 g serving: total energy 168 kcal, energy from fat 44 kcal, fat 44.28 g (0.73% AKG), protein 20.73 g (0.86% AKG), carbohydrates 145.34 g (0.11% AKG), fiber 0.13 g (0.00% AKG); and (5) Selling price per package: Rp. 18.000 (40% markup), with BEP at 4 packages.

Keywords:

Cinnamon Roll; Purple Sweet Potato Flour; Purple Sweet potato Puree.

Penelitian ini mengembangkan produk cinnamon roll berbasis ubi jalar ungu "Cinube" sebagai alternatif sehat pengganti sebagian tepung terigu untuk peningkatan konsumsi roti dan ketergantungan impor tepung. Penelitian ini bertujuan untuk: (1) Menemukan resep produk Cinube, (2) Menentukan penyajian dan kemasan produk Cinube, (3) Mengetahui tingkat kesukaan masyarakat terhadap produk Cinube, (4) Mengetahui kandungan nilai gizi produk Cinube, dan (5) Mengetahui harga jual dan Break Even Point (BEP) produk Cinube. Penelitian ini menggunakan metode R&D (Research and Development) dengan model pengembangan 4D (Define, Design, Develop, and

Disseminate) untuk merancang dan menguji produk, sedangkan analisis data dilakukan secara deskriptif dan diuji secara statistik menggunakan uji t berpasangan untuk menilai perbedaan sebelum dan sesudah intervensi. Penelitian dilakukan di: (1) Dapur Rumah Pribadi, Bekasi; (2) Laboratorium Pastry, Program Studi Sarjana Terapan Tata Boga, Fakultas Vokasi; (3) Auditorium UNY, kampus Kulon Progo; (4) Laboratorium SIG, Bogor. Waktu penelitian dimulai pada September 2024 hingga Maret 2026. Hasil penelitian ini yaitu: (1) Resep Cinube menggunakan substitusi puree dan tepung ubi jalar ungu sebanyak 20%; (2) Cinube dikemas menggunakan plastik OPP sebagai kemasan primer dan box kertas dengan tutup mika sebagai kemasan sekunder lengkap dengan label; (3) Hasil uji kesukaan pada 80 panelis menyimpulkan bahwa produk Cinube diterima secara luas oleh masyarakat, rata-rata skor: rasa 4,48; aroma 4,66; tekstur 4,47; kemasan 4,58; warna 4,58; dan sifat keseluruhan 4,68; (4) Kandungan gizi yang terdapat dalam 1 sajian seberat 80 gr produk Cinube yaitu: energi total 168 kkal, energi lemak 44 kkal, lemak 44,28 g (AKG 0,73%), protein 20,73 gr (AKG 0,86%), karbohidrat 145,34 gr (AKG 0,11%), dan serat 0,13 gr (AKG 0,00%); (5) Harga jual produk Cinube adalah Rp. 18.000 dengan mark-up 40% serta BEP unit Cinube adalah 4 kemasan.

1. Introduction

The increasing demand for bakery products in Indonesia has become a significant issue in food and nutrition research due to the country's high dependence on imported wheat flour. According to the Indonesian Flour Producers Association [1], Indonesia is among the world's largest wheat-importing countries, with domestic wheat flour production reaching 6.8 million metric tons in 2023. The growth of the bakery industry is also influenced by changing lifestyles and increasing consumer preference for practical food products. Data from the Central Bureau of Statistics Republic of Indonesia showed a continuous increase in national bread production, indicating the expanding market potential of bakery products [2]. However, conventional bakery products are generally produced using wheat flour, which has a high glycemic index and low dietary fiber content. Excessive consumption of such products may contribute to increased blood glucose levels and lower nutritional quality. Therefore, the development of bakery products utilizing local food resources with improved nutritional value has become an important concern.

Several studies have investigated the utilization of local ingredients as substitutes for wheat flour in bakery products. Purple sweet potato (*Ipomoea batatas* L.) has gained attention because of its nutritional composition, including carbohydrates, dietary fiber, vitamins, minerals, and anthocyanins that provide antioxidant properties and a distinctive purple color. Karinaswari et al. (2024) reported that purple sweet potato has a relatively low glycemic index, making it beneficial for blood glucose control. To improve its application in food products, purple sweet potato is commonly processed into flour and puree. Purple sweet potato flour is produced through peeling, slicing, drying, and milling processes, allowing it to be used as an intermediate food ingredient [3]. Meanwhile, puree processing aims to preserve the nutritional and sensory characteristics of the raw material while producing a soft texture suitable for food recipe [4]. Previous studies applied purple sweet potato puree in gyoza skin products and purple sweet potato flour in mille crepes recipes, demonstrating their potential to increase dietary fiber content and diversify food products.

Despite the positive findings reported in previous studies, several limitations remain. Most studies focused only on the use of either puree or flour separately, while the combined application of both forms in bakery products has received limited attention. In addition,

comprehensive evaluations regarding nutritional composition, such as protein, carbohydrate, fat, and dietary fiber content in modified bakery products, are still limited [5]. Sensory acceptance also remains a challenge because purple sweet potato may produce an earthy aroma and flavor imbalance that can reduce consumer preference and hedonic scores [6]. These limitations indicate the need for further product development to balance nutritional improvement and sensory quality in bakery products based on purple sweet potato. Therefore, combining purple sweet potato puree and flour in a bakery recipe may improve texture, nutritional value, and consumer acceptability while optimizing the utilization of local food resources.

Cinnamon roll is a popular sweet bakery product widely consumed by various age groups because of its distinctive flavor and attractive appearance. Conventionally, cinnamon rolls are produced using wheat flour combined with butter, sugar, yeast, and cinnamon powder [7]. However, the utilization of purple sweet potato in cinnamon roll products remains limited. Based on these considerations, this study developed “Cinube” (*Cinnamon Roll Ube*), a cinnamon roll product formulated with purple sweet potato puree and purple sweet potato flour. This study aims to analyze the effect of substituting purple sweet potato puree and flour on the organoleptic characteristics and nutritional potential of cinnamon roll products. The research was conducted through product recipe and organoleptic evaluation methods to determine consumer acceptance of the developed product.

2. Method

2.1. Research Design

The study used a Research and Development (R&D) approach to create or modify products and test their feasibility. R&D focuses on systematic product development so the outcomes can be used by the public. A common R&D framework is the 4D model (Define, Design, Develop, and Disseminate). The define, design, and develop stages were carried out at three locations: a private home kitchen in Bekasi, West Java; the Pastry Laboratory of the applied Bachelor’s Program in Culinary Arts, Faculty of Vocational Studies; and the disseminate stage took place at the UNY Auditorium, Kulon Progo campus, while proximate analysis was performed at the SIG Laboratory in Bogor, West Java.

2.2. Material

The primary materials used in the developed product (F1 formula) comprised: High-protein wheat flour, medium-protein wheat flour, purple sweet potato flour, purple sweet potato puree, UHT milk, granulated sugar, brown sugar, vanilla powder, instant yeast, egg, salt, margarine, and cinnamon powder. The reference recipe with no purple sweet potato flour and puree. Purple sweet potato was steamed at 100°C for 20 minutes then mashed into a smooth puree prior to incorporation into the dough.

2.3. Product Development (4D Stages)

Define stage: The define form was used to test three different reference recipes to select one final reference. It was completed by trained panelist (expert). Sensory parameters on the define form includes shape, size, color, aroma, taste, texture, and overall acceptability.

Design stage: The design stage developed the chosen benchmark recipe by substituting purple sweet potato flour into the cinnamon roll dough at 20%, 30%, and 40% levels. Sensory tests comparing each variant with the benchmark were conducted with experts and student peers, and the collected data were analyzed to determine mean score differences between the benchmark and the three developed recipes.

Develop stage: During the develop stage, Validation I was conducted on the selected benchmark and chosen developed recipe by three experts. Validation covered presentation and packaging: the cinnamon roll was served with purple sweet potato jam topping and packed in a paper box with a clear plastic lid. A limited hedonic test with 30 culinary students was also carried out on 22 November 2024; each panelist received one benchmark product, one developed product, and one evaluation form.

Disseminate stage: This stage involved disseminating the product to the public to assess consumer liking. Cinube was presented to 80 untrained panelists (target consumers) during the Wonderroots Culinary Festival on 24 May 2025 at UNY Wates campus. Panelists performed hedonic evaluations; the results were analyzed to identify the sensory attributes most preferred by consumers.

2.4. Sensory Evaluation

Preference (hedonic) tests used a five-point Likert scale (1 = strongly dislike, 2 = dislike, 3 = slightly like, 4 = like, and 5 = strongly like), following standard food sensory protocols. Assessed attributes were color, aroma, flavor, texture, packaging appearance, and overall acceptance. Paired-sample t-tests (significance threshold $p < 0.05$) were used to compare the reference product with Cinube.

2.5. Proximate Analysis

Nutritional analyses for the reference product and Cinube were performed in duplicate at SIG Laboratory in Bogor, West Java (March 2026). Measured parameters included moisture, ash, protein, fat, carbohydrate (by difference), and crude fiber. Results were compared using paired-sample t-tests, and per-serving (80 g) nutrient values were calculated following Indonesian BPOM Regulation No. 9/2019 and Ministry of Health RDA guidelines.

2.6. Price and Break Even point Analysis

The selling price of the product was determined using the Cost-Plus Pricing method by applying a 40% mark-up to the total production cost, which included fixed costs, variable costs, labor costs, and packaging expenses. This method was used to ensure that the selling price could cover all production expenses while generating a reasonable profit margin. In addition, the Break Even Point (BEP) analysis was calculated using standard fixed-cost and variable-cost formulas to identify the minimum number of product units that must be sold in order to avoid financial loss and achieve business sustainability.

3. Results and Discussion

3.1. Result

3.1.1. Define Stage

The define stage was the initial phase of the study, which involved selecting three different cinnamon roll recipe obtained from various sources. These recipes were evaluated by culinary experts and Culinary Arts students to determine the most suitable reference recipe for further development. The selected recipe was then used as the primary reference in the subsequent stages of product development. Based on the organoleptic evaluation conducted on the three reference recipes, the average results obtained are presented in Table 1.

Table 1. Recap of Reference Recipe

Sensory Prototypes	Average		
	R1	R2	R3
Shape	3.6	3.6	3.6
Size	3.6	3.6	3.6
Color	3.8	3.4	3.4
Aroma	3.4	3.6	3.6
Taste	3.6	4	3.6
Texture	4	3.8	3.4
Overall	3.7	3.2	3.6

Based on the average data presented in the table and the results of the characteristic evaluation, reference Recipe (R1) obtained the highest average score among the tested recipes. Therefore, R1 was selected as the reference recipe for further development in the design stage. The selected reference recipe is presented as follows.

Table 2. Selected Reference Recipe

No.	Ingredients	Quantity Dough	Quantity Filling
1.	High-protein wheat flour	250 g	-
2.	Medium-protein wheat flour	100 g	-
3.	UHT milk	180 ml	-
4.	Granulated sugar	30 g	-
5.	Brown sugar	30 g	80 g
6.	Vanili powder	2 g	-
7.	Instant yeast	7 g	-
8.	Egg	60 g	-
9.	Salt	1 g	-
10.	Margarine	50 g	75 g
11.	Cinnamon powder	-	8 gr

Source: Devina Hermawan (2021)

3.1.2. Design Stage

The design stage involved developing the selected reference recipe adapted from Devina Hermawan (2021) using predetermined substitution intervals. The percentage intervals for substituting purple sweet potato flour in the cinnamon roll dough were 20%, 30%, and 40%. The recipe plan for the substitution of purple sweet potato flour in the cinnamon roll dough is presented in the following table.

Table 3. Recipe Development Plan

Ingredients	Reference Recipe Selected	Recipe I (20% purple sweet potato flour)	Recipe II (30% purple sweet potato flour)	Recipe III (40% purple sweet potato flour)
High-protein wheat flour	250 g	200 g	175 g	150 g
Medium-protein wheat flour	100 g	80 g	70 g	60 g
Purple sweet potato flour	-	70 g	105 g	140 g

The result of product development from 3 different designs.

Table 4. Product Development Result of 3 Different Design



At the design stage, sensory evaluation was conducted on the selected reference recipe and the three develop recipes by culinary experts and Culinary Arts students. The collected data were then analyzed to determine the differences in average scores between the selected reference recipe and the developed recipes. The recap of the average data obtained is presented in the following table.

Table 5. Recap of Design Stage Sensory Test Data

Sensory Prototypes	Selected reference recipe	Mean		
		R1	R2	R3
Shape	3.6	4.4	3.4	2.8
Size	3.6	4.4	3.6	3
Color	3.8	4	3.6	2.8
Aroma	3.4	4.4	3.8	3.2
Taste	3.6	3.6	3.2	3
Texture	4	4.4	3.2	2.6
Overall	3.7	4.4	3.7	2,8

Based on the recap results of the sensory evaluation at the design stage and the characteristic differences among the three developed recipes, R1 (Recipe 1) obtained the highest average score and demonstrated the most appropriate characteristics. Therefore, R1 was selected as the chosen development recipe with a 20% substitution of purple sweet potato flour in the cinnamon roll dough.

3.1.3. Develop Stage

At the develop stage, Validation Test I was conducted on the selected reference recipe and the selected developed recipe by three culinary experts. In this stage, validation was carried out on the product presentation and packaging. Cinube was served with purple sweet potato spread as a topping and packaged using a paper box with a transparent plastic lid. Validation Test I was well accepted and produced the following average evaluation results.

Table 6. Result of Validation Test I Data Recap

Characteristicts	Reference recipe selected	Development recipe selected
Shape	4.19	4.22
Size	4.28	4.41
Color	4.06	4.34
Aroma	4.06	4.34
Taste	3.97	4.34
Texture	3.94	4.44
Overall	4.09	4.44
Presentation	4.16	4.38
Packaging	4.16	4.38

At the develop stage, a limited-scale preference test was also conducted involving 30 Culinary Arts students as panelists. The panel test was carried out on November 22, 2024. Each panelist was provided with one reference product, one developed product, and an evaluation questionnaire form.



Figure 1. Presentation of Cinube Product

Cinube was packaged using food-grade OPP (*Oriented Polypropylene*) plastic as the primary packaging and a food-grade cardboard box as the secondary packaging. The secondary packaging featured a transparent mica plastic window that allowed consumers to view the product inside. A label sticker was attached to the top of the packaging to enhance its visual appearance. The label also functioned as product identification and as a source of information for consumers. A limited-scale preference test yielded the following data.

Table 7. Limited-Scale Preference Test Results

Sensory Attributes	Reference product	Cinube	p-value	Description
Taste	3.97 ± 0.73	4.34 ± 0.97	0.01	Significantly different
Aroma	4.06 ± 0.87	4.34 ± 0.90	0.05	Significantly different
Texture	3.94 ± 0.91	4.44 ± 0.84	0.00	Significantly different
Packaging	4.16 ± 0.67	4.38 ± 0.70	0.01	Significantly different
Color	4.06 ± 0.84	4.34 ± 0.78	0.08	Not significantly different
Overall	4.09 ± 0.64	4.44 ± 0.71	0,01	Significantly different

Based on the limited-scale preference test, the Cinube product obtained higher average scores compared to the reference product. The average scores for Cinube were taste

(4.34), aroma (4.34), texture (4.44), packaging (4.38), color (4.34), and overall attributes (4.44).

3.1.4. Disseminate Stage

This stage aimed to introduce and distribute the product to the community or target consumers. The dissemination process was conducted to determine the level of consumer preference and acceptance toward the Cinube product.

Table 8. Recap Results of the Disseminate Test Data

Characteristicts	Reference recipe selected	Development recipe selected
Taste	3.97	4.48
Aroma	3.93	4.66
Texture	3.38	4.47
Packaging	4.01	4.58
Color	4.07	4.58.
Overall	3.98	4.68

The Cinube product was distributed to 80 untrained panelists representing the target consumers. The dissemination was conducted during the Wonderoots Culinary Festival on May 24, 2025, at Yogyakarta State University Wates Campus. Panelists evaluated the product through a preference test, and the collected data were analyzed to determine the sensory attributes most preferred by consumers. A large-scale preference test involving 80 untrained panelist yielded the following data.

Table 9. Large-Scale Preference Test Results

Sensory Attributes	Reference product	Cinube	p-value	Description
Taste	3.97 ± 0.79	4.48 ± 0.61	0.00	Significantly different
Aroma	3.93 ± 0.86	4.66 ± 0.47	0.00	Significantly different
Texture	3.88 ± 0.87	4.47 ± 0.59	0.00	Significantly different
Packaging	4.01 ± 0.81	4.58 ± 0.58	0.00	Significantly different
Color	4.07 ± 0.75	4.58 ± 0.56	0.00	Significantly different
Overall	3.98 ± 0.75	4.68 ± 0.46	0.00	Significantly different

Based on the paired *t*-test results from the large-scale preference test data, the *p*-values for taste, aroma, texture, packaging, color, and overall attributes were 0.00, indicating significant differences (*p*-value < 0.05). The analysis results showed that each sensory attribute of the Cinube product experienced an increase in score compared to the reference product. The increase in scores is illustrated in the diagram below.

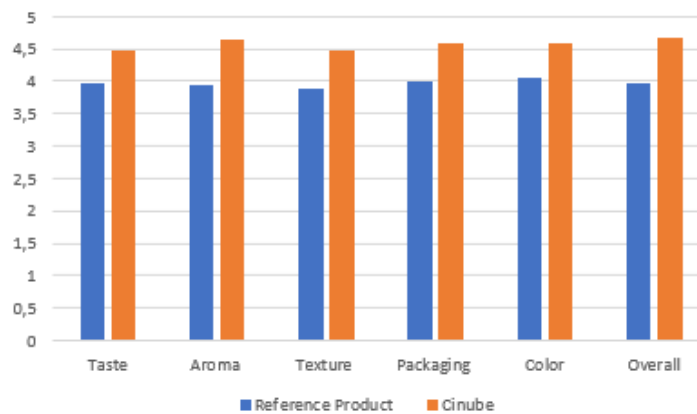


Figure 2. Score Comparison Chart

Based on the diagram, the average scores of the sensory attributes for the Cinube product approached a score of 5 (*strongly liked*). These results indicate that the developed Cinube product was accepted by both the general public and the target consumers.

3.1.5. Nutritional Content and Information of Cinube Product

The nutritional content of the developed product was determined through proximate analysis conducted in duplicate. The nutritional components analyzed included moisture, ash, protein, fat, carbohydrate, crude fiber, and energy content per 100 g of product. The results of the proximate analysis are presented in Table 12.

Table 10. Proximate Analysis Result

Nutritional Components	Reference product	Cinube	p-value	Description
Moisture (%)	29.10 ± 0.07	40.81 ± 0.22	0.01	Significantly different
Ash (%)	0.82 ± 0.01	1.13 ± 0.02	0.02	Significantly different
Protein (%)	8.27 ± 0.13	6.48 ± 0.20	0.01	Significantly different
Fat (%)	7.73 ± 0.12	6.15 ± 0.08	0.01	Significantly different
Carbohydrate (%)	54.06 ± 0.34	45.42 ± 0.09	0.01	Significantly different
Crude fiber (%)	0.14 ± 0.00	0.17 ± 0.00	0.00	Significantly different
Energy (kcal)	318.97 ± 0.23	259.99 ± 3.02	0.02	Significantly different

The average nutritional composition of the reference product consisted of 29.10% moisture, 0.82% ash, 8.27% protein, 7.73% fat, 54.06% carbohydrate, 0.14% crude fiber, and 318.97 kcal energy. Meanwhile, the developed product, Cinube, contained 40.81% moisture, 1.13% ash, 6.48% protein, 6.15% fat, 45.42% carbohydrate, 0.17% crude fiber, and 259.99 kcal energy. The moisture, ash, and crude fiber contents of Cinube were higher than those of the reference product, with differences of 11.71%, 0.31%, and 0.03%, respectively. In contrast, the protein, fat, carbohydrate, and energy contents were lower in Cinube than in the reference product, with differences of 1.79%, 1.58%, 8.64%, and 58.99 kcal, respectively. The paired *t*-test results indicated significant differences in all nutritional components analyzed.

Following the nutrient mass and energy calculations, the Percentage of Daily Nutritional Adequacy (% Daily Value) was calculated based on the Regulation of the Indonesian National Agency of Drug and Food Control (BPOM) No. 9 of 2016 regarding food nutrition labeling references. The % Daily Value calculation results for Cinube were as follows: protein 0.86%, fat 0.73%, carbohydrate 0.11%, and fiber 0.00%. The calculated nutritional

values and % Daily Value were subsequently used to develop the Nutrition Facts Table for Cinube, as presented in Figure 3.

NUTRITION FACTS		
Serving size	: 80 g	
Servings Per Package	: 1	
Total Energy		168 kkal
Energi from Fat		44 kkal
		% DV*
Fat	44,28 g	0,73%
Protein	20,73 g	0,86%
Carbohydrates	145,34 g	0,11%
Fiber	0,13 g	0,00%
*Percent Daily Values (%DV) are based on a 2,150 kkal diet. Individual energy needs may be higher or lower depending on age, gender, physical activity, and physiological conditions.		

Figure 3. Nutrition Facts table of Cinube

Based on the Nutrition Facts Table, one serving (80 g) of Cinube contained 168 kkal total energy, 44 kkal energy from fat, 44.28 g fat, 20.73 g protein, 145.34 g carbohydrate, and 0.13 g fiber. The Nutrition Facts Table was included on the product packaging label to provide nutritional information for consumers.

3.1.6. Selling price and BEP of Cinube Product

The production cost analysis of Cinube showed a total production cost based on the overall expenses incurred during the manufacturing process, including raw material costs, labor costs, packaging costs, and equipment depreciation. The selling price of Cinube was determined using the Cost-Plus Pricing method with a 40% mark-up applied to the total production cost, resulting in a selling price of Rp. 18,000 per package with a net weight of 80 grams. Cinube was considered relatively affordable compared to similar products and competitive in the market. Furthermore, the Break Even Point (BEP) analysis indicated that the minimum sales required to avoid financial loss were 4 packages, meaning that Cinube would begin to generate profit once sales exceeded 4 packages, demonstrating its commercial feasibility for small-scale business production.

To determine the competitiveness of Cinube in the market, a price comparison with several commercial cinnamon roll products was conducted. The comparison results are presented in Table 11.

Table 11. Product Price Comparison

Product name	Quantity	Weight	Price (IDR)	Source/Store
Cinube	1 piece	80 g	18,000	Research Product
Classic Cinnabon	1 piece	241 g	36,000	Cinnabon
Cinnamon roll	1 piece	200 g	40,000	Sinamon
Original Cinnamon	1 piece	70 g	18,000	Saint Cinnamon

Based on the comparison of the four cinnamon roll products, the selling price of Cinube at IDR 18,000 per piece demonstrated strong competitive potential within the middle-to-lower consumer market segment, which aligns with the price sensitivity characteristics of Indonesian consumers. This competitive pricing, combined with the improved nutritional value resulting from the substitution of purple sweet potato, provides additional strategic value compared to conventional wheat flour-based products. Meanwhile, products from Cinnabon and Saint Cinnamon are positioned in the premium market segment through higher pricing strategies supported by stronger brand recognition.

3.2. Discussion

The development of Cinube was carried out using the Research and Development (R&D) method with the 4D model, consisting of the define, design, develop, and disseminate stages. During the define stage, three reference cinnamon roll recipes were evaluated and validated by experts and trained panelists, resulting in the selection of Recipe 1 (R1) as the most suitable formulation for further development. In the design stage, partial substitution of wheat flour with purple sweet potato flour and purple sweet potato puree was applied at levels of 20%, 30%, and 40%. The sensory evaluation results indicated that the 20% substitution formulation achieved the highest overall acceptance scores, suggesting that this level of substitution successfully maintained the desirable sensory characteristics of cinnamon rolls while incorporating local ingredients. Expert validation conducted during the develop stage further confirmed the acceptability of the product, demonstrating that the formulation met the expected quality standards. The product was subsequently named Cinube, an abbreviation of Cinnamon Roll Ube, and was well accepted by target consumers during both limited-scale and large-scale preference tests.

Packaging was designed to preserve product quality and enhance consumer appeal by utilizing OPP plastic as the primary packaging and a paper box with a transparent lid as the secondary packaging. This packaging combination effectively protected the product, maintained its shape during storage and distribution, and allowed consumers to view the product directly, thereby increasing its visual attractiveness and perceived quality. Labeling information, including product name, ingredients, nutritional facts, net weight, production date, and expiration date, further improved product marketability and consumer confidence. Consumer acceptance testing involving 80 untrained panelists revealed that Cinube received favorable ratings across all sensory attributes, including color, aroma, taste, texture, and overall acceptability. Aroma obtained the highest score, likely due to the distinctive natural aroma contributed by the purple sweet potato ingredients, while the attractive purple color and pleasant sweetness positively influenced consumer perception. Statistical analysis using a paired t-test at a 5% significance level showed significant differences between the control product and Cinube in terms of taste and texture ($p < 0.05$), indicating that the incorporation of purple sweet potato flour and puree significantly enhanced product acceptance.

Nutritional analysis demonstrated that the substitution also contributed to the nutritional value of the product, with Cinube containing 40.81% moisture, 1.13% ash, 6.48% protein, 6.15% fat, 45.41% carbohydrates, 0.17% crude fiber, and 259.99 kcal per 100 g. Furthermore, the product was priced at IDR 18,000 per 80 g package, which is relatively affordable compared to similar products available in the market. The calculated break-even point (BEP) of four packages indicates that the product has favorable economic feasibility and profitability potential. Overall, the findings suggest that Cinube is a technically feasible, nutritionally valuable, economically viable, and consumer-acceptable bakery product that

promotes the utilization of locally sourced purple sweet potato as an alternative ingredient in bakery applications.

4. Conclusions

Based on the results of the study, it can be concluded that the developed Cinube recipe utilizing a 20% substitution of purple sweet potato puree and purple sweet potato flour demonstrated the best sensory characteristics, particularly in terms of color, taste, aroma, and texture, and was therefore selected as the final developed recipe. The Cinube product was packaged using OPP plastic as the primary packaging and a paper box with a transparent lid as the secondary packaging to maintain product quality, facilitate distribution, and enhance visual appeal. The organoleptic preference test involving 80 panelists indicated that Cinube was well accepted by consumers, with all sensory attributes obtaining average scores above 4, including taste (4.48), aroma (4.66), texture (4.47), packaging (4.58), color (4.58), and overall acceptability (4.68). In terms of nutritional value, one 80 g serving of Cinube contained 168 kcal total energy, 44 kcal energy from fat, 44.28 g fat (0.73% Daily Value), 20.73 g protein (0.86% Daily Value), 145.35 g carbohydrate (0.11% Daily Value), and 0.13 g fiber (0.00% Daily Value). Furthermore, the selling price of Cinube was determined at IDR 18,000 per 80 g package using a 40% markup calculation, while the Break Even Point (BEP) analysis showed that the product would reach the break-even point after the sale of four packages.

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