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DEVELOPMENT OF GRILLED PEMPEK (PEMPEK BAKU) USING POMFRET AND YELLOW SWEET POTATO AS A HEALTHY SNACK

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ABSTRACT

High consumption of low-nutrient, ready-to-eat foods among the Indonesian population has driven the need for more nutritious food product innovations. Grilled pempek made with freshwater pomfret and yellow sweet potato (Pempek BAKU) was developed as a healthy snack alternative with broad community acceptance potential. This study aimed to: (1) determine the optimal Pempek BAKU formula, (2) identify appropriate packaging, (3) assess community acceptance level, (4) analyze nutritional content, and (5) determine the selling price and Break Event Point (BEP). The study employed a Research and Development (R&D) approach with the 4D model (Define, Design, Develop, Disseminate), conducted from September 2025 to April 2026. Data were collected from 2 expert panelists, 30 semi-trained student panelists, and 80 general community panelists. Results showed: (1) the optimal formula comprised 10% yellow sweet potato substitution and 100% freshwater pomfret; (2) packaging consisted of OPP plastic as primary packaging and an oil-resistant mica box as secondary packaging with a product label; (3) the hedonic test yielded an overall mean acceptance score of 4.31, with flavor (4.23), aroma (4.25), texture (4.05), color (4.25), and packaging (4.18) scores, indicating positive community acceptance; (4) each 35-gram serving contained 57 kcal total energy, 3 g protein (5% RDA), 11 g carbohydrates (3% RDA), less than 1 g total fat, and less than 1 g dietary fiber; and (5) the selling price was set at IDR 30,000 per box of 10 pieces with a 40% mark-up, with BEP reached at 6 pieces.

Keywords:
grilled pempek; pomfret; yellow sweet potato

Tingginya konsumsi makanan cepat saji dan rendah nutrisi di kalangan masyarakat Indonesia mendorong perlunya inovasi produk pangan yang lebih bergizi. Pempek panggang dengan substitusi ubi jalar kuning dan ikan bawal air tawar (Pempek BAKU) hadir sebagai alternatif camilan sehat yang berpotensi diterima luas oleh masyarakat. Penelitian ini bertujuan untuk: (1) menentukan formula terbaik Pempek BAKU, (2) menentukan kemasan yang tepat, (3) mengetahui tingkat kesukaan masyarakat, (4) menganalisis kandungan gizi, serta (5) menentukan harga jual dan Break Even Point (BEP). Penelitian menggunakan metode R&D dengan model 4D (Define, Design, Develop, Disseminate), dilaksanakan pada September 2025–April 2026. Hasil menunjukkan: (1) formula terbaik menggunakan substitusi 10% ubi jalar kuning dan 100% ikan bawal; (2) kemasan menggunakan plastik OPP sebagai kemasan primer dan kotak mika berlapis anti-minyak sebagai kemasan sekunder; (3) uji kesukaan memperoleh rata-rata penerimaan keseluruhan 4,31; (4) setiap sajian 35 gram mengandung energi 57 kkal, protein 3 gram (5% AKG), karbohidrat 11 gram (3% AKG); dan (5) harga jual Rp30.000/box dengan BEP 6 buah pempek.

1. Introduction

The growing trend of high consumption of fast food and low-nutrient products among Indonesian society represents a significant public health concern. According to the 2023 Indonesian Health Survey (Survei Kesehatan Indonesia/SKI), the proportion of the population consuming unhealthy food patterns including fried foods, instant noodles, processed foods with preservatives, and high-sugar items remains considerably high. These foods are generally rich in simple carbohydrates and saturated fats while being deficient in balanced nutrients, yet are favored due to their palatability, accessibility, and affordability [1]. This dietary pattern is associated with elevated risks of vitamin deficiencies, obesity, and degenerative diseases [2]. Addressing this issue calls for innovative food product development that incorporates locally available, nutrient-dense ingredients as functional substitutes.

Yellow sweet potato (*Ipomoea batatas L.*) is a nutritionally rich tuberous crop ranked as the sixth most important food plant globally, with China leading world production in a market valued at USD 45 trillion. In Indonesia, sweet potato production reached 1,424,147 tons in 2021, down from 1,604,181 tons the previous year, primarily due to shrinking harvest areas estimated at approximately 67,738 hectares in 2021 [3]. Yellow sweet potato contains 119 kcal energy, 0.5 g protein, 0.4 g fat, 25.1 g carbohydrate, and 4.2 g dietary fiber per 100 g [4]. Despite being widely available, its utilization remains limited to simple preparations such as boiling, frying, or traditional desserts (kolak), with relatively few applications in innovative food products [5]. To complement its fiber and carbohydrate profile, pairing yellow sweet potato with a high-protein local ingredient is considered a promising strategy for developing a more nutritionally balanced food product.

Freshwater pomfret (*Colossoma macropomum*) is an aquaculture species originating from South American waters, known for rapid growth reaching up to 30 kg body weight and 90 cm length in natural habitats [6]. Indonesian production of freshwater pomfret in 2024 was recorded at 480,723 tons, considerably lower than marine fish production at 7,330,891 tons, partly attributable to the reduced availability of inland water bodies [7]. From a nutritional standpoint, freshwater pomfret provides 91 kcal energy, 19 g protein, and 1.7 g fat per 100 g fresh flesh, making it an ideal protein source. Additionally, it is rich in calcium, vitamins A, D, and B12, which are important for neural function and overall health [8]. Given its strong nutritional profile and underutilization as a processed food ingredient, freshwater pomfret presents considerable potential as the primary protein base in a reformulated traditional snack product.

Pempek is a traditional fishcake from South Sumatra, widely consumed across Indonesia [9]. It is commonly served with a dark sweet-sour sauce (cuko) made from tamarind and various spices. Pempek panggang (grilled pempek) is a popular variant characterized by its dry, crispy texture with a filling of dried shrimp (ebi), sweet soy sauce, and bird's-eye chili. Despite its popularity, conventional pempek is limited nutritionally, relying primarily on fish protein and sago starch without significant dietary fiber or micronutrient contributions [10]. This nutritional shortcoming, combined with the broad consumer familiarity of pempek as a platform product, creates an opportunity to develop an enriched formulation using underutilized local ingredients.

Previous studies have individually explored the utilization of yellow sweet potato in biscuits [11] and ice cream [12], and the incorporation of pomfret in composite-flour puff pastry [8]. However, no prior study has simultaneously combined yellow sweet potato and freshwater pomfret in a single pempek-based product. This research gap represents the novelty of the present study: developing Pempek BAKU (BAwal and ubi jalar KUning) as a nutritionally enhanced grilled pempek variant that

leverages local food ingredients while meeting contemporary consumer health demands. Building on this identified gap, the present study was structured around five specific research objectives.

The objectives of this study were to (1) determine the optimal Pempek BAKU formula, (2) identify appropriate primary and secondary packaging, (3) assess community acceptance through hedonic testing, (4) analyze nutritional content via proximate analysis, and (5) determine the selling price and Break Even Point (BEP) as indicators of commercial viability. To achieve these objectives, a Research and Development (R&D) approach employing the four-stage 4D model Define, Design, Develop, and Disseminate was adopted, combining systematic product formulation, expert and consumer sensory evaluation, laboratory proximate analysis, and economic feasibility assessment.

2. Method

2.1 Research Design

This study employed a Research and Development (R&D) approach following the 4D development model consisting of four sequential stages: Define, Design, Develop, and Disseminate [13]. The research was conducted from September 2025 to April 2026 across three locations: (1)Culinary Arts Laboratory, Faculty of Vocational Studies, Universitas Negeri Yogyakarta (Wates Campus) for product development and sensory testing; (2) Auditorium Courtyard of the same faculty for large-scale consumer hedonic testing; and (3) Chem-Mix Pratama Laboratory, Bantul, for proximate analysis.

2.2 Materials

The primary materials used in the developed product (F1 formula) comprised: freshwater pomfret (250 g), sago flour (135 g), yellow sweet potato purée (15 g), dried shrimp/ebi (50 g), green bird's-eye chili (5 pcs), sweet soy sauce (30 g), garlic (2 cloves), salt (7 g), and water (150 ml). The reference recipe used Spanish mackerel as the protein source with no sweet potato substitution. Yellow sweet potato was steamed at 100°C for 20–30 minutes then mashed into a smooth purée prior to incorporation into the dough [12].

2.3 Product Development (4D Stages)

Define stage: Three reference recipes were tested using Spanish mackerel as the base protein to identify the optimal benchmark recipe. Sensory evaluation was conducted by 2 expert panelists and 3 semi-trained panelists, resulting in Reference Recipe 3 (R3) being selected as the benchmark based on highest mean sensory scores across all attributes.

Design stage: Three formulations were developed by substituting yellow sweet potato purée at 10% (F1), 20% (F2), and 30% (F3) of the sago flour weight, while replacing 100% of Spanish mackerel with freshwater pomfret. The formulations were evaluated by 5 panelists (2 experts + 3 semi-trained).

Develop stage: The selected formulation (F1) underwent expert validation (n=2) followed by a limited consumer preference test (n=30 semi-trained panelists/culinary arts students). Packaging design was developed and evaluated at this stage.

Disseminate stage: Large-scale consumer acceptance testing was conducted with 80 untrained general-public panelists at the Wonderroots 2025 food festival. Both the reference recipe and Pempek BAKU were evaluated simultaneously.

2.4 Sensory Evaluation

Hedonic (preference) testing employed a five-point Likert scale (1 = strongly dislike, 2 = dislike, 3 = neutral, 4 = like, 5 = strongly like) adapted from standard food sensory evaluation protocols [14]. Evaluated attributes included color, aroma, flavor, texture, packaging appearance, and overall acceptance. Statistical analysis was performed using the paired-sample t-test ($p < 0.05$/ $p > 0.05$) to determine significant differences between the reference product and Pempek BAKU.

2.5 Proximate Analysis

Nutritional analysis of both the reference product and Pempek BAKU (F1) was conducted in duplicate at the Chem-Mix Pratama Laboratory, Bantul, Yogyakarta (February 2026). Parameters analyzed included moisture content, ash, protein, fat, carbohydrate (by difference), and crude fiber. Results were analyzed using the paired-sample t-test. Nutritional information per serving (35 g) was calculated based on Indonesian BPOM Regulation No. 9/2019 and Ministry of Health RDA values [4].

2.6 Price and Break Even Point Analysis

Selling price was determined using the Cost-Plus Pricing method with a 40% mark-up applied to total production cost. Break Even Point (BEP) was calculated using standard fixed-cost and variable-cost formulas to determine minimum units required to avoid financial loss [15].

3. Results and Discussion

3.1 Define Stage: Reference Recipe Selection

Three reference recipes sourced from published recipes and previous research [9, 10] were prepared using Spanish mackerel as the protein source. The recipes were evaluated for sensory attributes by expert and semi-trained panelists. As presented in Table 1, all three recipes produced products of similar roundish-flattened shape (6 cm diameter), a slightly yellowish-white color, and a savory-sweet-spicy flavor profile.

Tabel 1. Reference Recipe Grilled Pempek

No	Ingridients	Recipe 1	Recipe 2	Recipe 3
1.	Spanish mackerel	500 gr	500 gr	250 gr
2.	Sago flour	300 gr	400 gr	150 gr
3.	Dried shrimp (ebi)	200 gr	200 gr	50 gr
4.	Green chili	100 gr	100 gr	5 pcs
5.	Sweet soy sauce	100 gr	100 gr	30 gr
6.	Garlic	3 cloves	-	2 cloves
7.	Salt	10 gr	7 gr	7 gr
8.	Water	300 ml	200 ml	150 ml

Source :
Resep 1 : Cookpad (https://cookpad.com/id/resep/17239529-329-pempek-tunu-ikantenggiri
Resep 2 : (Febryan, 2021)
Resep 3 : https://resepkoki.id/resep/resep-pempek-panggang/

However, Recipe 1 & 2 produced a chewier texture due to higher sago content and exhibited a more prominent fish aroma due to the absence of garlic. Recipe 3 (R3) achieved the highest overall mean sensory score of 4.0 and was selected as the benchmark for product development. As can be seen in the following data :

Tabel 2. Mean sensory test define stage

Sensory Attribute	Mean		
	R1	R2	R3
Shape	3.6	3.2	4
Size	3.6	3.6	4
Color	3.6	3.6	4
Aroma	3.8	3.6	4.4
Taste	4	3.6	4.2
Texture	3.4	3	4
Overall	3.8	3.4	4

3.2 Design Stage: Formulation Development

Based on R3, three development formulations were produced by substituting yellow sweet potato purée at 10% (F1), 20% (F2), and 30% (F3) of the sago flour weight, while fully replacing Spanish mackerel with freshwater pomfret.

Table 3. Pempek BAKU Formulation

No.	Ingredients	Reference Recipe (R)	F1 (10%)	F2 (20%)	F3 (30%)
1	Freshwater pomfret	–	250 g	250 g	250 g
2	Spanish mackerel (reference)	250 g	–	–	–
3	Sago flour	150 g	135 g	120 g	105 g
4	Yellow sweet potato purée	–	15 g	30 g	45 g
5	Dried shrimp (ebi)	50 g	50 g	50 g	50 g
6	Green bird's-eye chili	5 pcs	5 pcs	5 pcs	5 pcs
7	Sweet soy sauce	30 g	30 g	30 g	30 g
8	Garlic	2 cloves	2 cloves	2 cloves	2 cloves
9	Salt	7 g	7 g	7 g	7 g
10	Water	150 ml	150 ml	150 ml	150 ml

Table 4 presents the mean sensory scores from the design-stage evaluation. F1 consistently outperformed F2 and F3 across all sensory attributes. Increasing the proportion of sweet potato purée progressively darkened the product color from slightly orange-white (F1) to dark orange-brown (F3), and rendered the texture increasingly moist and soft, deviating from the characteristic chewiness expected in grilled pempek. F1, with the smallest deviation from reference sensory standards, was selected for further development.

Table 4. Mean Sensory Scores

Sensory Attribute	Reference Recipe	F1 (10%)	F2 (20%)	F3 (30%)
Shape	4.4	4.2	4.0	3.8
Size	4.4	4.2	4.2	4.0
Color	4.4	4.0	3.8	3.6
Aroma	4.6	4.0	3.6	4.0
Flavor	4.4	3.6	3.0	3.2
Texture	4.8	4.2	3.8	3.8
Overall	4.6	4.2	3.9	3.4

3.3 Develop Stage: Validation and Packaging

Expert validation of F1 versus the reference recipe (R3) was conducted by two culinary experts. As shown in Table 5, the developed product (F1) received higher expert evaluation scores (mean 4.5) compared to the reference recipe (mean 4.0) across all attributes, including color, aroma, flavor, texture, and overall quality. Both experts agreed that the product demonstrated satisfactory sensory quality while exhibiting improvements in color and aromatic profile due to the yellow sweet potato incorporation. Minor feedback was noted regarding the consistency of the cuko filling spiciness level, which was addressed before the limited consumer test.

Table 5. Expert Validation Scores

Sensory Attribute	Reference Product (Mean)	Developed Product (Mean)
Color	4.0	4.5
Aroma	4.0	4.5
Flavor	4.0	4.5
Texture	4.0	4.5
Overall	4.0	4.5

Fig 1. Packaging Pempek BAKU
Source : (M. Ghozy, 2026)

The packaging system designed for Pempek BAKU consists of two layers: an OPP (oriented polypropylene) plastic bag (8×12 cm) as the primary packaging containing one individually wrapped piece (30–35 g), and a white mica box with a transparent lid (7×14 cm) as secondary packaging containing 10 pieces, sealed with an informational product sticker. The primary packaging was selected for its moisture resistance and transparency, while the secondary packaging was chosen for its visual appeal and ability to display the product.

Limited consumer acceptance testing with 30 semi-trained panelists (culinary arts students) using paired t-test analysis revealed no statistically significant differences ($p > 0.05$) between reference and developed products for aroma ($p = 0.67$), flavor ($p = 0.08$), texture ($p = 0.40$), and overall acceptance ($p = 0.55$). Only color showed a marginally significant difference ($p = 0.05$), attributed to the slight orange hue introduced by yellow sweet potato beta-carotene pigments.

Table 6. Semi-trained Acceptance Scores: Develop Stage (n = 30 panelists)

Sensory Attribute	Reference (Mean ± SD)	Pempek BAKU (Mean ± SD)	p-value	Significance
Flavor	4.43 ± 0.73	4.37 ± 0.76	0.08	ns
Aroma	4.40 ± 0.67	4.30 ± 0.70	0.67	ns
Texture	4.47 ± 0.68	4.33 ± 0.66	0.40	ns
Color	4.23 ± 0.73	4.33 ± 0.84	0.05	s
Overall	4.57 ± 0.63	4.53 ± 0.63	0.55	ns

Note: ns = not significant ($p > 0.05$), s = significant ($p < 0.05$)

3.4 Disseminate Stage: Community Acceptance

The large-scale hedonic test conducted with 80 untrained general-public panelists at the Wonderroots 2025 food festival yielded positive acceptance results for Pempek BAKU across all evaluated attributes. Table 7 presents comparative mean scores between the reference product and Pempek BAKU. Pempek BAKU consistently outperformed the reference product across all attributes, recording mean scores of 4.23 for flavor, 4.25 for aroma, 4.05 for texture, 4.18 for packaging, 4.25 for color, and 4.31 for overall acceptance. Paired t-test analysis confirmed no statistically significant differences between the two products across all attributes ($p > 0.05$), indicating that the substitution did not negatively affect consumer acceptance.

Table 7. Consumer Acceptance Scores: Disseminate Stage (n = 80 panelists)

Sensory Attribute	Reference (Mean ± SD)	Pempek BAKU (Mean ± SD)	p-value	Significance
Flavor	3.95 ± 0.82	4.23 ± 0.74	0.678	ns
Aroma	4.05 ± 0.76	4.25 ± 0.70	0.681	ns
Texture	3.74 ± 1.05	4.05 ± 0.84	0.878	ns
Packaging	3.95 ± 0.72	4.18 ± 0.65	0.706	ns
Color	3.98 ± 0.74	4.25 ± 0.80	0.369	ns
Overall	4.06 ± 0.76	4.31 ± 0.68	0.702	ns

Note: ns = not significant (p > 0.05)

The overall acceptance score of 4.31 indicates that Pempek BAKU was well-received by the community, with the product falling between the "like" and "strongly like" categories on the hedonic scale. This result supports the viability of freshwater pomfret and yellow sweet potato as effective ingredient substitutions in grilled pempek without compromising consumer acceptability.

3.5 Nutritional Composition

Proximate analysis results comparing the reference product and Pempek BAKU are presented in Table 8. Significant differences ($p < 0.05$) were found in moisture content, protein, and carbohydrate levels between the two products. Pempek BAKU showed a higher moisture content (55.76% vs. 53.83%), higher protein content (8.94% vs. 8.24%), and lower carbohydrate content (30.48% vs. 33.16%). The increase in moisture and protein can be attributed to the higher water-holding capacity and protein profile of freshwater pomfret relative to Spanish mackerel. The reduction in carbohydrate content aligns with the partial substitution of sago flour with yellow sweet potato purée.

Table 8. Proximate Analysis: Reference Product vs. Pempek BAKU

Nutritional Component	Reference Recipe (%)	Pempek BAKU (%)	p-value	Significance
Moisture	53.83 ± 0.03	55.76 ± 0.08	0.001	Significant
Ash	1.86 ± 0.01	2.05 ± 0.07	0.063	Not significant
Protein	8.24 ± 0.08	8.94 ± 0.03	0.008	Significant
Fat	0.42 ± 0.07	0.56 ± 0.14	0.339	Not significant
Carbohydrate	33.16 ± 0.20	30.48 ± 0.14	0.004	Significant
Crude fiber	2.49 ± 0.01	2.21 ± 0.12	0.080	Not significant

Although the difference in crude fiber content between the two products was not statistically significant ($p = 0.080$), this is attributed to the limited proportion of sweet potato substitution (10% of sago flour weight), which corresponds to only 15 g of purée per batch. To achieve a more meaningful increase in dietary fiber, a higher substitution level would be required;

however, sensory evaluation findings indicate that formulations beyond 10% negatively impact texture quality and consumer acceptance. These findings suggest a practical upper boundary for sweet potato incorporation in this product type.

Table 9. Nutritional Information per Serving of Pempek BAKU

Nutrient	Amount per 35 g serving	% Daily Value (RDA)
Total energy	57 kcal	–
Energy from fat	2 kcal	–
Total fat	<1 g	0%
Protein	3 g	5%
Carbohydrate	11 g	3%
Dietary fiber	<1 g	2%

**% Daily Value based on 2,150 kcal/day reference energy intake per Indonesian Ministry of Health AKG 2019. Individual needs may vary.*

Table 9 presents the complete nutritional information per 35-gram serving of Pempek BAKU. Each serving contains 57 kcal total energy, with 3 g protein (5% RDA), 11 g carbohydrates (3% RDA), less than 1 g total fat (0% RDA), and less than 1 g dietary fiber (2% RDA). As a snack product, Pempek BAKU provides a reasonable protein contribution at 5% of the daily recommended protein intake per serving. The relatively low fat content (<1 g) is consistent with the grilled (non-fried) preparation method, making it a preferable option compared to deep-fried snack alternatives. The low carbohydrate and caloric density position Pempek BAKU as a suitable light snack for health-conscious consumers.

3.6 Selling Price and Break Even Point

Production cost analysis yielded a total cost of IDR 34,860 per batch of 18 pieces, comprising raw material costs (IDR 29,050), equipment depreciation (10% = IDR 2,905), and labor costs (10% = IDR 2,905). Applying a 40% mark-up, the calculated selling price is IDR 3,000 per piece, or IDR 30,000 per box of 10 pieces. The BEP was calculated at 6 pieces per batch (IDR 16,600 in revenue), indicating that profitability begins after the sale of only 6 out of 10 pieces per box a commercially viable threshold for small-scale production. Table 10 compares Pempek BAKU pricing with competing products in the market.

Table 10. Price Comparison: Pempek BAKU vs. Competing Market Products

Product Name	Weight/piece	Price (IDR)	Source/Brand
Pempek BAKU	35 g	IDR 3,000	M. Ghozy Al Qushoyyi (this study)
Pempek Mix	40 g	IDR 5,500	Pempek Candy
Pempek Panggang	30 g	IDR 6,000	Pempek Vico
Pempek Bakar	30 g	IDR 7,000	Pempek 123

As shown in Table 10, Pempek BAKU is priced competitively at IDR 3,000/piece (35 g), which is 45–57% lower than comparable grilled pempek products from established brands (IDR 5,500–7,000/piece). Despite the lower price point, Pempek BAKU offers a nutritional advantage through

its yellow sweet potato and freshwater pomfret incorporation, targeting health-conscious consumers in a growing functional snack market. The favorable pricing reflects the use of locally available freshwater pomfret as a more cost-effective alternative to marine fish species such as Spanish mackerel.

4. Conclusions

This study successfully developed Pempek BAKU, a nutritionally enhanced grilled pempek formulated with 100% freshwater pomfret and 10% yellow sweet potato purée substituted from sago flour. The optimal formula (F1) demonstrated satisfactory sensory quality comparable to the reference product across all evaluated attributes, with no statistically significant differences in community acceptance scores ($p > 0.05$). The product received an overall acceptance score of 4.31 out of 5 from 80 general-public panelists. Proximate analysis confirmed significant increases in protein content (8.94% vs. 8.24%) and moisture content in Pempek BAKU compared to the reference, while maintaining a low fat content (<1 g per serving) consistent with its grilled preparation. Each 35-gram serving delivers 57 kcal and 3 g protein (5% RDA). The selected two-layer packaging system and competitive pricing at IDR 30,000 per box of 10 pieces with a 40% mark-up support commercial viability, with BEP achieved at 6 pieces per box. Pempek BAKU demonstrates the potential for traditional Indonesian snack innovation using underutilized local ingredients. Future research is recommended to investigate higher substitution levels of yellow sweet potato in combination with modified processing techniques to enhance fiber content without compromising textural quality, as well as shelf-life studies and larger-scale market validation.

References.

[1] Kemenkes RI. Survei Kesehatan Indonesia 2023 (SKI). Jakarta: Kementerian Kesehatan Republik Indonesia; 2023.

[2] Domika A, Nurdin A, Fitria U, Dinen KA, Kurnia R. Perilaku konsumsi makanan cepat saji pada remaja dan dampaknya bagi kesehatan. J Kesehatan. 2021;3.

[3] Rahmawati et al. Pengaruh substitusi tepung ubi jalar kuning terhadap karakteristik produk pangan. J Pangan. 2024.

[4] Kementerian Kesehatan Republik Indonesia. Data Komposisi Pangan Indonesia. Jakarta: Kemenkes RI; 2023.

[5] Darmawansyah A, Ninsix R. Studi pembuatan roti manis dengan substitusi tepung ubi jalar kuning. J Teknol Pertanian. 2016;5(1):30–36. https://doi.org/10.32520/jtp.v5i1.88

[6] Fakultas Perikanan dan Kelautan UNAIR. Budidaya ikan bawal air tawar (Colossoma macropomum). Surabaya: UNAIR; 2024.

[7] Pusat Data dan Informasi Pertanian. Data produksi ikan budidaya Indonesia 2023. Jakarta: Kementan; 2023.

[8] Handayani I, Prameswari SA. Puff pastry substitusi komposit ikan bawal dan daun kol banda. Garina. 2022;14(2):103–117.

[9] Surya R, Destifen W, Nugroho D, Stephanie. Pempek: Traditional fishcake dish from South Sumatra, Indonesia. Canrea J Food Technol Nutr Culin J. 2023;6(1):57–76. https://doi.org/10.20956/canrea.v6i1.964

[10] Widyaningrum S, Setyowati S, Dewi S. Effect of the addition of red spinach on making pempek tenggiri fish. J Health Technol. 2019;15(1):8–15.

[11] Lestari YD, Ansharullah A, Isamu KT. Pengaruh perbedaan penambahan tepung ubi jalar kuning (Ipomoea batatas L) dan daging ikan cakalang terhadap gizi dan sensorik biskuit. J Sains Teknol Pangan. 2022;6(6):4616–4628. https://doi.org/10.33772/jstp.v6i6.22855

[12] Alicia R, Hapsari MW. Karakteristik es krim ubi kuning dengan pewarna alami tepung kulit buah naga merah. J Trop AgruFood. 2024;6(1):42–49.

[13] Judijanto L et al. Metodologi Research and Development (Teori dan Penerapan Metodologi RnD). Sonpedia Publishing Indonesia; 2024.

[14] Sari NA, Said AE. Pengujian organoleptik dan hedonik dalam formula sabun susu kambing. J Pendidikan Islam. 2022;11(3):1–13. https://doi.org/10.30868/ei.v11i03.3301

[15] Awaliyah ZS, Jumiyati A, Liliyani A, Winona M, Faku P. Analisis perencanaan laba perusahaan melalui penerapan break even point pada PT Semen Indonesia 2023. 2025;01(03):497–505.

[16] Gordon L Robertson. Food Packaging: Principles and Practice. 3rd ed. CRC Press; 2012.

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SUBSTITUTION OF GARUT STARCH AND GURAMI FISH IN THE PRODUCTION OF FISH FLOSS ROLLS

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ABSTRACT

Indonesia is a maritime nation and the world's second-largest producer of fish for human consumption after China; however, fish consumption in Indonesia remains very low, ranking 20th globally in terms of per capita fish consumption. In addition to fish, Indonesia has vast land suitable for agriculture, such as root crops; however, the utilization of root crops in Indonesia remains very limited. Consequently, minor root crops in Indonesia are rarely utilized, such as the garut tuber. The garut tuber is a local food source with the potential to serve as an alternative to wheat flour. Furthermore, Indonesians have a strong preference for bread and other flour-based foods, leading to an annual increase in wheat imports. This study aims to: (1) Develop an optimal recipe for making rolled meatloaf using garut starch and gurami fish as substitutes, (2) Determine the appropriate presentation and packaging for rolled meatloaf using garut starch and gurami fish as substitutes, (3) To determine the level of public preference for rolled meat floss bread made with garut starch and gurami fish substitutes, (4) To determine the composition and nutritional information of rolled meat floss bread made with garut starch and gurami fish substitutes, and (5) To determine the selling price and Break-Even Point (BEP) for rolled meat floss bread made with garut starch and gurami fish substitutes. The research method used was Research and Development (R&D) based on the 4D model: define, design, develop, and disseminate. This study was conducted from September 2025 to April 2026. The results of this study are as follows: (1) The optimal recipe for a rolled bread product using garut starch and gurami fish as substitutes consists of 30% garut starch and 10% gurami fish, while the fish floss uses 100% gurami fish meat (2) packaging made of clear mica for the semicircular lid and white mica plastic at the bottom to hold the bread, with package dimensions of 8 cm x 5.5 cm x 7 cm (3) A panel test of 80 participants showed that the developed product was preferred by more people (4) The nutritional values of the product are 9% fat, 10% protein, 9% carbohydrates, 10% dietary fiber, and 203 kcal (5) The selling price of the product is Rp 20,000 per piece, with a break-even point of 5 units

Keywords :
Garut root, Shredded Beef Roll, Gurami Fish, Floss Roll

Indonesia adalah negara maritim dan Indonesia sebagai produsen ke 2 ikan konsumsi di dunia setelah cina, namun konsumsi ikan di Indonesia masih sangat rendah, konsumsi ikan di dunia Indonesia berada pada posisi ke 20 sebagai negara konsumsi ikan di dunia. Selain ikan Indonesia memiliki lahan yang luas untuk pertanian seperti umbi-umbian namun pemanfaatan umbi-umbian di Indonesia masih sangat terbatas, sehingga umbi-umbian minor di Indonesia

jarang di manfaatkan seperti umbi garut, umbi garut merupakan salah satu sumber pangan lokal yang berpotensi menjadi alternatif pengganti tepung terigu. Selain itu masyarakat Indonesia gemar mengonsumsi roti-rotian atau makanan yang bertepung sehingga impor gandum di Indonesia setiap taun meningkat. Penelitian ini bertujuan untuk (1) Menemukan resep yang tepat dalam pembuatan roti gulung abon substitusi pati garut dan ikan gurami, (2) Mengetahui penyajian dan kemasan yang tepat untuk roti gulung abon substitusi pati garut dan ikan gurami, (3) Mengetahui tingkat kesukaan masyarakat pada roti gulung abon substitusi pati garut dan ikan gurami (4) Menentukan komposisi dan informasi nilai gizi pada roti gulung abon substitusi pati garut dan ikan gurami (5) Menentukan harga jual dan *Break Even Poin* (BEP) produk roti gulung abon substitusi pati garut dan ikan gurami. Metode penelitian yang digunakan adalah Research and Development (R&D) dengan model 4D, yaitu define, design, develop, dan disseminate. Penelitian ini dilaksanakan pada bulan September 2025 – April 2026. Hasil pada penelitian ini (1) Resep yang tepat dalam produk roti gulung abon substitusi pati garut dan ikan gurami dengan 30% pati garut dan 10% ikan gurami sedangkan pada abon menggunakan 100% daging ikan gurami (2) kemasan berbahan mika bening di bagian penutup yang berbentuk setengah lingkaran dan di bagian bawah plastik mika berwarna putih sebagai tempat roti ukuran kemasan 8cm x 5,5 cm x 7cm (3) uji panelis 80 masyarakat produk pengembangan lebih banyak di sukai (4) nilai gizi pada produk memiliki 9% lemak, 10% protein, 9% karbohidrat, 10% serat kasar dan 203 kkal (5) harga jual pada produk Rp 20.000 per pcs dengan BEP unit sebanyak 5 unit

1. Introduction

Indonesia is the largest archipelago and is geographically situated in a strategic location at the crossroads of two continents and two oceans. Thanks to this geographical position, Indonesia possesses abundant fish resources and is the world's second-largest producer of fish for human consumption after China, with 6,843 tons in 2022 [1]. But with the abundance of fish in Indonesia, the country ranks 20th in the world in terms of fish consumption, a figure that remains very low for a maritime nation.

Fisheries are an important commodity and a protein-rich food source that is good for consumption. However, fish is a highly perishable food item [2]. In Indonesia, the fisheries sector encompasses not only marine fisheries but also freshwater fisheries. One example of freshwater fisheries is the gurami fish (*Osphronemus goramy*)[3]. The gurami is a freshwater fishery commodity with high economic value and is widely recognized as a food fish. One of the nutrients found in gurami is protein, which accounts for 19% of its composition. This is higher than the protein content of other freshwater fish commonly consumed by humans, such as catfish (18.2%), tilapia (16.6%), and carp (16.6%) [4]. In addition to the fishing industry, Indonesia has an agricultural and plantation sector; one of the products of this sector is root vegetables.

Tubers and roots are plant parts obtained from the soil, such as cassava, sweet potatoes, potatoes, and garut. In Indonesia, tubers and roots are divided into two categories: major tubers and minor tubers. Major tubers, such as cassava and sweet potatoes, are more popular than minor tubers. Minor tubers exhibit greater diversity, including taro, gadung, gembili, uwi, and arrowroot, yet these minor tubers are underutilized by the community [5]. According to data from the National Food Agency (BPN) in 2022, root crops are categorized into five types: cassava, sweet potatoes, potatoes, sago, and other root crops. Cassava had the highest consumption at 9.7 kg/capita/year, while other tubers accounted for only 0.8 kg/capita/year. One of the minor tuber crops that can be utilized is the garut tuber.

The arrowroot plant (*Maranta arundinacea* L.) is a local food source with the potential to serve as an alternative to wheat flour. Arrowroot, also known as West Indian Arrowroot, has been designated by the government as a priority food commodity for development due to its significant potential as a wheat flour substitute [6]. The main product of the arrowroot tuber is starch. Arrowroot starch has gastroprotective properties (it coats the stomach) and is easily digested by the stomach. The arrowroot tuber is used by people with a history of stomach ulcers as a preventive measure [7]. This means that Garut starch can be incorporated into bread dough.

Based on data from the Food Consumption Statistics (2024), the average consumption of bread in Indonesia reached 1,095 slices per week, an increase of 2.48% from the previous year; this increase was also accompanied by a rise in wheat imports into Indonesia. According to the Central Statistics Agency (BPS), wheat imports in 2023 reached 10,586 tons, and in 2024, they reached 11,715 tons. These figures indicate that wheat imports in Indonesia continue to rise, and the country remains heavily dependent on wheat. Abon rolls are made from wheat flour and topped with animal-based abon and have become so popular in Indonesia that they are now a signature snack from various regions[8]. Several studies have examined the use of garut starch as a substitute, such as in the production of sweet bread using garut starch, which showed an increase in the nutritional value of dietary fiber; however, the protein content remains very low, and further innovation and precise formulation are needed for the product to be widely accepted by the public[9].

Based on the existing issues, this study developed a shredded fish roll using garut starch and gurami fish as substitutes, with the shredded fish topping made from fish flakes. The objectives of this study are to develop a recipe formulation using garut starch and gurami fish as substitutes, determine the presentation and packaging, assess consumer preference, determine the composition and nutritional information, and establish the selling price and break-even point (BEP).

2. Method

This study employed a Research and Development (R&D) methodology using the 4D framework, which consists of the define, design, develop, and disseminate stages. The research was conducted at the Vocational Faculty of Yogyakarta State University. The define stage involved selecting three recipes for shredded beef rolls to serve as reference recipes; these three recipes were then tested simultaneously to evaluate their sensory properties, including color, aroma, taste, texture, and overall impression. The design phase was conducted in two stages: the first design involved substituting 20%, 30%, and 40% of the starch with arrowroot starch, followed by a second design using 10%, 20%, and 30% substitutions. These were then tested by a panel to determine their sensory properties, The selected percentages from the design phase were then advanced to the development phase, which involved refining the product including packaging, labeling, and toppings. During this phase, testing was also conducted on 30 semi-trained panelists to assess the product's sensory properties. The dissemination stage is the final stage of development, involving the distribution of the product to 80 untrained panelists to assess the product's sensory characteristics and determine whether the product is suitable and acceptable to the public.

The test data were analyzed using a paired t-test to compare the sensory scores of the reference product and the prototype, to determine whether there were significant differences between the two. The data analysis was conducted in stages, beginning with evaluations by experts and trained panelists, followed by a hedonic test involving 80 untrained panelists[10].

3. Results and Discussion

3.1 Results

a. Formulation of a recipe for fish floss rolls using garut starch and gurami fish as substitutes

The first stage of the study involved identifying recipes to serve as references and a basis for development; three recipes were compared based on their ingredient composition. The results of this comparison will be used to determine the most suitable recipe as the basis for developing a meat floss roll using garut starch and gurami fish as substitutes. A comparison of the three recipes is shown in Table 1.

Table 1. Basic Recipe for Shredded Beef Roll

ingredients	Recipe 1	Recipe 2	Recipe 3
flour	300 gr	1000 gr	275 gr
Granulated sugar	50 gr	200 gr	35 gr
Powdered milk	7 gr	30 gr	-
Instant yeast	4 gr	15 gr	4 gr
Bread improver	-	10 gr	-
Eggs	50 gr	150 gr	-
Egg yolks	-	-	2 item
Cold milk	-	-	150 ml
Cold water	130 gr	400 ml	-
Unsalted butter	35 gr	-	-
Butter	-	150 gr	25 gr
Salt	3 gr	20 gr	1,9 gr
Spread			
Egg yolk	25 gr	25 gr	1 item
Milk	15 ml	-	-
Water	-	50 gr	-
Filling & Toppings			
Mayonnaise	90 gr	200 gr	100 gr
condensed milk	55 gr	-	40 gr
Shredded chicken	As needed	400 gr	As needed
Tomato sauce	-	50 gr	-
Large chili peppers	1 items	1 items	-
Green onions	1 items	1 items	-

Table 1 lists three recipes for shredded beef rolls that differ in ingredient composition. To explore how variations in ingredients affect the sensory characteristics of the bread rolls such as color, aroma, taste, texture, and overall properties the three recipes were tested simultaneously to determine the differences in their characteristics. The characteristics of the three recipes are presented in Table 2.

Table 2. Characteristics of the results from the Define phase

Sensoris	Resep 1	Resep 2	Resep 3
Color	*Golden brown*	Brownish	*Golden brown*
Aroma	Distinctive yeast sweetness	yeast-flavored	Distinctive yeast sweetness
Shape	Round	Round	Round
Taste	Sweet	Sweet	Sweet
Texture	Dry with large air pockets	Dense and crumbly	Small, soft air pockets
Overall	Dry and crumbly when eaten	Dense and crumbly when eaten	Soft when eaten, not crumbly

Table 2 shows the differences in the characteristics of the reference recipes at the define stage. Recipe 1 has appropriate characteristics in terms of color, aroma, and shape, but the texture of the bread is dry and has large air pockets. Recipe 2 has appropriate characteristics in terms of aroma, shape, and taste, but the color is too brown, and the texture is too dense and crumbly when eaten. Recipe 3 exhibits characteristics that are highly consistent in terms of color, aroma, shape, taste, texture, and overall properties. Based on these characteristics, Recipe 3 is the most superior.

In addition to the evaluation of product characteristics, sensory observations were also conducted to visually assess the products made according to each reference recipe; the purpose of these sensory observations was to identify differences in product appearance. The results of the visual assessment of the three recipes are presented in Table 3.

Table 3. Visual results of the define phase

Deskripsi foto	Resep 1	Resep 2	Resep 3
The top of the bread			
The side of the bread			

After conducting the characteristic tests, the next step was to evaluate the panelists' preferences regarding the reference product. The evaluation covered several sensory attributes, including shape, size, color, aroma, taste, texture, and overall characteristics. The average results of the panelists' evaluations are presented in Table 4.

Table 4. Average score for the Define phase

Sensory properties	Average value		
	R1	**R2**	**R3**
Shape	4	3,8	3,8
Size	3	3,6	3,8
Color	4,2	3,8	4
Aroma	3,8	3,6	4
Taste	3,6	3,8	3,8
Texture	3,2	3,2	3,8
Overall	3,6	3,8	4,4

Table 4 shows the average sensory scores for the three reference recipes. The highest average score for overall quality was for Recipe 3, at 4.4, while Recipe 1 had an average score of 3.6 and Recipe 2 had a score of 3.8, indicating that Recipes 1 and 2 were less preferred and Recipe 3 was more preferred. therefore, Recipe 3 will be used as the basis for further development. In the next stage, Recipe 3 is substituted with arrowroot starch in Design 1; the substitution recipe for the first design is shown in Table 5.

Table 5. Design Phase 1 Recipe: Garut Starch Substitution

Ingredients	**Reference**	**F1 20%**	**F2 30%**	**F3 40%**
Garut root starch	0	55 gr	82,5 gr	110 gr
All-purpose flour	275 gr	220 gr	192,5 gr	165 gr
Granulated sugar	35 gr	35 gr	35gr	35 gr
Instant yeast	4 gr	4 gr	4 gr	4 gr
Egg yolk	2 units	2 units	2 units	2 units
Milk or water	150 ml	150 ml	150 ml	150 ml
Butter	25 gr	25 gr	25 gr	25 gr
Salt	1,9 gr	1,9 gr	1,9 gr	1,9 gr
Bread spread				
Egg yolk	1 units	1 units	1 units	1 units
Topping				
Mayonnaise	100 gr	100 gr	100 gr	100 gr
Sweetened condensed milk	40 gr	40 gr	40 gr	40 gr
Shredded beef (Abon)	As needed	As needed	As needed	As needed

Table 5 shows the experimental recipes for substituting arrowroot starch at 20%, 30%, and 40% replacement rates. The difference among the recipes lies in the addition of arrowroot starch and the reduction of wheat flour; these adjustments were made to determine the effect of the substitution on the final product characteristics. The results of the arrowroot starch substitution for the three recipes are presented in Table 6.

Table 6. Characteristics of the results of Design Phase 1.

Sensory	**F1 20%**	**F2 30%**	**F3 40%**
Color	*Golden brown*	*Golden brown*	*Golden brown*
Aroma	Distinctive yeast sweetness	Distinctive yeast sweetness	Yeast
Shape	Round	Round	Round with cracks
Taste	Sweet	Sweet	Sweet
Texture	Soft, with small air pockets	Soft, with slightly wide air pockets	Starting to get a little dense, with large air pockets.
Overall	Soft, and slightly crumbly when eaten	Soft and not too crumbly when eaten	Dry, cracks easily, and crumbles when rolled

Table 6 shows the results of the substitution test for shredded beef rolls with added arrowroot starch. In the test results, recipe design F1 has a texture almost similar to the control, but the bread clumps slightly when eaten, and the garut starch content can still be increased; in F2, the bread texture begins to be slightly dry but remains soft like the control; in F3, the bread is dry and crumbles easily when rolled, and the bread cracks easily.

Table 7. Visual results of Design Phase 1

Photo description	**Acuan**	**F1 20%**	**F2 30%**	**F3 40%**
The top of the bread				
The side of the bread				
The bottom of the bread				

The three tested recipes exhibited sensory differences; the addition of arrowroot starch can alter the product's characteristics, particularly its texture, especially when more arrowroot starch is added.

Table 8. Average score for Design Phase 1

Sensory properties	Average value			
	Selected recipes	**F1**	**F2**	**F3**
Shape	4	3,8	3,8	3,6
Size	3,8	4	4	4
Color	4	4	4	4
Aroma	3,6	3,6	3,8	3,2
Taste	3,8	4,2	3,6	3,6
Texture	3,8	3,6	3,8	2,8
Overall	4	3,4	3,8	2,8

Table 8 shows differences in the average scores for overall development: (F1) scored 3.4, (F2) 3.8, and (F3) 2.8. Among these, F2 had the highest average score, and the F2 recipe containing 30% arrowroot starch proceeded to Design Phase 2 with the addition of gurami fish.

Table 9. Recipe for Garut Starch and Gurami Fish

ingredient	**Reference**	**F1 10%**	**F2 20%**	**F3 30%**
Gurami fish	0	19,25 gr	38,5 gr	57,75 gr
Garut starch	82.5 gr	82.5 gr	82.5 gr	82.5 gr
All-purpose flour	192,5	173,25 gr	154 gr	134,75 gr
Granulated sugar	35 gr	35 gr	35 gr	35 gr
Instant yeast	4 gr	4 gr	4 gr	4 gr
Egg yolk	2 units	2 units	2 units	2 units
Milk or water	150 ml	150 ml	150 ml	150 ml
Butter	25 gr	25 gr	25 gr	25 gr
Salt	1,9 gr	1,9 gr	1,9 gr	1,9 gr
Bread spread				
Egg yolk	1 units	1 units	1 units	1 units
Topping				
Mayonnaise	100 gr	100 gr	100 gr	100 gr
Sweetened condensed milk	40 gr	40 gr	40 gr	40 gr
Shredded beef	As needed	As needed	As needed	As needed

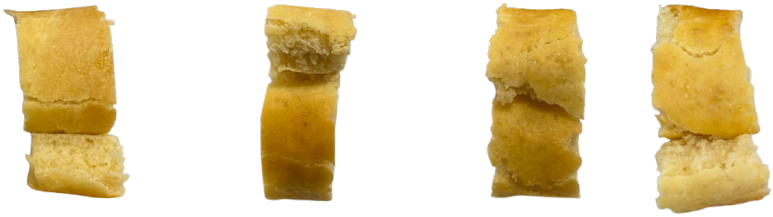
Table 9 presents substitution recipes using gurami fish meat and garut starch, with gurami fish meat comprising 10%, 20%, and 30% of the mixture, and garut starch comprising 30%. These three recipes were tested simultaneously to determine differences in sensory characteristics. The sensory characteristics for Design 2 are shown in Table 10.

Table 10. Characteristics of the design results

Sensory	F1 10%	F2 20%	F3 30%
Color	*Golden brown*	*Golden brown*	*Golden brown*
Smell	Distinctive yeast sweetness	Slightly fishy-smelling	Has a fishy smell
Appearance	Round	Round	Cracked and round
Taste	Sweet	Sweet	Sweet
Texture	Soft, with small air pockets	Slightly hollow and starting to go soft	Soft and has closed cavities
Overall	Soft and doesn't clump when eaten	Soft and clumps together when eaten	Soft and clumps together when eaten

In the second design trial, which included the addition of F1 gurami fish (10%), the texture remained soft; in the F2 trial, the texture began to become dense and clumped when eaten; and in the F3 trial, the texture was dense and cracked, and the bread was inedible. The visual results for Design 2 are shown in Table 11.

Table 11. Visual results of Design Phase 2

Photo description	Reference	F1 10%	F2 20%	F3 30%
The top of the bread				
The side of the bread				
The bottom of the bread				

There are several sensory differences in the products developed using arrowroot starch and gurami fish, such as color, texture, taste, aroma, shape, and overall characteristics of the bread. This occurs because a certain percentage of the gluten in the bread is replaced by the starch and gurami fish meat. The results of the sensory test conducted with panelists are presented in Table 12.

Table 12. Average score for the design phase 2.

Sensory properties	Average value			
	Selected recipes	F1	F2	F3
Shape	4,4	4,6	4,4	4,2
Size	4,4	4,4	4,4	4,2
Color	4,4	4,4	4,6	4
Aroma	4,2	4,2	3,9	3,2
Taste	4,2	4,4	3,9	3,2
Texture	4,2	4,4	4	3,6
Overall	4,3	4,5	4,04	3,62

Based on the summary table of sensory test results above, the F1 formulation which included a 10% addition of gurami fish scored the highest on overall quality. Based on previous research, the optimal recipe formulation includes 30% garut starch and 10% ground gurami fish.

b. Determination of the presentation and packaging of fish floss rolls made with garut starch and gurami fish

After developing a good recipe, the next design phase involved refining the product by adding toppings and determining the presentation and packaging. Additionally, during this phase, a validation test was conducted with two experts using sensory evaluation to assess aspects such as shape, size, color, aroma, taste, texture, and overall quality. The following is the recipe for the 13th topping.

Table 13. Recipe for shredded beef topping for bread**.**

Ingredient	portion
Gurami fish	800 gr
Red chili peppers	10 units
Garlic	2 units
Shallots	15 units
Turmeric	2 cm
Galangal	2 cm
Ground black pepper	½ sdt
Ground coriander	½ sdt
Seasoning	1 sdt
Thick coconut milk	65 ml

Table 13 shows a recipe for 100% gurami fish floss used as a bread topping. At this stage, the bread proceeds to the final stages of packaging and proper presentation, including the packaging used for the fish floss roll a bread roll made with garut starch and gurami fish.

Figure 1. packaging label

Figure 2. product packaging

The packaging for the shredded meat roll made with Garut starch and gurami fish substitutes uses primary packaging. The packaging features a semi-circular, clear lid, while the container beneath it is white and made of plastic. The dimensions of this product packaging are 8 cm x 5.5 cm x 7 cm. The label is placed on the top of the lid to provide clear information about the shredded meat roll product. After the packaging was finalized, the product proceeded to the validation testing phase with two experts; the following are the validation test results

Table 14. Validation test results.

Sensory properties	Nilai rerata	
	Selected recipes	**development recipes**
Shape	4	4
Size	4	4
Color	4	4
Aroma	4	3,75
Taste	4	4,25
Texture	4	4,5
Overall impression	4	5
Presentation	3,5	4
Packaging	3,5	4,5

In the validation test phase, the test product was preferred over the reference product in terms of overall sensory characteristics; the test product received a score of 5, meaning it was highly preferred, while the reference product received a score of 4, meaning it was liked. The product will now proceed to the dissemination phase.

c. Analysis of Consumer Preferences for Fish Floss Rolls Made with Garut Starch and Gurami Fish

The development process for the bread roll product made with garut starch and gurami fish substitutes has been completed. At this stage, the product was distributed to 80 panelists to determine whether the product was liked or not, and also whether there were any significant differences between the reference product and the developed product. The

distribution was conducted through sensory evaluations, including taste, aroma, texture, packaging, color, and overall impression. The following are the results of the t-test at the distribution stage

Table 15. Results of a test involving 80 panelists

Sensory properties	Reference Products			Product Development			p-value	Description
Color	4,11	±	0,62	4,24	±	0,51	0,06	No significant difference
Aroma	4,04	±	0,66	4,10	±	0,63	0,45	No significant difference
Taste	4,02	±	0,70	4,26	±	0,65	0,01	Significant difference
Texture	4,05	±	0,59	4,28	±	0,55	0,00	Significant difference
Overall	4,35	±	0,62	4,54	±	0,50	0,03	Significant difference

In the paired t-test table above, if the P-value is > 0.05, the reference and the modified version are not significantly different; if the P-value is < 0.05, the reference and the modified version are significantly different. The results for the rolled bread with shredded meat, using Garut starch and gurami fish as substitutes, show P-values less than 0.05 for sensory attributes such as taste, texture, and overall quality, indicating a significant difference between the two products. However, for color and aroma, the P-values are greater than 0.05, indicating no significant difference between the two products.

There was no significant difference in aroma due to the low moisture content of the abon; as a dried product, its volatile aromas tend to dissipate or diminish during the baking process. Regarding color, there was no significant difference because the same baking technique was used for both the control and experimental products, along with the same temperature, and the egg wash applied to the bread used the same amount of egg yolk. the graph data indicates that the developed product is preferred by the public compared to the reference product

d. Analysis of the composition and nutritional information of fish floss rolls made with garut starch and gurami fish

At this stage, proximate analysis was conducted in the laboratory with two replicates; the following are the results of the proximate analysis and the average nutritional values for the bread rolls made with garut starch and gurami fish substitutes.

Table 16. average proximate analysis results.

Sample	Nutrients	On average
Guidelines	Water (%)	35,77
Development		37,21
Guidelines	Ash (%)	1,10
Development		1,56
Guidelines	Protein (%)	6,49
Development		8,51
Guidelines	Fat (%)	10,46
Development		9,46
Guidelines	Crude fiber	2,37
Development	(%)	4,10
Guidelines		46,18

Sample	Nutrients	On average
Development	Carbohydrates (%)	43,26
Guidelines	Energy (%)	300,17
Development		288,52

Table 16 shows the average results of the proximate analysis, including moisture content, protein, and crude fiber. The average values for these parameters are higher in the developed product, while the values for ash, fat, carbohydrates, and energy are lower compared to the reference product. The higher protein and crude fiber content in the developed product provide benefits to the community. Based on these average results, calculations for %AKG, mass, and energy were then performed.

Table 17. Calculation of mass and energy

Nutrients	Level	Crowd	Energy (kcal)
Fat	9,46%	$\frac{9,46}{100}$ x 70 = 6,62 Rounded 6 g	6.622 x 9 = 59,598 Rounded (59 kkal)
Protein	8,51%	$\frac{8,51}{100}$ x 70 = 5,95 Rounded 6 g	5,957 x 4 = 23,828 Rounded (23 kkal)
Carbohydrates	43,26%	$\frac{43,26}{100}$ x70= 30.28 Rounded 30 g	30,282 x 4 = 121,128 Rounded (121 kkal)
Total energy			**203 kcal**

As shown in Table 17, the bread roll product made with garut starch and gurami fish as substitutes contains 203 kcal. Based on this data, most of the calories come from carbohydrates, indicating that this product can serve as a sufficient source of energy for the body. After calculating mass and energy, the next step is to calculate the Recommended Dietary Allowances (RDAs) for the bread roll product made with garut starch and gurami fish substitutes.

Table 18. Calculation of % AKG

Nutrients	Reference Products	Product Development
Fat	$\frac{7,06}{67}$ x 100 = 10,53 % Rounded (10 %)	$\frac{6,62}{67}$ x 100 = 9,88 % Rounded (9%)
Protein	$\frac{4,54}{60}$ x100 = 7,56% Rounded (7%)	$\frac{5,95}{60}$ x 100 = 9,91% Rounded (10%)
Carbohydrates	$\frac{32,33}{325}$ x 100 = 9,94% Rounded (10%)	$\frac{30,28}{325}$ x 100 = 9,31% Rounded (9%)
Crude fiber	$\frac{1,91}{30}$ x 100 = 6,36 Rounded (6%)	$\frac{2,87}{30}$ x 100 = 9,56 Rounded (9%)

Based on the results of the %RDA calculation, with a product weight of 70 grams per serving, the nutritional content is sufficient to meet daily nutritional needs. Both the

reference product and the developed product have a protein content of >5%. The developed product contains a higher protein content than the reference product, and its crude fiber content is also higher than that of the reference product. Based on this data, the developed product can meet the daily nutritional needs of the population. The following table provides nutritional information for the bread roll product made with shredded meat and a substitute of garut starch and gurami fish.

INFORMASI NILAI GIZI		
Serving size		1 pcs (70 g)
Servings per package		1
Serving size		
Total energyl		203 kkal
		% AKG
Fat	6 g	9 %
Protein	6 g	10 %
Total carbohydrates	30 g	9 %
Crude fiber	3 g	9 %
Percentage of RDA based on an energy requirement of 2,150 kcal. Your energy requirement may be higher or lower.		

According to the nutritional information table, the bread roll made with shredded meat and a substitute of garut starch and gurami fish contains 203 kcal per 70 grams. The product is particularly rich in protein and dietary fiber, making it a good source of daily nutrition and an excellent source of protein and fiber to aid digestion for the general public.

Table 19. Calculation of the selling price

Ingredients	**Total**	**Unit price**	**Total price**
Total cost of raw materials (A)			**114.000**
Total label packaging cost (B)			**16.000**
Total fixed costs (C)			**41.000**
Distribution Costs (D)			**5.000**
Production cost (A+B+C+D)			176.000
Production cost per unit 176,000 : 12			14.666
Profit margin of 30%,			4.399
Markup 30% x 14,666			19.062 Rounded 20.000

Based on the calculation of the selling price for the shredded meat roll made with garut starch and gurami fish which costs 20,000 per serving with a 30% markup and yields a net profit of 4,399 per serving the break-even point (BEP) for this product can be calculated to minimize losses.

$$\text{BEP Unit} = \frac{\text{fixed cost}}{\text{selling price in unit} - \text{variable cost in unit}}$$

$$= \frac{41.000}{20.000 - 11.250}$$

$$= \frac{41.000}{8,750}$$

= 4,69 units rounded 5

$$\text{BEP Rupiah} = \frac{\text{fixed cost}}{1 - \frac{\text{variable cost in unit}}{\text{selling price in unit}}}$$

$$= \frac{41.000}{1 - \frac{11.250}{20.000}}$$

$$= \frac{41.000}{1 - 0.5625}$$

$$= \frac{41.000}{0.4375}$$ = 93. 714 rounded 100.000

Based on the calculations above, it can be concluded that the break-even point for the bread rolls made with garut starch and gurami fish as substitutes is 5 units sold per production run, and the break even sales amount in rupiah needed to cover a loss of 100,000.

3.2. Discussion

a. Recipe for Shredded Meat Rolls Substituting Garut Starch and Gurami Fish

An innovation in shredded fish roll bread using garut starch and gurami fish as substitutes in the selected development product, with a 30% substitution of garut starch and a 10% substitution of gurami fish. For the shredded fish filling, 100% gurami fish meat is processed and dried into shredded fish; the use of gurami fish aims to increase the protein content. In the bread-making process, the straight dough method is used: dry ingredients are mixed, then liquid is added and the mixture is stirred until semi-smooth; fat is then added and the mixture is stirred until smooth. The fermentation process for making the rolled bread requires three stages: bulk fermentation, intermediate proofing, and final proofing. Baking is done at 180°C for 20 minutes.

b. Presentation and packaging of meat floss rolls made with garut starch and gurami fish

The packaging for the shredded beef and gurami fish roll which uses garut starch and gurami fish as substitutes features primary packaging with a semicircular lid made of clear plastic film; the bottom of the package is also made of white plastic film. The package measures 8 cm x 5.5 cm x 7 cm, and the product label is yellow, displaying information such as the product name, ingredient list, allergen information, and nutritional information.

c. Public preference for meat floss rolls made with garut starch and gurami fish

In the preference test, questionnaires and products were distributed to untrained panelists or the public, and it was found that the experimental product a meat floss roll made with Garut starch and gurami fish was preferred over the control product. In terms of sensory parameters, there was no significant difference between the reference product and the developed product regarding color and aroma, but there were significant differences in taste, texture, and overall characteristics. There was a significant difference between the reference and the developed product, with panelists preferring the developed product, which is well-received by the public.

d. Composition and Nutritional Information of Shredded Meat Rolls Made with Garut Starch and Gurami Fish

Based on the results of the proximate analysis of a 70-gram sample, the shredded meat roll product made with garut starch and gurami fish substitutes has superior nutritional content, such as protein and crude fiber. The composition and nutritional information for the developed product show a nutritional profile of 9% fat, 10% protein, 9% carbohydrates, 10% crude fiber, and 210 kcal. With this composition, the

bread roll product made with shredded meat and a substitute of garut starch and gurami fish can meet daily nutritional needs

e. Selling price and break-even point (BEP) for meat floss rolls made with Garut starch and gurami fish

The selling price of the meat floss roll made with Garut cassava starch and gurami fish has been set at 20,000 per unit. This calculation is based on production cost estimates. The break-even analysis indicates that the break-even point for this product is 5 units, meaning that once that quantity is sold, production costs are covered.

4. Conclusion

Based on the results of this study, the development of shredded meat rolls using garut starch and gurami fish as substitutes can be summarized as follows:

1. The best recipe for shredded beef rolls, using 30% garut starch and 10% ground gurami fish as substitutes.
2. The product is served with sauce and comes in a package with a clear plastic lid and a white base, measuring 8 cm x 5.5 cm x 7 cm.
3. In the acceptability test, the sensory parameters for color and aroma had values above 0.05, indicating no significant difference, whereas the values for taste, texture, and overall impression were below 0.05, indicating a significant difference.
4. The nutritional content of the shredded meat roll made with garut starch and gurami fish as substitutes is 9% fat, 10% protein, 9% carbohydrates, 10% crude fiber, and 210 kcal
5. The selling price of the product is Rp 20,000 per unit, and the break-even point is 5 units, while the break-even amount is Rp 100,000

Referensi

[1] FAO, *The State of World Fisheries and Aquaculture 2024*. FAO, 2024. doi: 10.4060/cd0683en.

[2] A. Rizkia, G. Iwang, and M. Ine, “Strategi Pengembangan Usaha Pengolahan Abon Ikan (Studi Kasus Rumah Abon Di Kota Bandung) Business Development Strategies Of Processing Fish Floss (Case Study Of Rumah Abon In Bandung),” *Jurnal Perikanan Kelautan*, vol. VI, no. 2, pp. 78–84, Dec. 2022.

[3] M. Kristina and Sulantiwi, “SISTEM PENDUKUNG KEPUTUSANMENENTUKAN KUALITASBIBIT IKAN GURAMEDI PEKON SUKOSARI MENGGUNAKAN APLIKASI VISUAL BASIC 6.0,” Lampung, 2021. [Online]. Available: www.stmikpringsewu.ac.id

[4] M. F. Hidayatullah, H. Fitriyah, and F. Utaminingrum, “Sistem Klasifikasi Kesegaran Daging Ikan Gurami berdasarkan Warna dan Gas Amonia menggunakan K-Nearest Neighbor (KNN) berbasis Arduino,” 2022. [Online]. Available: http://j-ptiik.ub.ac.id

[5] I. T. Hoky, I. A. Astarini, and M. Pharmawati, “KEANEKARAGAMAN TANAMAN UMBI – UMBIAN YANG BERPOTENSI SEBAGAI PANGAN ALTERNATIF DI KECAMATAN RENDANG DAN BEBANDEM, KABUPATEN KARANGASEM, BALI,” *SIMBIOSIS*, vol. 10, no. 2, p. 122, Jun. 2022, doi: 10.24843/jsimbiosis.2022.v10.i02.p01.

[6] Alifah, “KUE SUS ISI VLA GARUT COKLAT DENGAN SUBSTITUSI TEPUNG UMBI GARUT UNTUK MENINGKATKAN POTENSI PANGAN LOKAL,” *Prosiding Pendidikan Teknik Boga Busana*, no. Vol. 16 No. 1 (2021): Prosiding PTBB 2021, Oct. 2021.

[7] T. Melyandra, N. T. Dara, and D. Nurjanah, "Pelatihan Usaha Baru dengan Pemanfaatan Umbi Garut sebagai Bahan Dasar, Cookies Umbi Garut 'Cosut' Pencegah Maag Segala Usia," *JPPM (Jurnal Pengabdian dan Pemberdayaan Masyarakat)*, vol. 8, no. 3, p. 377, Nov. 2024, doi: 10.30595/jppm.v8i3.13450.

[8] C. Rosa, "Roti Abon Gulung, Oleh-oleh Khas Papua dari Tanah Jauh," https://www.akurat.co/food/1302311429/Roti-Abon-Gulung-Oleholeh-Khas-Papua-.

[9] A. Ta'in, H. Handjani, U. Chasanah, and D. DwiSiskawardani, "Sweet Bread Characterization from Modified Arrowroot Starch within Lecithin Addition," 2022.

[10] Okpatrioka, "Research And Development (R&D) Penelitian Yang Inovatif Dalam Pendidikan," *Jurnal Pendidikan, Bahasa dan Budaya*, vol. 1, pp. 86–100, Mar. 2023, doi: https://doi.org/10.47861/jdan.v1i1.154.

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PURPLE SWEET POTATO FLOUR SUBSTITUTIONIN MAKING STEAMED BAKED CUISINE (*BOLUKUU*) AS A HIGH-FIBER PRODUCT FOR Z GENERATION

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ABSTRACT

The development of value-added bakery products using functional local ingredients has gained increasing attention due to growing consumer demand for nutritionally improved foods. Steamed sponge cake represents a widely consumed traditional bakery product that can be reformulated through partial substitution with purple sweet potato flour, a source of dietary fiber. Nevertheless, product development requires systematic evaluation of formulation performance, packaging suitability, consumer acceptance, nutritional characteristics, and economic feasibility. This study aimed to develop and evaluate a steamed sponge cake product (Bolukuu) formulated with purple sweet potato flour, assess Generation Z consumer acceptance, analyze dietary fiber content and nutritional value, and determine appropriate packaging and pricing strategies.

A Research and Development (R&D) approach was applied using four sequential stages: define, design, develop, and disseminate. The study was conducted in the Culinary Laboratory and Chemistry Laboratory of the vocational Culinary Arts learning Program, Yogyakarta States University, with consumer acceptance testing carried out at the Pedestrian Area of the Karangmalang Rectorate. Product validation involved expert assessors, followed by sensory evaluation using a hedonic Likert scale with expert panelists, 31 semi-trained panelists in a limited-scale test, and 80 Generation Z consumers in a large-scale test. Data analysis was conducted through descriptive statistics and paired-sample t-tests, and scoring analysis.

The results demonstrated that the optimal formulation consisted of a 40% substitution of purple sweet potato flour. Packaging evaluation identified a gold-colored mica box with a floral cupcake base as the most suitable option. Findings from the sensory analysis showed a high degree of acceptance among consumers, with a mean hedonic score of 4.61 among Generation Z participants. Nutritional analysis revealed that a 45 g serving of Bolukuu provides 100 kcal of energy and 2.4 g of dietary fiber, indicating its potential contribution to digestive health. Economic analysis established a selling price of IDR 10,000 per package, with a break-even point of eight units. Overall, the findings confirm that Bolukuu represents a nutritionally enhanced bakery product with favorable sensory acceptance and economic feasibility.

Keywords:
steamed sponge cake, purple sweet potato flour, obesity, Generation Z, dietary fiber

Pengembangan produk bakery bernilai tambah dengan memanfaatkan bahan lokal berpotensi meningkatkan kualitas gizi dan daya tarik konsumen, khususnya Generasi Z. Bolu kukus merupakan produk bakery tradisional yang dapat dikembangkan melalui substitusi tepung ubi ungu sebagai sumber serat pangan. Namun, pengembangan produk memerlukan evaluasi terhadap formulasi, kemasan, tingkat penerimaan konsumen, kandungan gizi, serta kelayakan ekonomi. Penelitian ini bertujuan untuk mengembangkan produk bolu kukus (Bolukuu) dengan substitusi tepung ubi ungu, menentukan kemasan yang sesuai, menganalisis tingkat penerimaan konsumen Generasi Z, mengetahui kandungan serat dan nilai gizi, serta menetapkan harga jual produk.

Penelitian ini menggunakan **pendekatan penelitian dan pengembangan** yang dilaksanakan melalui tahapan define, design, develop, dan disseminate, yang dilaksanakan di Laboratorium Boga dan Laboratorium Kimia Program Studi D4 Tata Boga Fakultas Vokasi Universitas Negeri Yogyakarta, serta uji penerimaan konsumen di area Pedestrian Rektorat Karangmalang. Hasil penelitian menunjukkan bahwa formulasi optimal Bolukuu menggunakan substitusi tepung ubi ungu sebesar 40% dengan kemasan kotak mika berwarna keemasan. Produk Bolukuu memperoleh tingkat penerimaan tinggi oleh Generasi Z dengan nilai rata-rata 4,61. Analisis gizi menunjukkan bahwa Bolukuu dengan takaran saji 45 gram mengandung energi sebesar 100 kkal dan serat pangan sebesar 2,4 gram. Harga jual produk ditetapkan sebesar Rp10.000 per kemasan dengan titik impas sebanyak 8 buah, sehingga produk ini layak dikembangkan secara gizi dan ekonomi.

1. Introduction

Generation Z exhibits consumption behaviors that are strongly shaped by intensive digital media exposure and the Fear of Missing Out (FOMO) phenomenon, which significantly influences food preferences and purchasing decisions. This demographic tends to favor snack foods and ready-to-eat products that are high in energy and sugar yet low in dietary fiber. When coupled with low levels of physical activity, these dietary patterns contribute to inadequate fiber intake and elevate the risk of early-onset obesity. In Indonesia, average daily fiber consumption is estimated at only 5.7 g, substantially below the recommended Dietary Reference Intake of 29–37 g per day, indicating a pronounced imbalance in nutrient intake among young populations [1], [2].

Alongside these nutritional concerns, wheat flour consumption in Indonesia continues to rise, with domestic demand relying heavily on imported wheat as the primary raw material. Per capita wheat flour consumption has reached 2.94 kg per year, while national wheat imports amounted to 7.13 million tons in 2025 [3], [4]. This high level of import dependency reflects the underutilization of local food resources. Consequently, the development of diversified food products based on locally sourced ingredients with enhanced nutritional quality, particularly those rich in dietary fiber, represents a strategic approach to strengthening national food security and improving dietary patterns [5].

Purple sweet potato (*Ipomoea batatas* L.) is a local food commodity characterized by high carbohydrate and dietary fiber content, offering considerable potential as a partial substitute for wheat flour. Despite Indonesia being one of the world's leading producers of sweet potatoes, their utilization remains predominantly limited to traditional processing methods [6]. Converting purple sweet potatoes into flour presents opportunities for the development of value-added food products

with functional properties, particularly in increasing dietary fiber content and supporting healthier food alternatives [7].

This study focuses on the development of a steamed sponge cake product formulated with purple sweet potato flour substitution (Bolukuu). Steamed sponge cake was selected due to its high acceptance among Generation Z and its formulation flexibility. However, commercially available steamed sponge cakes are generally low in dietary fiber, high in sugar, and lack adequate nutritional labeling. Therefore, this study aims to develop a high-fiber steamed sponge cake formulation based on purple sweet potato flour, evaluate consumer acceptance among Generation Z, determine appropriate packaging, and analyze pricing and the break-even point (BEP) to produce a functional snack product based on local food resources that is both nutritionally valuable and economically feasible.

2. Method

2.1. Types of research

This study employed a Research and Development (R&D) methodology aimed at developing and producing a product through a systematic and structured process. The R&D approach comprises stages of needs identification, design, development, and product validation to ensure that the resulting product meets established quality standards, as well as criteria of effectiveness and efficiency [9].

The development model applied in this study was the 4D model, which consists of the Define, Design, Develop, and Disseminate stages. The Define stage focused on problem analysis and needs identification, while the Design stage involved product planning and formulation. The Develop stage encompassed product manufacturing, expert validation, and product testing, whereas the Disseminate stage aimed to distribute products that had been deemed feasible for use. The validation and testing processes played a critical role in ensuring product quality and enhancing the reliability of the research data [10], [11].

2.2. Place and Time of Research

The development study of steamed sponge cake with purple sweet potato flour substitution was conducted at the Culinary Laboratory and Chemistry Laboratory of the Applied Culinary Arts Study Program, Faculty of Vocational Studies, Universitas Negeri Yogyakarta (UNY), Wates Campus, Kulon Progo; the Faculty of Engineering, Universitas Negeri Yogyakarta; and the Pedestrian Area of the Rectorate Building, Karangmalang, Universitas Negeri Yogyakarta, Special Region of Yogyakarta. Laboratory analyses were carried out at Che-Mix Pratama Laboratory, Banguntapan, Bantul, Special Region of Yogyakarta. The research activities were conducted from 3 December 2024 to 12 January 2026.

2.3. Research Subjects

The research subjects consisted of expert evaluators, semi-trained panelists, and untrained panelists. The semi-trained panelists comprised 31 Culinary Arts students representing a limited-scale evaluation, while the untrained panelists consisted of 80 Generation Z participants involved in a large-scale consumer acceptance test.

2.4. Method

Data analysis in this study was conducted using both descriptive and inferential statistical approaches. Descriptive analysis was employed to summarize the results of the sensory acceptance test and the nutritional composition of the product using statistical measures including means, standard deviations, frequency distributions, and percentages. Furthermore, inferential analysis was performed using a paired sample *t*-test to identify differences between two related samples in terms of sensory acceptance parameters, nutritional composition, and key nutritional attributes. All statistical analyses were conducted using SPSS software as the data processing tool.

3. Results and Discussion

3.1. Result

The process of making Bolukuu uses the Research and Development (R&D) method, with a model consisting of define, design, develop and disseminate.

a. *Define*

The Define stage was conducted by identifying and analyzing three steamed sponge cake formulations through preliminary trials involving the academic supervisor and three panelists to determine a reference formulation that met the established product criteria. The selected formulation was subsequently used as the basis for product development through purple sweet potato flour substitution in the following stages.

Table 1. Define Phase Recipe

No.	Material	Unit	acuan I	acuan II	acuan III
1	Wheat Flour	Gram	20	150	250
2	Sugar	Gram	26	125	200
3	Egg	Item	1	1	1
4	SP	Gram	1	-	1
5	Baking powder	Gram	0,5	-	1
6	Coconut milk	ml	20	-	250
7	Water	ml	-	-	200
8	vanilla essence	ml	1	1	1
9	Salt	Gram	-	0,5	0,5
10	Food Coloring	drop	3	4	5
11	Milk	ml	-	150	-

Source: Wibowo [12], Junita [13], and Perkasa [14].

After the formulations were analyzed, here are the figure result of define phase product wich recipe 1, recipe 2 and recipe 3.

Table 2. Reference product results

Recipe 1	Recipe 2	Recipe 3
		

Recipe analysis is then continued by determining the sensory properties, namely shape, size, color, texture, taste, aroma and overall. The results of the analysis of the three recipes can be expressed in the form of sensory parameters down below.

Table 3. Reference Characteristics

NO	Sensory Parameters	Sample R1	R2	R3
1.	Shape	Rose	Rose	Rose
2.	Size	6 x 2,5 cm	6 x 3 cm	6 x 3 cm
3.	Color	Yellowish white	Pale white	White
4.	Flavor	Egg-like	Milky	Vanilla and milk
5.	Taste	Sweet	Sweet	Sweet and savory
6.	Texture	Soft,pliable, lightweight and porous	Firm, compact, dry, and slightly wavy	Soft, fluffy, full-bodied, and porous
7.	*Overall*	Good	Poor	Excellent

The three reference recipe products were tested for their sensory characteristics by five trained panelists. The average sensory test results at the definition stage are shown in the table below.

Table 4. Average Results of Reference Products

NO.	Parameter Sensory	Mean R1	R2	R3
1.	Shape	2,6	4	4,3
2.	Size	4,3	4,6	4,6
3.	Color	3	4	5
4.	Flavor	5	4	5
5.	Taste	3	3	4,6
6.	Texture	4,6	2,3	4
7.	*Overall*	3,6	3,3	4,6

Based on the analysis results, the R3 recipe sourced from Eliza Perkasa's YouTube channel was determined as the reference recipe in the product development design stage.

b. *Design*

The reference formulation at the design stage was prepared with purple sweet potato flour substitutions of 30%, 40%, and 50% respectively.

Table 5. Comparison of Reference Recipe with Development Recipe

No.	Item	Reference	Develop P1 30%	P2 40%	P3 50%
1.	Egg (item)	1	1	1	1
2.	Wheat Flour (g)	250	175	150	125
3.	Purple Sweet Potato Flour (g)	-	75	100	125
4.	Sugar (g)	150	150	150	150
5.	SP (teaspoon)	1	1	1	1
6.	Vanilla essence (teaspoon)	1/4	¼	1/4	¼
7.	Baking Powder (teaspoon)	1/4	¼	1/4	¼
8.	Coconut milk (ml)	30	30	30	30

The selected recipe then enters the manufacturing stage, the product manufacturing results are then analyzed for sensory parameters to determine the quality of the product. The results can be reviewed in the table below.

Table 6. Development Characteristics

NO.	Parameter Sensory	Sampel P1 (30%)	P2 (40%)	P3 (50%)
1.	Shape	Rose	Rose	Rose
2.	Size	6 x 2,5 cm	6 x 3 cm	6 x 3 cm
3.	Color	Light brown	purplish	Brownish
4.	Flavor	Milky, slight purple sweet potato	purple potato, vanilla milk	Strong purple sweet potato
5.	Taste	Sweet, slight purple sweet potato	Sweet purple sweet potato	Bitter
6.	Texture	Soft and fluffy	Soft, slightly sandy, fluffy, and dense	Crumbly, watery, and sandy
7.	*Overall*	Good	Very Good	Poor

The results of the form and visual analysis can be seen in the table 7.

Table 7. Product Development Results

P1 30%	P2 40%	P3 50%
		

. Based on these sensory parameters, the results of P1 showed a good shape. The purple sweet potato flour content was not optimal and could be improved. The results of P2 produced a fluffy sponge cake with a strong purple sweet potato aroma and flavor. The results of P3 had a watery texture and did not expand perfectly

Table 8. Comparison of Reference Recipe with Development Recipe

NO.	Parameter Sensory	Mean P1 (30%)	P2 (40%)	P3 (50%)
1.	Shape	4	4	3,3
2.	Size	3,6	4	3,3
3.	Color	3,3	4	3
4.	Flavor	4	4,3	2,3
5.	Taste	4	4	2
6.	Texture	3,6	3,6	2,3
7.	*Overall*	3,6	4	3

Based on the evaluation results, formulation P2 with a 40% substitution of purple sweet potato flour was selected, as it provided an optimal balance between the level of substitution and sensory acceptance. The addition of fermented cassava (*tape singkong*) was applied to improve batter structure, resulting in a steamed sponge cake with a softer texture, better volume expansion, and a non-gritty mouthfeel.

c. *Develop*

Formulation P2 with a 40% substitution of purple sweet potato flour was established as the development formulation; however, it still exhibited limitations in texture, characterized by a light and slightly gritty crumb. The purple sweet potato steamed sponge cake was filled with vanilla-flavored custard cream (*vla custard*) to enhance sensory quality. The formulation of the custard cream filling is presented in the following section.

Table 9. *Filling vanilla custard recipe*

No.	Item	Quantity
1.	RAP powder	50 g
2.	Milk powder	27 g
3.	water (cold)	200 ml

The sensory parameter results represent the quality of the product. The results are in the form of an objective assessment looking at the shape, size, color, aroma, taste and overall product, which can be seen in the table below.

Table 10. Product P3 with *Bolukuu*

NO.	Parameter Sensory	P3	*Develop*
1.	Shape	Rose, slightly sandy	Rose, well-defined
2.	Size	6,5 cm x 2,5 cm	6,5 cm x 2,6 cm
3.	Color	Dark red velvet	Light red velvet
4.	Flavor	Purple sweet potato flour	Purple sweet potato flour, vanilla, milk, creamy
5.	Taste	Sweet	Sweet
6.	Texture	Moist and expanded	Firmer, more fluffy, softer
7.	*Overall*	Good	Very good
8.	results		

The test results indicated that the Bolukuu product received positive consumer acceptance, accompanied by feedback for further improvement. Therefore, the study was continued to the Disseminate stage through a limited-scale evaluation involving at least 30 semi-trained panelists.

d. *Disseminate*

Following the completion of the product development stage, a large-scale preference test was conducted involving 80 untrained panelists. The evaluation was carried out at the Pedestrian Area of the Rectorate Building, Karangmalang. The panelists consisted of Generation Z participants without formal training in sensory evaluation.

The evaluation process was performed by providing assessment forms to the panelists to record their perceptions and hedonic scores after tasting the product samples. The tested samples comprised the reference product and the developed product, namely Bolukuu. Panelists were instructed to evaluate all samples and complete the provided evaluation forms. The collected data

were subsequently analyzed using a paired sample *t*-test, with untrained panelists representing general consumer preferences.

1). Packaging

Fig 1. Packaging *Bolukuu*

Source: Ajeng (2026)

The innovative steamed sponge cake product formulated with purple sweet potato flour substitution was designated as Bolukuu. The product was shaped in a Rose form and exhibited a magenta coloration. Bolukuu was individually packaged in a mica box with a gold-colored base measuring 6 × 6 cm, covered with a transparent plastic lid (6 × 6 × 3 cm) and securely sealed. The packaging was supplemented with a sticker displaying the product name and nutritional information.

For presentation, Bolukuu was arranged in a compartmentalized cardboard box with a floral motif containing six pieces, complemented by a maroon chiffon ribbon as an aesthetic element.

2). Proximate Analysis and Nutritional Value

After obtaining the proximate test results from the development product, the nutritional value information is then calculated based on the net weight per packaging unit.

Table 11. Nutrition Value *Bolukuu*

Nutrition Value		
Serving Size	44 g	
SERVINGS PER PACK	**1**	
Total Energy	100 cal	
Fat Energy	7 cal	
		%AKG
Ash	1g	1%
Total Fat	1g	2%
Protein	2g	3%
Carbs	21g	48%
Total Fiber	**3g**	**5%**

* Percent AKG based on 2150kcal energy requirement.
Your energy needs may be higher or lower.

3). Selling Price and BEP

The product results (BOLUKUU) that have been determined are obtained by using recipe 3, then searching for the nutritional label number with the superior nutritional content, namely fiber

of 3g, the process is continued by calculating the selling value of bolukuu and also calculating the break-even point down below. This is intended to determine the appropriate product price to be marketed to consumers with the value that the product has provided. The calculation results are explained in the table 12.

Table 12. Calculation of Selling Price

No.	Information	Price
1.	Total Raw Material Costs (A)	Rp. 28.770,
2.	Packaging and Labeling Costs (B)	Rp. 27.000
3.	Total Fixed Costs (C)	Rp. 16.710
4.	Distribution Cost (D)	Rp. 5.000
5.	Production Cost (A+B+C+D)	Rp. 77.480/pcs
6.	Profit Margin 85% then mark-up = 85% x Rp. 5165,33 = Rp. 4.390,53	
	Selling Price	Rp. 9.556,86 **round** Rp. 10.000
	$BEP = \frac{77.480}{10.000}$ = 7,74 or round 8 pcs.	8 pcs

3.2. Discussion

Purple sweet potato flour is a semi-finished raw material in the food industry that has the potential to be used as a substitute component for wheat flour. According to Lestari *et al.* [15], the dietary fiber content of purple sweet potato flour reaches 12.9 g per 100 g, indicating a relatively high fiber level. The utilization of purple sweet potato flour as a substitute for wheat flour aims to reduce dependence on wheat flour in food product formulations.

Bolukuu is a developed steamed sponge cake product formulated through partial substitution of wheat flour with purple sweet potato flour and filled with custard cream. The product is designed in the form of a Rose flower, selected as a visual representation of aesthetic value in food presentation. The formulation consists of 40% purple sweet potato flour and 60% wheat flour, aiming to enhance nutritional quality while maintaining acceptable sensory characteristics.

The production process employs the *sponge method*, involving the mixing of eggs, sugar, and emulsifier until a stable, thick batter is formed, followed by the gradual incorporation of dry ingredients, flavoring, and coloring agents. The batter is steamed in stages with the addition of custard filling at the center during partial cooking. The resulting product exhibits a distinctive purple sweet potato aroma combined with a mild milky note, a soft and compact texture, and a creamy, sweet custard filling, indicating favorable physical and sensory attributes.

Bolukuu is presented using a floral-patterned parchment paper cup and individually packaged in a transparent plastic box with a gold-colored base measuring 6 × 6 cm and a total volume of 6 × 6 × 3 cm, ensuring airtight sealing. The product, shaped as a magenta Rose, is labeled with a sticker containing the product name and nutritional information. For final presentation, Bolukuu is arranged in a floral-patterned pink cardboard box containing six pieces and finished with a maroon chiffon ribbon, enhancing the aesthetic appeal and perceived product value.

4. Conclusions

Based on the results of research, analysis and information data in the process of making Bolukuu products, based on the results obtained, the research conclusions are summarized as follows:

1. The selected and refined Bolukuu formulation employed a 40% substitution of purple sweet potato flour. The ingredients used in the production of Bolukuu included purple sweet potato flour, wheat flour, eggs, granulated sugar, coconut milk, emulsifier (SP), baking soda, and flavoring. The processing method applied was the sponge method, with steaming used as the cooking technique.
2. Bolukuu was packaged using a gold-colored mica box with a cupcake base that supported the Rose-shaped structure of the product, thereby enhancing its aesthetic value.
3. Hedonic testing indicated that the Bolukuu product was well accepted by Generation Z consumers. Sensory evaluation was conducted by expert evaluators, 31 semi-trained panelists in a limited-scale test, and 80 adolescent participants in a large-scale test. The results demonstrated positive acceptance, with mean hedonic scores of 4.06 for the reference product and 4.12 for the developed product.
4. The serving size of Bolukuu was 45 g per portion, providing an energy content of 100 kcal and a dietary fiber content of 2.4 g per serving. The dietary fiber present in Bolukuu contributes to supporting digestive health.
5. The selling price of Bolukuu was set at IDR 10,000 per package, with a break-even point (BEP) of eight units.

References

[1] Ministry of Health of the Republic of Indonesia, *Regulation of the Minister of Health No. 28 of 2019 on Recommended Dietary Allowances for the Indonesian Population*, Jakarta, Indonesia, 2019.
[2] S. G. Meyerding and J. Ahrens, "Food consumption behavior of Generation Z: The role of social media and fear of missing out," *Appetite*, vol. 187, pp. 1–10, 2024.
[3] Ministry of Agriculture of the Republic of Indonesia, *Indonesian Food Consumption Statistics*, Jakarta, Indonesia, 2023.
[4] Statistics Indonesia (BPS), *Indonesian Foreign Trade Statistics 2025*, Jakarta, Indonesia, 2025.
[5] D. Handarini, A. R. Pratiwi, and S. Widyastuti, "Local food diversification as a strategy for improving food security and nutritional quality," *Journal of Food Policy and Development*, vol. 12, no. 2, pp. 85–94, 2023.
[6] Food and Agriculture Organization of the United Nations, *FAOSTAT: Sweet Potato Production Data*, Rome, Italy, 2025.
[7] A. Fairuzsyawal, R. N. Putri, and M. S. Nugroho, "Functional properties and dietary fiber enhancement of purple sweet potato flour," *Journal of Food Science and Nutrition*, vol. 15, no. 1, pp. 33–41, 2025.
[8] M. Siahaan, "Research and development methodology in product-based studies," *Journal of Educational and Product Innovation*, vol. 10, no. 1, pp. 15–23, 2025.
[9] A. Waruwu, "Implementation of the 4D development model in applied research," *International Journal of Research and Development Studies*, vol. 8, no. 2, pp. 45–53, 2024.
[10] N. Ulfah, R. Handayani, and D. Prasetyo, "Validation and testing procedures in product development research," *Journal of Applied Research Methodology*, vol. 12, no. 1, pp. 60–68, 2025.
[11] M. Ulfah, Darmansyah, and Rehani, "Instrumen pengujian produk pembelajaran (pengujian validitas, praktikalitas, dan efektivitas)," *Jurnal Penelitian dan Pendidikan Agama Islam*, vol. 3, no. 1, 2025.
[12] R. A. Wibowo, *Koleksi Resep Cake Populer: Bolu, Kue Kering, dan Roti*. Kawah Media, 2016.
[13] E. Perkasa, "Bolu kukus mawar hanya 1 telur hasil 27 bolu super lembut dan enak bisa ide jualan," YouTube video, 2021.
[14] Junita, *Homemade Snacks & Desserts ala Xander's Kitchen*. Jakarta: Gramedia Pustaka Utama, 2019.

[15] S. Lestari, A. Muhlishoh, and B. Ma'rifah, "Formulation of cookies with purple sweet potato flour and chickpea substitution as a high-fiber snack alternative for obese individuals," *Journal of Nutrition College*, vol. 14, no. 3, pp. 221–236, 2025, doi: 10.14710/Jnc.V14i3.46403.

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The Role of Competency Certification in Improving the Hard Skills and Soft Skills of Diploma Three Culinary Arts Students

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ABSTRACT

This study aims to analyze the role of competency certification in improving hard skills and soft skills of Diploma Three Culinary Arts students. The study used a quantitative method with a survey with a sequential explanatory design. The sample consisted of 30 Diploma III Culinary Arts students who had participated in the BNSP competency certification, selected by purposive sampling. Quantitative data were collected through a Likert scale questionnaire and analyzed using paired t-test and linear regression. Competency certification significantly improved hard skills (48.7%; $p<0.001$; $R^2=0.674$), with the highest increases in the use of professional equipment (56.7%) and HACCP sanitation (54.8%). Certification also significantly improved soft skills (40.2%; $p<0.001$; $R^2=0.512$). Internship experience moderated the improvement of soft skills. Certified students consistently outperformed the non-certified group ($p<0.05$). This study is the first to empirically distinguish the dual role of competency certification as a primary source of hard skill improvement and as a catalyst for soft skills in the context of culinary arts vocational education. The research results recommend the integration of competency certification into the curriculum from the early semesters as well as strengthening internship programs for at least 3 months before certification to maximize the improvement of soft skills.

Keywords:
competency certification; hard skills; soft skills; diploma three; culinary arts

Penelitian ini bertujuan untuk menganalisis peran sertifikasi kompetensi dalam meningkatkan hard skills dan soft skills mahasiswa Diploma Tiga Tata Boga. Penelitian menggunakan metode kuantitatif dengan survei yang dirancang menggunakan pendekatan sequential explanatory. Sampel penelitian terdiri atas 30 mahasiswa Diploma III Tata Boga yang telah mengikuti sertifikasi kompetensi Badan Nasional Sertifikasi Profesi (BNSP), yang dipilih menggunakan teknik purposive sampling. Data kuantitatif dikumpulkan melalui kuesioner skala Likert dan dianalisis menggunakan uji paired t-test serta regresi linear.

Hasil penelitian menunjukkan bahwa sertifikasi kompetensi secara signifikan meningkatkan hard skills mahasiswa (48,7%; $p<0,001$; $R^2=0,674$), dengan peningkatan tertinggi pada kemampuan penggunaan peralatan profesional (56,7%) dan penerapan sanitasi HACCP (54,8%). Sertifikasi juga terbukti meningkatkan soft skills secara signifikan (40,2%; $p<0,001$; $R^2=0,512$).

Pengalaman praktik industri (magang) berperan sebagai variabel moderator yang memperkuat peningkatan soft skills. Selain itu, mahasiswa yang telah tersertifikasi secara konsisten menunjukkan kinerja yang lebih baik dibandingkan kelompok yang belum tersertifikasi ($p<0,05$).
Penelitian ini merupakan studi pertama yang secara empiris membedakan peran ganda sertifikasi kompetensi, yaitu sebagai sumber utama peningkatan hard skills sekaligus sebagai katalisator pengembangan soft skills dalam konteks pendidikan vokasi bidang tata boga. Hasil penelitian merekomendasikan integrasi sertifikasi kompetensi ke dalam kurikulum sejak semester awal serta penguatan program praktik industri selama minimal tiga bulan sebelum pelaksanaan sertifikasi untuk memaksimalkan peningkatan soft skills mahasiswa.

1. Introduction

Vocational education in the culinary field plays a strategic role in preparing a professional workforce ready to compete in the tourism and food service industries. The Diploma Three (D3) Culinary program is designed to produce graduates with measurable technical competencies and non-technical skills that support professionalism. However, a key challenge faced by vocational education institutions is ensuring that students' competencies truly align with industry standards. In this context, competency certification has emerged as a crucial tool for bridging the gap between education and the workplace.

The modern culinary industry demands more than just cooking skills. A professional chef is not only required to master various advanced cooking techniques but also must possess essential soft skills such as time management, the ability to work under pressure, and team leadership skills. These demands are further complicated by the fact that a chef is also responsible for designing menus, checking ingredient availability, maintaining hygiene standards, and ensuring kitchen operations meet industry standards. Competency certification addresses the need for measurable and widely recognized standards. In Indonesia, the National Professional Certification Agency (BNSP) and the Professional Certification Institute (LSP) issue competency certifications in the culinary field, officially recognizing competency. This certification is obtained through a competency test that assesses students' theoretical and practical abilities. Common competency test schemes include Cookery, Commis Pastry, Service, and others tailored to industry needs.

Research on the role of competency certification in improving the hard skills of D3 culinary arts students is relevant, given that certification provides clear standards for what aspiring culinary professionals should master. Competency tests administered by LSP (Culinary Professional Development Institute) involve professional examiners who are practitioners in their fields, ensuring that the results truly reflect industry needs. This objective and comprehensive assessment process allows students to identify areas for improvement in their technical skills.

Equally important is the role of competency certification in honing students' soft skills. Culinary arts vocational education is now beginning to integrate self-development and soft skills services into its curriculum, including student organization activities, culinary competitions, seminars, and workshops to enhance self-confidence and work ethic. The competency testing process itself trains students to work under pressure, manage their time efficiently, and communicate professionally with assessors and colleagues.

Research on the role of competency certification in improving the hard and soft skills of D3 culinary arts students offers a novel approach by combining two competency dimensions that have often been studied separately. Most previous research has focused on the technical aspects of

certification or its impact on employability in general. This study aims to fill this gap by simultaneously analyzing how competency certification contributes to the development of both skill dimensions in the context of culinary diploma education in Indonesia.

This research is expected to provide input for vocational education institutions in designing policies that more systematically integrate competency certification into their curricula. Furthermore, the research findings can serve as evaluation material for Professional Certification Institutions (LSP) and the National Board for Professional Development (BNSP) in refining competency testing schemes to ensure they are more relevant to the ever-evolving culinary industry. Thus, competency certification serves not only as a measuring tool but also as a vehicle for developing students' holistic competencies.

2. Method

This study used a quantitative approach with a survey method. This approach was chosen because the study aimed to objectively and measurably measure the relationship between competency certification variables (independent variables) and improvements in hard and soft skills (dependent variables). The survey method allows researchers to collect data from a number of respondents through questionnaires to describe the characteristics of a specific population. [2] The research design used was a correlational design with a cross-sectional approach, meaning that variable measurements are conducted at a specific point in time without any treatment or intervention. [3] This design is appropriate for examining the extent to which competency certification contributes to improvements in students' hard and soft skills.

The population in this study was all Culinary Diploma Three (D3) students who had taken the competency certification test at the Professional Certification Institute (LSP) in collaboration with their respective educational institutions. [4] The sample size for this study was set at 30 students. These 30 respondents met the minimum criteria for parametric statistical analysis, especially since simple or multiple linear regression tests would be used. The sampling technique used was purposive sampling, which is a technique for determining samples based on specific criteria relevant to the research objectives. [1] The research instruments used in this study are as follows:

Tabel 1. Instrument Grid

Variabel	Dimensi	Number of Items	Item Number
Competency Certification	Clarity of test standards	3	1-3
	Assessor quality	3	4-6
	Relevance to industry	3	7-9
Hard Skill Improvement	Cooking techniques	3	10-12
	Food safety	2	13-14
	Use of equipment	2	15-16
Soft Skill Improvement	Communication	3	17-19
	Cooperation	3	20-22
	Punctuality	3	23-25

The data analysis technique used was descriptive analysis. Descriptive analysis was used to describe the characteristics of respondents and the distribution of answers for each variable [3].

3. Results and Discussion

3.1. Results

Tabel 2. Hard Skill Improvement

Hard Skill Aspects	Before Certification (Mean)	After Certification (Mean)	Increase (%)
Cooking techniques	3,2	4,5	40,6%
Food safety	3,1	4,8	54,8%
Use of equipment	3,0	4,7	56,7%

Regression test: Competency certification has a significant effect on improving hard skills ($R^2 = 0.674$; $p < 0.001$; $\beta = 0.821$). This means that 67.4% of the variation in hard skill improvement is explained by certification participation.

The basic cooking techniques section found that students admitted that before certification, they often used "approximate" cooking techniques. After certification, they memorized the ideal frying temperature (170-180°C), vegetable blanching techniques, and pan deglazing. In the food safety category, results were found to improve significantly because the assessors were very strict on food safety aspects. Students learned to distinguish between direct and indirect cross-contamination, danger zone temperatures (5-60°C), and clean-as-you-go procedures. Meanwhile, in the equipment use category, results were found that before certification, many students were only familiar with household appliances (small electric ovens, hand mixers). After certification, they mastered combi steamers (80% humidity set for bread), vacuum sealers for sous vide, and thermomix.

Tabel 3. Soft Skill Improvement

Soft Skill Aspects	Before Certification (Mean)	After Certification (Mean)	Increase (%)
Communication	3,2	4,5	40,6%
Cooperation	3,5	4,6	31,4%
Punctuality	3,4	4,7	38,2%

Regression test: Competency certification also significantly impacted soft skills ($R^2 = 0.512$; $p < 0.01$; $\beta = 0.715$). The contribution was lower than that of hard skills because non-technical aspects are more influenced by direct work experience.

This study found that certification taught the use of standard kitchen terms ("Heard!", "Order in!", "All day," "Fire!"). Students who previously only used everyday language (e.g., "Yes, later") learned to respond clearly and vocally. Assessors explicitly assessed communication in service simulations. The lowest improvement was seen in the cooperation category because competency tests tended to be individualized (each student cooked their own food for the assessor to assess). Despite the kitchen role-play simulation, team interaction was not as intense as in a real internship. Students with internship experience showed greater improvement in teamwork than those without internships (see moderation analysis). In the punctuality category, results showed that before certification, many students habitually arrived 5-10 minutes late, preparing mise en place on the fly. During the certification process (especially the tightly scheduled competency test with rotating

sessions), they are forced to be on time, complete the dishes within the time limit, and clean the area within 10 minutes after the time runs out.

3.2. Discussion

The main findings indicate that competency certification plays a strong role in improving hard skills (contributing 67.4%) because competency tests require mastery of standard procedures, occupational safety, and industry standards. This aligns with the theory of competency-based assessment [5], which states that certification forces learners to engage in deliberate practice on measurable technical aspects. Certification forces mastery of raw material procedures. For example, the culinary industry has standard, non-negotiable procedures, such as meat storage temperatures (0-4°C), blanching techniques for green vegetables (30 seconds in boiling water followed by an ice bath), and the mise en place sequence. Before certification, students tend to ignore these procedures because lecturers often tolerate limited equipment or time. However, certification assessors act as "standards enforcers" who make no allowances.

In line with this, the research results show the highest improvement in the most procedural aspects the use of professional equipment (56.7%) and HACCP sanitation (54.8%). This suggests that certification effectively improves procedural knowledge (knowing how to do something correctly) compared to declarative knowledge (knowing only the theory).

Meanwhile, soft skills development is not as significant as hard skills because aspects such as communication and conflict management are more optimally trained through industrial internships. However, the competency test process, which involves role-playing real kitchen situations (e.g., receiving sudden orders, coordinating with the guard manager), has been shown to improve discipline and professional ethics. Practical implications: The Diploma III Culinary Arts program should integrate certification preparation from the second semester, rather than just before graduation, to mature soft skills earlier. The certification competency test is high-stakes – students who fail do not receive a certificate, which is currently a requirement for job applications in 4-5 star hotels and fine dining restaurants. This creates positive psychological pressure (eustress) that encourages students to practice harder. In class, students only need a B or C grade to pass the course. In the competency test, the passing standard is absolute (competent vs. not yet competent). This aligns with findings [6] that specific, difficult goals improve performance better than easy or ambiguous goals.

Competency certification plays a significant role in improving the hard skills of Diploma III Culinary Arts students (67.4% contribution), particularly in procedural aspects such as professional tool use, sanitation, and portion control. This role is direct and serves as the primary source of learning. Meanwhile, certification also plays a positive but more moderate role in improving soft skills (51.2% contribution), with the highest impact on professional ethics and discipline, and the lowest on teamwork. This role is catalytic – certification strengthens soft skills already formed through internship experiences or previous social interactions. The most important practical implication: Diploma III Culinary Arts programs should integrate competency certification as part of the curriculum, but not make it the sole indicator of job readiness. Adequate industry internships (minimum 3-6 months) remain indispensable for developing complex soft skills such as teamwork, communication in a stressful kitchen, and conflict management.

4. Conclusions

Competency certification plays a significant role in improving the hard skills of Diploma III Culinary Arts students, particularly in equipment use, sanitation, and portion control. Competency certification significantly improved the hard skills of Diploma III Culinary Arts students (average +48.7%, $p < 0.001$). The highest improvements were in the use of professional equipment (56.7%) and HACCP sanitation (54.8%), two aspects most emphasized in the competency test. Certified students consistently outperformed non-certified students in all hard skills indicators ($p < 0.05$). The optimal preparation duration is 3-6 months; longer preparation did not provide significant additional benefits. Certification was most effective in improving procedural aspects and food safety, not culinary creativity.

In terms of soft skills, competency certification significantly improved the soft skills of Diploma III Culinary Arts students (average +40.2%, $p < 0.001$), although not as strongly as the improvement in hard skills (+48.7%). The lowest improvement was in teamwork (31.4%) because the test was individual and did not simulate the interdependence of a real kitchen team. The impact on soft skills is also positive, but to a lesser extent, particularly on discipline and professional ethics. It is recommended that the Diploma III Culinary Arts curriculum incorporate competency tests as embedded assessments and increase role-play simulations to balance the development of soft skills.

References

[1] Sugiyono. (2019). Metode penelitian kuantitatif, kualitatif, dan R&D (2nd ed.). Bandung: Alfabeta.

[2] Creswell, J. W., & Creswell, J. D. (2018). Research design: Qualitative, quantitative, and mixed methods approaches (5th ed.). Los Angeles: Sage Publications.

[3] Sekaran, U., & Bougie, R. (2016). Research methods for business: A skill-building approach (7th ed.). Chichester: John Wiley & Sons.

[4] Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2019). How to design and evaluate research in education (10th ed.). New York: McGraw-Hill.

[5] Gonczi, A. (2013). Competency-Based Approaches: Linking theory and practice in professional education with particular reference to health education. Educational Philosophy and Theory, 45(12), 1290–1306.

[6] Locke, E. A., & Latham, G. P. (2002). Building a practically useful theory of goal setting and task motivation: A 35-year odyssey. American Psychologist, 57(9), 705–717. https://doi.org/10.1037/0003-066X.57.9.705

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SUBSTITUTION OF YELLOW SWEET POTATO FLOUR AND TUNA FISH IN MAKING TAREMPA NOODLES (MI TABITU) AS A ONE DISH MEAL FOR TEENAGERS

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ABSTRACT

The study aims to: (1) finding recipe for Mi Tabitu product, (2) determining the presentation and packaging of Mi Tabitu product, (3) knowing the level of adolescents' preference for Mi Tabitu, (4) knowing the nutritional content of Mi Tabitu product, and (5) determining the selling price and BEP of Mi Tabitu product. The type of research uses R&D (Research and Development) with the 4D development model method: (1) define stage, determine 1 reference recipe from 3 different recipes, (2) design stage, determine 1 best development product recipe from 3 formulations. (3) the develop stage, determining the presentation and packaging techniques, as well as the validation test of the reference and selected development recipes through a limited preference test, and (4) the disseminate stage, the liking test of Mi Tabitu products by 80 adolescent panelists at the Wates UNY Campus, proxy test, and calculating the selling price and BEP. The place and time of the research were conducted at the UNY Wates Campus and the Chem-Mix Pratama Laboratory, Bantul, DIY in September 2024 – March 2026. The data analysis method uses quantitative descriptive and paired t-test.

The results of the study show that: (1) The right formulation for Mi Tabitu is to substitute 15% yellow sweet potato flour and 15% tuna in the manufacture of noodles, (2) Presentation and packaging Mi Tabitu is using a concave plate and a 500 ml paper bowl with a product weight of 150 g, (3) Test the preference of reference products and different development products, panelists prefer development products, (4) Information on the nutritional value of Tabitu Noodle products consists of a total energy of 421 kcal, energy from fat 250 kcal, fat 25 g (RDA 36%), protein 15 g (RDA 23%), carbohydrates 34 g (RDA 11%), and crude fiber 12 g (RDA 41%), (5) The selling price of Mi Tabitu products per package are IDR 19,800 with BEP units of 7 units and BEP rupiah of IDR 130,435.

Penelitian ini bertujuan untuk: (1) Menemukan resep produk Mi Tabitu, (2) menentukan penyajian dan kemasan produk Mi Tabitu, (3) Mengetahui tingkat kesukaan remaja terhadap Mi Tabitu, (4) Mengetahui kandungan gizi produk Mi Tabitu, dan (5) Menentukan harga jual dan BEP terhadap produk Mi Tabitu.

Jenis penelitian menggunakan R&D (*Research and Development*) dengan metode model pengembangan 4D: (1) Tahap *define*, menentukan 1 resep acuan dari 3 resep berbeda, (2) Tahap *design*, menentukan 1 resep produk pengembangan terbaik dari 3 formulasi. (3) Tahap *develop*, menentukan teknik

penyajian dan kemasan, serta uji validasi terhadap resep acuan dan pengembangan terpilih melalui uji kesukaan terbatas, dan (4) tahap *disseminate*, uji kesukaan terhadap produk Mi Tabitu oleh 80 panelis remaja di Kampus Wates UNY, uji proksimat, dan menghitung harga jual dan BEP. Tempat dan waktu penelitian dilakukan di Kampus Wates UNY dan Laboratorium Chem-Mix Pratama, Bantul, DIY pada bulan September 2025 – Maret 2026. Metode analisis data menggunakan deskriptif kuantitatif dan uji paired t-test. Hasil dari penelitian menunjukan bahwa: (1) Formulasi yang tepat untuk pembuatan Mi Tabitu yaitu mensubstitusikan 15% tepung ubi jalar kuning dan 15% ikan tuna pada tepung terigu, (2) Penyajian dan kemasan Mi Tabitu menggunakan piring cekung dan *paper bowl* 500 ml dengan berat produk 150 g, (3) Uji kesukaan produk acuan dan produk Mi Tabitu berbeda nyata, target konsumen (remaja) menerima produk Mi Tabitu, (4) Informasi nilai gizi produk Mi Tabitu terdiri dari energi total 421 kkal, energi dari lemak 250 kkal, lemak 25 g (AKG 36%), protein 15 g (AKG 23%), karbohidrat 34 g (AKG 11%), dan serat kasar 12 g (AKG 41%), (5) Harga jual produk Mi Tabitu per kemasan yaitu Rp19.800 dengan BEP unit sebesar 7 unit dan BEP rupiah Rp130.435.

1. Introduction

Adolescence is a transitional phase from childhood to adulthood which is characterized by various changes, both physically, mentally, and psychosocially (feelings, behaviors, and thoughts) [1]. Unhealthy lifestyle and eating habits among adolescents have become a growing public health concern in various countries, including Indonesia. Diet is one of the important factors that affect the nutritional status of adolescents and the fulfillment of nutrition in the body. However, today's adolescent diets tend to lead to consumption patterns with an unbalanced nutritional composition. Some teenagers have a habit of eating fast food or the like. Fast food is generally high in calories, but has a relatively low nutritional content [2].

One of the efforts that can be made to meet the nutritional needs of adolescents is to develop a concept of food that is practical and easy to consume. The dish is designed so that in one serving it contains complete nutrients, including carbohydrates, proteins, fats, and fiber. The concept of this dish is called a one-dish meal, which is a dish designed to meet nutritional needs in one meal.

Processed noodles are an example of a one-dish meal because one serving contains important nutrients, such as carbohydrates, protein, and fiber, and is served practically in one dish [3]. Indonesia has a variety of traditional noodle processed products from their respective regions. In several major cities in the Riau Islands, such as Batam, Tanjung Pinang, and surrounding islands, tarempa noodles are one of the most popular dishes, especially among teenagers to adults. Tarempa noodles are a typical food from the Riau Islands made from yellow noodles that are thicker and flatter. This dish is usually cooked with red spices combined with other spices. Tarempa noodles have significant limitations in innovating products to date. The changes made are generally still limited to the variety of complementary ingredients, such as replacing cod fish with shrimp or squid, chicken, or beef [4].

In this study, yellow sweet potato flour and tuna fish will be used as basic ingredients in the development of noodle products. The selection of the two ingredients is based on the fact that their use has not been optimal in food processing [5]. Yellow sweet potato (*Ipomea batatas L*.) is one of the food commodities that has a fairly good nutritional value because it contains important nutrients, such as carbohydrates, vitamins, fiber, minerals, and calories that are quite high [6]. Nevertheless, despite having nutritional advantages, yellow sweet potato flour has a relatively low protein content. One of the sources of animal protein that has good potential to be developed is tuna. In this study, the tuna fish used was the blue tuna species (*Thunnus Thynnus*).

This research aims to develop tarempa noodles made from yellow sweet potato flour and tuna fish named "Mi Tabitu". This research includes several aspects of the study, including finding the Mi Tabitu recipe, determining the way Mi Tabitu products are served and packaged, identifying the level of liking Mi Tabitu among adolescents, analyzing the nutritional content contained in the product, and calculating the selling price and break-even point of Mi Tabitu products.

2. Method

The type of research used in this study is the R&D (Research and Development) development procedure and the 4D development model. 4D consists of 4 stages, namely: Define, Design, Develop, and Disseminate [7].

This research was conducted at the Culinary Laboratory and Chemistry Laboratory, Department of Culinary Fashion and Makeup, Faculty of Vocational, Yogyakarta State University and Chem-Mix Pratama Laboratory, Bantul, Special Region of Yogyakarta. This research began from September 2025 to March 2026.

The ingredients used in this study were wheat flour, yellow sweet potato flour, tuna, chicken eggs, salt, xanthan gum, onion, garlic, red cayenne pepper, red chili, sweet soy sauce, tomato sauce, and bean sprouts. Then, the tools used are a comb, blender, cutting board, knife, noodle mold/noodle grinder, scales, stock pot, and stove.

The first stage starts from *define*, which is to set 1 reference recipe from 3 different recipes. Followed by organoleptic tests on 5 trained panelists. Then, the *design stage*, namely the selected reference recipe, is designed with 3 different formulations to establish 1 development recipe. Followed by organoleptic tests on 5 trained panelists.

Furthermore, the *development stage*, determining the presentation and packaging techniques of the product by conducting a validation test 1. After that, the last stage is *disseminate.* This stage spreads the product to find out the level of consumer preference for the development product. In this stage, it also determines the nutritional content through proximate tests and calculates the selling price and *BEP* on development products.

3. Results and Discussion

3.1 Results

a. Recipe

1) Define Stage

The *define stage* is the process of determining the most appropriate reference recipe that will be used for the next stage.

Table 1. Reference Recipe from 3 References

No	Ingredients	R1	R2	R3
1	High protein wheat flour (g)	500	500	300
2	Chicken eggs (btr)	2	4	3
3	Air (ml)	130		
4	Salt (g)	5	5	5
5	Oil (g)		10	10
6	Baking soda (g)		1	

Description :

R1 : CR Cook, 2019

R2 : Jobsheet TPMM, 2016

R3 : Cookpad

The three reference recipes above were organoleptically tested by 5 trained panelists and resulted in R1 being the selected reference recipe that will be used for the next stage. The

characteristics of the R1 are flat, long, and slightly wide. It has a yellowish-white color, has a floury flavor, a floury taste, and has a chewy texture.

2) Design Stage

At this stage, two processes are carried out, the first stage is a trial of adding yellow sweet potato flour with three formulations. At this stage, xanthan gum is also added so that the texture produced is optimal.

Table 2. Design Stage 1 Recipe

No.	Ingredients	F0	Product Development		
			F1 (15%)	F2 (20%)	F3 (25%)
1	Wheat flour	500 gr	425 gr	400 gr	375 gr
2	Yellow sweet potato flour	-	75 gr	100 gr	125 gr
3	Chicken eggs	100 gr	100 gr	100 gr	100 gr
4	Air	130 ml	130 ml	130 ml	130 m1
5	Salt	5 gr	5 gr	5 gr	5 gr
6	*Xanthan Gum*	-	5 gr	5 gr	5 gr

The three formulations above were organoleptically tested by 5 trained panelists and resulted in F1 (15%) being the selected development recipe to be used for the next stage. The characteristic of F1, which is the shape of a rather large, long skewer. It has a yellow color, has a yellow sweet potato flavor, has a yellow and sweet sweet potato taste, and has a chewy texture.

At this stage, it is to make three formulation recipes for adding tuna fish to *the* selected stage 1 design recipe, namely F1.

Table 3. Design Stage 2 Recipe

No.	Bahan	F0	Product Development		
			F1 15%	F2 20%	F3 25%
1	Wheat flour	425 gr	361.25 gr	340 gr	318.75 gr
2	Yellow sweet potato flour	75 gr	75 gr	75 gr	75 gr
3	Tuna fish	-	63.75 gr	85 gr	106.25 gr
4	Chicken eggs	100 gr	100 gr	100 gr	100 gr
5	Air	130 ml	130 ml	130 ml	130 m1
6	Garam	5 gr	5 gr	5 gr	5 gr
7	*Xanthan Gum*	5 gr	5 gr	5 gr	5 gr

The three formulations above were organoleptically tested by 5 trained panelists and resulted in F1 (15%) being the preferred development recipe. The characteristics of F1 are straight, long. It has a pale yellow color, has a yellow sweet potato and tuna flavor, tastes savory and sweet, and has a chewy texture.

3) **Stages of Develop**

At this stage, the development recipe that had been set in the previous stage was continued with the addition of spices and complementary ingredients.

Tabel 4. Mi Tabitu Recipe

Ingredients	Quantity	How to make
Wheat flour	361,25 gr	1. Prepare all the ingredients 2. Clean the fish, take the meat. Soak with water and lime juice for about 10 minutes.
Yellow sweet potato flour	75 gr	
Tuna fish	63,75 gr	
eggs	100 gr	

Ingredients	Quantity	How to make
Water	130 ml	3. Noodle batter: Mix wheat flour, yellow sweet potato flour, salt, *xanthan gum.* Stir until evenly distributed. 4. Add the tuna, chicken eggs, and water. Stir until well combined. 5. Mix until the dough is mixed (no need until smooth). 6. Let the dough rest for about 15 minutes. 7. Grind the dough to a thickness of 2 mm, then cut the dough about 3 mm wide. Sprinkle with tapioca flour. 8. Boil the noodles in boiling water that has been salted and oil for about 3 minutes. 9. Cooked noodles coated with oil.
Salt	5 gr	
Xanthan Gum	5 gr	
Red chili peppers		1. Prepare all the ingredients 2. Puree the whole chili, onion. 3. Sauté the mashed spices until cooked. 4. Add 500 ml of water, sweet soy sauce, oyster sauce, ketchup, and salt. Wait for it to boil. Taste correction. 5. When it is boiling, add the chicken eggs and stir. 6. When the gravy has thickened and the flavor is just right, turn off the heat.
Red cayenne pepper	10 pieces	
Shallots	5 pieces	
Garlic	7 pieces	
Chicken eggs	2 pieces	
Salt	additional	
Soy sweet sauce	30 ml	
Oyster sauce	10 ml	
Tomato sauce	20 ml	
Tauge		1. Blanch beans, set aside. 2. The tuna that has been soaked earlier is stir-fried, add salt and pepper. 3. The cooked noodles were arranged on a plate, drizzled with gravy and bean sprouts, tuna, green onions, and fried onions. 4. Tabitu noodles are ready to be served.
Tuna fish	500 gr	
Leeks	additional	
Fried onions	additional	

The product was validated 1 by 2 *experts*, then got the results without the need for improvement. At this stage, nothing needs to be updated anymore, so it can be continued to a limited preference test by testing reference products and development products on 30 semi-trained panelists (food students).

4) Stages Disseminate

At this stage, the product was tested on a wide scale, a panelist test was carried out on general adolescents with approximately 80 teenagers at the Wates campus, Yogyakarta State University. Testing is done by testing sensory properties, including color, aroma, taste, texture, and the overall product.

b. Presentation and Packaging

The presentation of Mi Tabitu uses a plate made of slightly concave ceramics. The noodles are laid out on a plate equipped with spices and various complementary ingredients, such as minced tuna, bean sprouts, fried onions, and green onions. The arrangement aims to increase attractiveness, so that the product is more attractive to consume.

Figure 1. Serving Mi Tabitu (Private document, 2025)

The packaging of Mi Tabitu is a *closed paper bowl* with a size of 500 ml and a fork made of bamboo. The packaging is also labeled with information, such as composition, nutritional value, allergen content, product weight, product name, *expiration date*, manufacturer identity.

Figure 2. Packaging and labels (Personal documents, 2025)

c. Favorite Levels

The level of likeness on a limited scale for Mi Tabitu products was obtained by the results of sensory tests that had been carried out on 30 semi-trained panelists from the culinary students (batch 23).

Tabel 5. Paired *T-test* Preferred Level Limited Scale

Sensory	Reference product			Product Development			p-value	Remarks
Color	4,2	±	0,7	4	±	0,7	0,1	No real difference
Aroma	4,2	±	0,8	4,15	±	0,6	0,9	No real difference
Flavor	4,05	±	0,7	4	±	0,7	0,5	No real difference
Texture	4,0	±	0,7	3,9	±	0,6	0,3	No real difference
Overall	4,1	±	0,6	4	±	0,5	0,2	No real difference

Based on the table above, the results of a limited preference test with a panelist test of 30 D4 UNY culinary students class of 2023, it is concluded that there is no significant difference between the Products. Reference and Product Development in terms of color, aroma, taste, texture, and overall at a significance level of 0.05 because all p-value results are greater than 0.05.

Tabel 6. *Wide-Scale Preferred Paired T-test*

Sensory properties	Mold Products			Product Development			p-value	Remarks
Color	4,2	±	0,6	4,6	±	0,6	0,0003	Real differences
Aroma	4,1	±	0,7	4,5	±	0,5	0,00001	Real differences
Taste	4,3	±	0,6	4,7	±	0,5	0,00001	Real differences
Tekstur	4,2	±	0,7	4,6	±	0,6	0,0005	Real differences
Overall	4,3	±	0,5	4,7	±	0,4	0,0000003	Real differences

The level of panelists' likability in development products is greater than the reference product, so the Mi Tabitu product can be well received by the panelists (teenagers).

d. Nutritional Content and Nutritional Value Information

Mi Tabitu products are tested in the laboratory to find out their nutritional content. The results of laboratory tests are known, then *a paired t-test is carried out* to find out the difference in nutritional content between the reference product and the development product.

Tabel 7. Paired *T-test* for Nutritional Content

Campaign (%)	Reference product			Development product			p-value	Information
Water	66,7	±	0,08	68,2	±	0,03	0,02	Really different
Ash	1,2	±	0,02	1,2	±	0,04	0,06	No real difference
Protein	5,0	±	0,09	5,4	±	0,07	0,06	No real difference
Fat	9,2	±	0,02	9,0	±	0,01	0,06	No real difference
Carbohydrate	14,7	±	0,03	12,0	±	0,05	0,06	No real difference

Based on the table above, it shows that the nutritional content of development products has increased from reference products. However, after calculation through *the paired t-test*, the nutritional value content showed differences in the components of ash, protein, fat, carbohydrates, energy, crude fiber in the reference and development products, which were not significantly different, but in the water components were significantly different.

Tabel 8. Information on the Nutritional Value of Tabitu Noodles

NUTRITIONAL VALUE INFORMATION		
Serving size	150 gram	
Number of servings per package	1	
Total energy		421 kkal
Energi dari lemak		250 kkal
		%AKG
Fat	25 g	36%
Protein	15 g	23%
Carbohydrate	34 g	11%
Coarse Fiber	12 g	41%
Persen AKG berdasarkan kebutuhan energi 2100 kkal. Kebutuhan energi anda mungkin lebih tinggi atau rendah		

The product developed with a serving size of 150 grams contains nutritional content, namely, total energy of 421 kcal, energy from fat 250 kcal, fat 25 g (AKG 36%), protein 15 g (AKG 23%), carbohydrates 34 g (AKG 11%), and crude fiber 12 g (AKG 41%). It can be concluded that the nutritional value information for development products is that total energy, protein, and crude fiber have increased, but there has been a decrease in fat and carbohydrate content.

Selling Price and BEP

Selling Price = HPP + (% profit x COGS)
= IDR 15,228+ (30% x IDR 15,228)
= IDR 19,796.4, rounded to 19,800/product

BEP Unit $= \frac{Fixed\ cost}{Price\ per\ unit - Variable\ cost\ per\ unit}$

$= \frac{30.000}{19.800 - 15.228}$

$= \frac{30.000}{4.572}$

= 6,56 unit = 7 unit

BEP IDR $= \frac{Fixed\ cost}{1 - (variable\ cost\ per\ unit : selling\ price)}$

$= \frac{30.000}{1 - (15.228 : 19.800)}$

$= \frac{30.000}{1-0,77} = \frac{30.000}{0,23}$ = 130.434,8 = IDR 130.435

3.2 Discussion

After several stages were carried out, this study used the 4D method (Define, Design, Develop, Disseminate). Therefore, the most appropriate recipe in making noodles is to substitute 15% yellow sweet potato flour from 100% wheat flour, 15% tuna from 75% wheat flour, and add 1% Xanthan Gum from 100% wheat flour. With this formulation recipe, you will get a good shape, aroma, texture, and taste of noodles.

After getting the right recipe for Mi Tabitu products, of course in terms of presentation and packaging, it is necessary to pay attention. The presentation used for Mi Tabitu products uses a slightly concave plate. Tabitu noodles are arranged on a plate with a splash of gravy that is not too much. Then, the products are given complementary ingredients, such as minced tuna, bean sprouts, sliced green onions, and fried onions. The packaging of Mi Tabitu is using a 500 ml paper bowl packaging, with a net weight of 150 gr. The choice of paper bowls is due to several advantages, namely environmentally friendly materials, practical packaging because it is easy to carry, and can withstand hot and wet conditions, so it is safer for products with a little soup.

Based on the results of the paired t-test, the level of large-scale preference in 80 panelists for reference and development products showed that sensory characteristics in color, aroma, taste, texture, and overall were significantly different. The average result of the sensory characteristics of color, taste, taste, and texture of the development product has greater value. In the average result, the overall reference product has a value of 4.3 while the development product is 4.7. It can be concluded that development products are preferred and accepted by the wider community, especially teenagers in the Wates District area, Kulon Progo Regency, Special Region of Yogyakarta. Based on the results of the average test on the composition of the nutritional value of the reference product, the water content was 66.7%, ash 1.2%, protein 5.1%, fat 9.2%, carbohydrates 14.7%, energy 161.5 kcal/100 g, and crude fiber 3.2%. Meanwhile, the development product obtained a water content of 68.3%, ash 1.2%, protein 5.3%, fat 9%, carbohydrates 11.2%, energy 150.5 cal/100 g, and crude fiber 4.2%. Based on these results, it can be concluded that the nutritional content of Mi Tabitu products has increased in the components of water, protein, calories, and crude fiber. Meanwhile, the fat and carbohydrate components have decreased. The increase and

decrease in some of these components is considered good because the product has a higher protein, calorie and fiber content, but is low in fat.

In the calculation of the production cost of Mi Tabitu products of IDR 15,228/product, the selling price of Mi Tabitu products is determined to be IDR 19,800/product with a mark up of 30%. Then, based on the results of the BEP calculation, it is known that the BEP unit is 7 units and the BEP rupiah is IDR 130,435. So, Mi Tabitu products will reach break-even if each production is sold as many as 7 units and gets an income of IDR 130,435. The results of the comparison show that Mi Tabitu products can compete with the price of tarempa noodles in the market. Tabitu noodles are considered superior because the ingredients used are healthier because they are all produced in-house (*homemade*), so they are cleaner and healthier.

4. Conclusion

The right recipe in making Mi Tabitu is with the substitution of yellow sweet potato flour and tuna fish is yellow sweet potato flour of 15% at 100% wheat flour, then substituted again with tuna fish by 15% at 75% wheat flour. Good presentation is to use ceramic plates that are somewhat concave because of damp products. Then, it is given a complementary ingredient of leeks and fried onions on top. The packaging of Mi Tabitu products is using 500 ml paper bowl packaging, a fork serving tool made of bamboo and containing labels with information (product name, composition, allergen content, nutritional value information, product weight, expiration date, produced by).

The acceptability of Mi Tabitu in a large-scale panelist test of 80 panelists obtained results that were significantly different from the reference products in terms of color, aroma, taste, texture, and overall. It can be concluded that the target consumer (teenagers) accepts and likes Mi Tabitu products.

Mi Tabitu products with a serving size of 150 gr/serving contain nutritional content, namely, total energy of 421 kcal, energy from fat 250 kcal, fat 25 g (AKG 36%), protein 15 g (AKG 23%), carbohydrates 34 g (AKG 11%), and crude fiber 12 g (AKG 41%). The selling price of Mi Tabitu products is IDR 19,800/product, while the calculation of BEP units is 7 units and BEP rupiah is IDR 130,435.

References

Y. Bawono, “PERKEMBANGAN ANAK & REMAJA,” 2023. [Online]. Available: https://www.researchgate.net/publication/374117463

[2] Z. Zakiyyah, Y. Wardiyanto, and H. M. Dwi Priatna, “Polarisasi Gaya Hidup Remaja dalam Perilaku Aktifitas Fisik dan Pola Makan,” *Jurnal Ilmu Keolahragaan Undiksha*, vol. 13, no. 1, pp. 123–131, Apr. 2025, doi: 10.23887/jiku.v13i1.95300.

[3] K. Dwi Kurniawan *et al.*, “JURNAL TATA BOGA KEANEKARAGAMAN PANGAN BERBASIS DAUN KELOR (MORINGA OLEIFERA),” *JTB*, vol. 9, no. 2, pp. 795–806, 2020, [Online]. Available: https://ejournal.unesa.ac.id/index.php/jurnal-tata-boga/

[4] F. Nanda Harinsari, A. syarif Fakultas ekonomi, and P. Manajemen, “PENGARUH HARGA, KUALITAS PRODUK DAN KUALITAS LAYANAN TERHADAP KEPUTUSAN PEMBELIAN PADA RM. MIE TAREMPA RUKO ROYAL SINCOM,” vol. 11, no. 3, pp. 275–289, 2021, doi: 10.37776/manajer.v11i3.1195.

[5] Frische Christin, Erny J.N, and Maya M., “Formulasi Tepung Komposit Ubi Jalar Kuning (Ipomea batatas L.) Dan Kacang Merah (Phaseolus vulgaris L.) Untuk Pembuatan Biskuit,” *AGROEKOTEKNOLOGI*, vol. 3, 2022.

[6] R. Alfiah, E. Handarsari, H. Sulistyaningrum, and Y. Kholifatuddin Sya'di, "Kadar Lemak, Kadar Serat dan Karakteristik Sensori Brownies Panggang dengan Substitusi Tepung Ubi Jalar Kuning," 2025.
[7] N. W. Saputra, A. P. Wibawa, U. Pujianto, and P. Anugrah, "Pengembangan Bahan Ajar Data Mining Menggunakan Four-D Model dalam Kerangka Kerja CDIO," 2020.

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SUBSTITUTION OF TARO FLOUR *(Colocasia esculenta)* AND KATUK LEAVES *(Sauropus androgynus)* IN THE MANUFACTURE OF CATFISH DIMSUM

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ABSTRACT

The increase in consumption of practical foods such as dimsum has not been balanced with optimal nutritional content. The use of local food ingredients such as taro flour and katuk leaves has the potential to increase the nutritional value of products. This research aims to develop dimsum by substituting taro flour and katuk leaves with catfish as a source of protein. This research aims to: (1) find recipes for taro dimsum, katuk leaves, and catfish products; (2) determine the presentation and packaging of taro dimsum, katuk leaves, and catfish products; (3) to find out the level of public preference for dim sum products; (4) to know the composition and nutritional value information of dimsum products; and (5) knowing the selling price and Break Event Point (BEP) of dimsum products. The research method uses (R&D) Research and Development 4D method: Define, Design, Development, and Disseminate. Quantitative descriptive data analysis methods and paired t-test tests. The research was conducted at Yogyakarta State University January 2026 - April 2026. The results of the study showed: (1) The Wiffle recipe used 30g of taro flour, 14g of katuk leaf powder, 56g of wheat flour, and 281g of catfish filling, as well as other complementary ingredients. Processed by steaming technique; (2) The weight of the sacrificial product is 100gr; (3) The level of likability of the product received a score of 4.5 out of 5; (4) Nutritional value per serving: total energy 129 kcal, total fat 26 g, protein 33 g, carbohydrates 70 g, fiber 2 g; (5) Selling price Rp.16,500/4pcs (100gr), BEP product Rp.19.532. The research shows that Dimsum Takatin has the potential to be a nutritious and economically viable local food substitution product.

Keywords:
dimsum, taro flour, katuk leaves, catfish, substitutions

Meningkatnya konsumsi makanan praktis seperti dimsum belum diimbangi dengan kandungan gizi yang optimal. Pemanfaatan bahan pangan lokal seperti tepung talas dan daun katuk berpotensi meningkatkan nilai gizi produk. Penelitian ini bertujuan mengembangkan dimsum dengan substitusi tepung talas dan daun katuk dengan ikan patin sebagai sumber protein. Penelitian ini bertujuan untuk: (1) menemukan resep produk dimsum talas, daun katuk, dan ikan patin; (2) menentukan penyajian dan kemasan produk dimsum talas, daun katuk, dan ikan patin; (3) mengetahui tingkat kesukaan masyarakat terhadap produk dimsum; (4) mengetahui komposisi dan informasi nilai gizi produk dimsum; serta (5) mengetahui harga jual dan Break Even Point (BEP) produk dimsum. Metode penelitian menggunakan (R&D) Research and Development metode 4D: Define, Design, Development, dan Disseminate. Metode analisis

data deskriptif kuantitatif dan uji paired t-test. Penelitian yang dilakukan di Universitas Negeri Yogyakarta Januari 2026 - April 2026. Hasil penelitian menunjukkan : (1) Resep Wiffle menggunakan 30gr tepung talas, 14gr bubuk daun katuk, 56gr tepung terigu, dan isian ikan patin 281gr, serta bahan pelengkap lainnya. Diolah dengan teknik steaming; (2) Berat produk persajian 100gr; (3) Tingkat kesukaan produk mendapat nilai 4,5 dari 5; (4) Nilai gizi per sajian: energi total 129 kkal, lemak total 26 g, protein 33 g, karbohidrat 70 g, serat 2 g; (5) Harga jualRp.16.500/4pcs (100gr), BEP produk Rp 19.532. Penelitian tersebut menunjukkan bahwa Dimsum Takatin mempunyai potensi sebagai produk substitusi pangan lokal yang bergizi dan layak secara ekonomis.

1. Introduction

The consumption of snacks has become part of the lifestyle of modern society along with changes in dietary patterns, increased daily activities, and easy access to various food products. Snacks are chosen as a practical alternative to accompany activities, fill free time, or overcome temporary hunger. This phenomenon is not only occurring in Indonesia, but also globally, which is shown by the increasing trend of snack consumption in various walks of life. This condition reflects the existence of significant market opportunities for the food industry, especially the snack sector.

The *snack* industry in Indonesia shows stable growth and continues to expand. However, the fierce competition in the snack industry demands a deep understanding of people's consumption behaviors and habits. Analysis of snack consumption habits is important as a basis for formulating product development strategies, pricing, distribution, and promotion. In addition, increasing public awareness of a healthy lifestyle has also encouraged the demand for healthy snacks, thus opening up opportunities as well as challenges for business actors to produce products that are not only practical and liked, but also have better nutritional value. [1]

Improving the quality of community nutrition is one of the important efforts to support health, growth, and productivity. Diverse and balanced food consumption plays a role in meeting the needs of macro and micronutrients optimally. Food diversification is one of the strategies that can be carried out to improve the nutritional quality of the community, because the variety of food types allows the fulfillment of nutritional needs more comprehensively and reduces dependence on one type of food. [2]

One of the efforts to improve the quality of community nutrition is through the development of food products that are nutritious, practical, and easily accepted by the community. Food product innovation is expected to be an alternative choice of snacks that are not only preferred, but also contribute to the fulfillment of daily nutrients in a more balanced manner and support better consumption patterns.

The development of dimsum made from catfish with the substitution of taro flour (Colocasia esculenta) and the addition of katuk leaf powder (Sauropus androgynus) was carried out to determine its effect on the nutritional value of the product while utilizing local foodstuffs. However, research related to the development of catfish dim with the combination of these ingredients, especially from the aspects of nutritional value and sensory characteristics, is still limited. Therefore, this research was carried out to fill this gap through the development of catfish dimsum products as an alternative to nutritious snacks.

Takatin products are the result of food development in the form of dimsum with the use of local food ingredients, namely taro flour and katuk leaves on the skin and catfish as fillings. The name "Takatin" stands for Taro Katuk Dimsum Isi Ikan Catin which is given to

reflect the main ingredients used while providing an easy-to-remember product identity. Product development is carried out through the partial substitution of wheat flour with taro flour on the dimsum skin and the addition of katuk leaves as a source of nutrients and natural dyes.

2. Method

This type of research uses R&D (Research and Development) with a 4D development model, namely Define, Design, Develop, and Disseminate. R&D is a systematic process that is carried out to create, develop, or improve products, processes, or services. In the context of this research, R&D aims to produce taro catfish dimsum and katuk leaves as protein-rich snacks. The R&D process involves data collection, analysis, and testing to ensure the product meets the nutritional needs and tastes of consumers.

Preference test data from the sensory test were analyzed using paired t-tests to determine the significant differences in panelist preferences between the two products being compared. This method is done by comparing the assessments of the same group of panelists on several sensory aspects, such as color, taste, texture, and aroma. The design stage is carried out by designing product formulations through the substitution of wheat flour with taro flour at three concentration variations, namely 25%, 30%, and 35%. In addition, at this stage, the design of the concept of presentation and product packaging was also carried out. The product was then tested by semi-trained panelists using sensory test instruments, which included aspects of color, aroma, taste, texture, and overall likability. The entire product development and evaluation process is carried out within the Faculty of Vocational Studies, State University of Yogyakarta, Wates Campus from September 2025 to April 2026.

The purpose of using the t-test in sensory testing is to find out whether the difference in the panelist's assessment or level of preference for the product being tested is significant or not. Thus, the results of the t-test can show whether the differences obtained really reflect the preferences of the panelists

3. Results and Discussion

3.1. Results

a. Determination of the Recipe for Katuk Taro Dimsum Products with Catfish Filling (Takatin)

The determination of reference recipes is carried out by collecting several relevant recipes from reliable sources, then three recipes are selected to be tested. The three recipes are then observed for their characteristics including shape, color, aroma, taste, and texture to obtain a recipe that has characteristics that are closest to the expected product. The three reference recipes used in this study can be seen in Table 1.

Table 1. Dimsum Reference Recipe

Ingredients	Reference Recipes 1	Reference Recipes 2	Reference Recipes 3
Chicken Thighs Fillet (g)	250 gr	250 gr	250 gr
Peeled shrimp (g)	50 gr	100 gr	125 gr
Garlic (cloves)	2		2
Shallots (granules)			2
Egg White (g)	56		56
Tapioca Flour (g)	90		40
Cornstarch (g)		10	
Salt & Pepper (g)	2	1	3
Sugar (g)	2		2
Flavoring (tsp)	1/4		1/2
Saus Tiram (ml)	10		10
Soy Sauce (ml)	10	10	20
Sesame Oil (ml)	10	10	10
Wortel Parut (g)	50		60
Spring Onions (btg)		2	3
Leather Material			
Medium Pro Wheat Flour (g)	135	200	100
Tapioca Flour (g)	10		2 tbsp
Warm Water (ml)	70	100	As needed
Salt (g)	2	2	2
Vegetable Oil (ml)		10	

Table 1 shows three reference recipes for shrimp chicken dimsum products that have different ingredient compositions, especially in the proportion of shrimp, flour, and additives used. Reference recipe (1) uses the dominant composition of chicken fillet with the addition of less shrimp, as well as the use of tapioca flour which is high enough to have an effect on a chewier texture.

The reference recipe (2) has a simpler composition, which is to use chicken and shrimp with the addition of leeks as a complementary ingredient without the addition of other vegetables. In addition, in this recipe, cornstarch is used in small amounts and a larger composition of the skin, so it can affect the texture of dimsum to be lighter.

Meanwhile, the reference recipe (3) uses a higher amount of shrimp than other recipes, as well as the addition of grated carrots as a complement. The flour composition in this recipe is lower than that of the recipe (1), resulting in a softer texture with a richer flavor than the combination of chicken, shrimp, and vegetables.

The differences between these three recipes aim to explore the influence of ingredient variations on the final characteristics of shrimp chicken dimsum products, both in terms of taste, aroma, texture, and appearance, so that the best reference recipe can be obtained before product development with catfish and taro flour substitution.

After determining the reference recipe, a trial is carried out at the *definition stage* to find out the characteristics of each recipe based on sensory parameters. The assessment includes shape, color, aroma, taste, and texture to determine the initial quality of the product. The results of testing the characteristics of the three reference recipes are presented in Table 2.

Table 2. Characteristics of Definition Stage Reference Recipe Trial Results

No	Characteristics of Reference Recipe I	Reference Recipe II	Reference Recipe III
1	Shape	Round	Round	Round
2	Color	Pale white	Pale white	Pale white
3	Taste	Savory	Savory	Most Savory
4	Aroma	Savory	Savory	Savory
5	Texture	Soft	Less soft	Softest
6	Overall	Somewhat preferred	Somewhat preferred	Liked

Table 2 shows the sensory characteristics of the three reference recipes of the test results at the *defined* stage. Based on the data that has been presented, the recipe that is selected at the definition stage is reference recipe 3. This decision was taken because reference recipe 3 has the most savory taste and the softest texture, which results from the use of more complete spices in its composition. By considering these factors and the results of data analysis, reference recipe 3 is the choice of reference recipe that will be used in the next stage, namely *the design* stage.

In addition to the assessment of sensory characteristics, visual observations were made of the product results in each *of the defined* stage reference recipes. This observation aims to see the difference in the appearance of the resulting product as a support for the initial quality evaluation. The product results of the three reference recipes are presented in Table 3.

Table 3. Results of Stage Mold Products *Define*

Product Results

Figure 1. Reference Recipe 1 Figure 2. Reference Recipe 2 Figure 3. Reference Recipe 3

Table 4. Average Results of Assessment of Define Stage Test Products

Sensoris parameters	R1	R2	R3
Shape	4	4,4	4,2
Size	4	4,2	4,2
Color	4	4,4	3,6
Aroma	3,8	4,4	3,6
Taste	2,8	4,2	3,8
Tekstur	3,4	4,2	3,6
Overall	3,8	3,6	4,4

Table 4 shows the average results of sensory assessments of the three reference recipes by the panelists. Based on the data, recipe 3 obtained the highest score with an average of (4.4). Recipe 1 with an average (3.8) and recipe 2 with an average (3.6). Recipe 3 also showed the highest scores on almost all parameters, especially on taste, texture, and overall rating. These results show that recipe 2 is the most preferred formulation by the panelists, so it was chosen as a reference recipe for the next stage of development.

Table 5. Recipe for Taro Flour Ingredient Substitution Design

Material Name	Mold	F1 (25%)	F2 (30%)	F3 (35%)
Wheat Flour (g)	100	75	70	65
Taro Flour (g)	-	25	30	35
Tapioca Flour (g)	20	20	20	20
Salt (g)	2	2	2	2
Warm Water (ml)	20	20	20	20

Products that have been made based on recipe formulations are then subjected to sensory tests to determine the characteristics of the product including shape, color, aroma, taste, and texture. The results of sensory tests on the product are presented in table 6.

Table 6. Design Stage 1 Sensory Test Results

Features	F1 (25%)	F2 (30%)	F3 (35%)
Shape	Round	Round	Round
Color	Pale white	Brownish-white	Brownish-white
Aroma	Savory	Savory	Savory
Taste	Savory	Savory	Savory
Texture	Skin is a bit thick	Soft	Skin is a bit thick

Table 6 shows the sensory characteristics of the product at the *design stage* with taro flour substitution. The results showed that F2 (30%) showed the characteristics that

most closely resembled the reference product, with the corresponding shape, size, color, aroma and texture as well as a perfectly suitable taste. Meanwhile, F1 (25%) also has quite good characteristics, but the taste is still considered somewhat in accordance with the meaning that it can still be improved to the formulation of the percentage above it. F3 (35%) produces dimsum skin that tends to be thick and torn.

Table 7. Product Results Design Stage 1

Figure 4. Substitution 25%

Figure 5. 30% substitution

Figure 6. Substitution 35 %

These results suggest that an increase in the percentage of taro flour substitution may affect the sensory characteristics of the product, especially in aroma, taste, and texture which tend to be stronger and less optimal at higher substitution levels.

Table 8. Recipe Design Substitution of Katuk Leaf Powder Ingredients

Material Name	Mold	F1 (10%)	F2 (15%)	F3 (20%)
Wheat Flour (g)	70	63	59,5	56
Taro Flour (g)	30	30	30	30
Katuk Leaf Powder (g)	0 gr	7	10,5	14
Tapioca Flour (g)	20	20	20	20
Salt (g)	2	2	2	2

Products that have been made based on recipe formulations are then subjected to sensory tests to determine the characteristics of the product including shape, color, aroma, taste, and texture. The results of sensory tests on the product are presented in table 9.

Table 9. Design Stage 2 *Sensory Test Results*

Features	F1 (10%)	F2 (15%)	F3 (20%)
Shape	Round	Round	Round
Color	Dull green	Dull green	Dull green
Aroma	Savory	Savory	Savory
Taste	Savory	Savory	Savory
Texture	Skin is a bit thick	Soft	Skin is a bit thick

Table 9 shows the sensory characteristics of the product at the *design* stage with taro flour substitution. The results showed that F3 (20%) did not show a bitter aftertaste. So it was chosen for the next formula.

Table 10. Product Results Design Stage 2

Figure 7. 10% substitution

Figure 8. Substitution 15%

Figure 9. Substitution 20%

These results suggest that an increase in the percentage of Katuk Leaf substitution can affect the sensory characteristics of the product, especially on the aroma, taste, and texture which tend to be stronger and less optimal at higher substitution levels.

Table 11. Catfish Stuffing Substitution Design Recipe

Material Name	Mold	F1 (50%)	F2 (75%)	F3 (100%)
Chicken Thighs Fillet (g)	250	125	62,5	-
Catfish meat (g)	-	187,5	281,25	375
Peeled shrimp (g)	125	62,5	31,25	-
Shallots (fruit)	2	2	2	2
Garlic (cloves)	2	2	2	2
Egg White (g)	56	56	56	56
Tapioca Flour (g)	40	40	40	40
Salt & Pepper (g)	3	3	3	3
Sugar (g)	2	2	2	2
Flavoring (tsp)	1/2	1/2	1/2	1/2
Saus Tiram (ml)	10	10	10	10
Soy Sauce (ml)	20	20	20	20
Sesame Oil (ml)	10	10	10	10
Wortel Parut (g)	60	60	60	60
Spring Onions (btg)	3	3	3	3

Products that have been made based on recipe formulations are then subjected to sensory tests to determine the characteristics of the product including shape, color, aroma, taste, and texture. The results of sensory tests on the product are presented in table 12.

Table 12. Design Stage 3 Sensory Test Results

Features	F1 (50%)	F2 (75%)	F3 (100%)
Shape	Round	Round	Round
Color	Dull green	Dull green	Dull green
Aroma	Savory	Most Savory	Savory
Taste	Typical earthy taste of catfish	Balanced savory	Typical earthy taste of catfish
Texture	Chewy and dense	Dense and softest	Too mushy

Table 12 shows the sensory characteristics of the product at the *design stage* with taro flour substitution. The results showed that F2 (75%) showed the characteristics most close to the reference product, with the corresponding shape, size, color, aroma and texture as well as a perfectly suitable taste. Meanwhile, F1 (50%) also has quite good characteristics, but the taste is still considered somewhat in accordance with the meaning that it can still be improved to the formulation of the percentage above it. F3 (100%) produces a slightly fishy dimsum skin and a earthy smell.

Table 13. Product Results Design Stage 3

Figure 10. 50% substitution

Figure 11. 75% substitution

Figure 12. 100% substitution

These results suggest that an increase in the percentage of Catfish substitution in fillings can affect the sensory characteristics of the product, especially on aroma, taste, and texture which tend to be stronger and less optimal at higher substitution rates.

Based on the results of development at the taro flour substitution stage, the addition of katuk leaf powder, and the use of catfish, the best formulation was obtained which was then used as the final product of the research. The selected product formulation is a combination of using taro flour by 30%, katuk leaf powder by 20%, and catfish by 75% which produces product characteristics as expected.

b. Determination of Presentation and Packaging of Taro Katuk Dimsum Products with Catfish Filling (Takatin)

After obtaining the best formulation at the previous stage, validation tests are carried out by experts to evaluate the quality of the development product compared to the reference product. The assessment is carried out based on organoleptic parameters which include shape, size, color, aroma, taste, texture, and overall. The results of the organoleptic test at the validation stage I are presented in Table 14.

Table 14. Results of Organoleptic Test Validation Test I

Sensoris parameters	Mold	Development
Shape	4	4,5
Size	4	4
Color	4	4
Aroma	4	4
Taste	3,8	4,5
Texture	3,8	4,3
Overall	3,8	4,5

Table 12 shows the average results of the organoleptic assessment of the development stage, the reference product obtained an average value of 3.9 while the development product obtained an average value of 4.2. These results show that the development product has a better acceptance rate than the reference product.

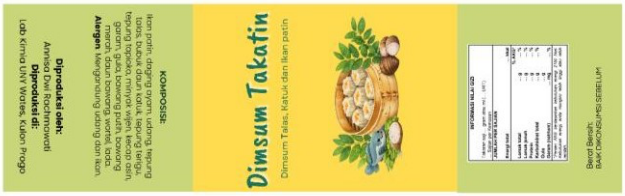

Figure 13. Packaging Labels

INFORMASI NILAI GIZI		
Takaran saji 25 g (4 buah) 1 Sajian per Kemasan		
JUMLAH PER SAJIAN		
Energi Total		**34 kkal**
		%AKG
Lemak total	1 g	1%
Protein	2 g	4%
Karbohidrat total	4 g	1%
Serat	2 g	6%
**persen AKG berdasarkan kebutuhan energi 2150 kkal. Kebutuhan energi anda mungkin lebih tinggi atau rendah.*		

Figure 14. Nutritional Value Information

Figure 15. Product Packaging

c. Analysis of the Level of Public Preference for Taro Katuk Dimsum Products with Catfish Filling (Takatin)

After the product development and validation stage, a preference test is then carried out at the *disseminate* stage to determine the level of public acceptance of the products produced. The test involves untrained panelists who provide assessments based on several sensory parameters, namely taste, aroma, texture, packaging, color, and overall. The results of the sensory test score assessment are presented in Table 15.

Table 15. Average Results of Disseminate Stage Sensory Test (80 Panelis)

Sensoris parameters	Mold	Development
Taste	3,99	4,56
Aroma	3,95	4,53
Tekstur	3,93	4,50
Packaging	3,89	4,56
Color	3,79	4,48
Overall	3,99	4,68

Based on the average table of sensory test results, the development product showed a higher average value of likability than the reference product in all aspects of the assessment which included taste, aroma, texture, color, appearance, and overall.

d. Analysis of the Composition and Information of the Nutritional Value of Taro Katuk Dimsum Products with Catfish Filling (Takatin)

Table 16. Average Results of Proximate Analysis Lab Tests

No	Nutritional Content	Mold	Development
1.	Air	64,67	63,05
2.	Item	1,28	1,19
3.	Protein	9,49	8,44
4.	Fat	3,23	2,93
5.	Carbohydrates	16,85	17,28
6.	Crude Fiber	134,62	129,13
7.	Energy	4,47	7,10

Table 16 shows the results of the proximate tests that have been carried out, it is known that reference dimsum products and development dimsum products have different nutritional content compositions. The components analyzed include moisture content, ash, protein, fat, carbohydrates, energy, and crude fiber. The test results data were obtained from two repetitions for each product so that they could describe the nutritional content of dimsum products more accurately. The results of the analysis showed that the development product had a higher content of carbohydrates and crude fiber compared to the reference product.

Table 17. Results of Paired T-Test Proximate Analysis and Superior Nutrition

Sensory	Properties		Development		P-value	Description
Air	44,33	0,17	57,25	0,15	0,0009	Real differences
Item	0,88	0,11	0,85	0,05	0,8099	No real difference
Protein	5,57	0,51	3,44	0,23	0,0595	Real differences
Fat	8,89	0,15	7,37	0,11	0,0111	Real differences
Crude Fiber	1,85	0,02	2,65	0,15	0,0751	No real difference
Carbohydrates	38,47	0,58	28,45	0,00	0,1425	No real difference
Energy	252,39	1,28	190,91	1,99	0,0052	Real differences

Table 17 shows The results of the analysis show that the development product has a higher carbohydrate and crude fiber content compared to the reference product. The nutritional composition of the product is known after laboratory testing is carried out, then a *t-test is carried out* to determine the difference between the reference product and the development product.

Table 18. Mass and Energy Analysis of Takatin Dimsum

Nutrition	Up to	Bulk	Energy (kcal)
Fat	2,93	1 gr	6,60
Protein	8,44	2 gr	8,44
Carbohydrates	17,28	4 gr	17,28
			32,32

Table 19. Calculation Results of the %AKG of Takatin Products

Nutritional Content	Mass of Nutrients	Total Nutrition Label Reference	
Fat	0,73	67	1%
Protein	2,11	60	4%
Carbohydrates	4,32	325	1%

Table 19 shows the results Based on the results of the calculation of the percentage of the daily Nutritional Adequacy Rate (%AKG), it is known that the contribution of nutrients to reference products and development products is relatively low to daily nutritional needs. The percentage of AKG in development products was obtained as a percentage of protein AKG of 4%, fat of 1%, and carbohydrate of 1%. These results show that the product plays more of a role as an interlude food because its contribution to daily nutritional needs is still relatively small.

The calculation of the percentage of Nutritional Adequacy Rate (%AKG) in dimsum products is carried out by comparing the nutrient content per serving with the daily nutritional reference. The daily nutritional mold for nutrients such as fats, proteins, and carbohydrates refers to the prevailing CGI values.

Information on nutritional value in reference and development products can be seen in table 20 below.

Table 20. Information on the Nutritional Value of Takatin Products

NUTRITIONAL VALUE INFORMATION		
Serving size 25 g (4 pieces) 1 Serving per Package		
AMOUNT PER SERVING **Total Energy 34 kcal**		
		%AKG
Total fat 1 g 1%		
Protein	2 g	4%
Total carbs 4 g 1%		
Fiber 2 g 6%		
**percent AKG based on energy needs of 2150 kcal. Your energy needs may be higher or lower.*		

Nutritional value information per serving shows that Rainer Pancake products contain energy of 32.32 kcal per 25 grams serving. This value shows that the product has a

relatively controlled energy profile and is supported by fiber and carbohydrate content that provides added value for health.

Table 21. Selling Price of Takatin Products

Ingredients	quantity	Pricing
Raw Material (A)		
Wheat Flour	56 gr	1.000
Taro Tuber Flour	30 gr	2.000
Katuk Leaf Powder	14 gr	2.000
Warm Water	Sck	500
Salt	Sck	50
Tapioca Flour	20 gr	500
Paha Ayam Fillet	62.5 gr	2.480
Patin fish meat	281.25 gr	9.800
Peel shrimp	31.25 gr	1.900
Shallots	2 siung	500
Garlic	2 siung	500
Egg White	56 gr	2.500
Tapioca Flour	40gr	500
Garam & Lada	3 gr	100
Gula	2 gr	100
Flavoring	1/2 tsp	100
Oyster Sauce	10 ml	1.000
Kecap Asin	20 ml	1.300
Sesame Oil	10 ml	1.700
Wortel Parut	60 gr	700
Leeks	3 btg	1.000
Variable Cost (A)		**30.230**
Packaging and label costs (B)	5 pcs	**10.000**
Fixed costs (C)		
Wages	15% x BV	4.535
Tool cost	10% x BV	3.023
Gas	5% x BV	1.511
Air	5% x BV	1.511
Total fixed costs		**10.582**
Total production cost (A+B+C)		**50.812**
Fruit production costs	50.812÷16	3.176
***Mark Up* (30%)**	30%×3,176	953
Selling Price	Production cost per piece + *mark up*	4.100

The results of table 21 show Based on the calculation of production costs, one recipe for Takatin products yielded ±16 pieces of dimsum. The product is then packaged with the contents of 4 pieces per package so that 4 packages are obtained in one production. The total production cost obtained is IDR 50,812, so the production cost per piece of dimsum is IDR 3,176. The selling price is determined by adding a mark up of 30% of the production cost per piece. The mark-up is IDR 953 so that the selling price per piece of dimsum is IDR 4,129 which is then rounded to IDR 4,100 per piece. Thus, the selling price per package containing 4 pieces of dimsum is IDR 16,516 which is then rounded up to IDR 16,500 per package.

Table 22. Calculation of *Break Event Point* (BEP) of Takatin Products

Yes	Components	Formula	Results
1	BEP Unit	$= \frac{\text{Biaya Tetap}}{\text{Harga Jual per Unit} - \text{Biaya variabel per unit}}$	2 Units
		$= \frac{10.582}{(16.500 - (30.230 \div 4)}$	
2	BEP Rupiah	$= \frac{\text{Biaya Tetap}}{1 - (\text{Biaya variabel per unit} \div \text{Harga Jual per unit})}$	Rp. 19,253
		$\frac{10.582}{1 - (7.558 \div 16.500)}$	

Table 22 shows the results of the selling price that has been set, then a Break Even Point (BEP) calculation is carried out to determine the break-even point of the business. The calculation results show that the BEP unit is 1.18 packages which are then rounded up to 2 packages. Meanwhile, BEP in currency amounted to Rp19,523. This shows that Tatatin's dimsum business will reach a break-even point if sales have reached mi mi nimal 2 product packaging or worth around IDR 19,523.

3.2. Discussion

a. Takatin Product Recipes

The recipe for Katuk Taro Dimsum with catfish filling was obtained through a research and development (R&D) approach with a 4D development model. The first stage in this study is the *dedefine stage*, which is the stage to determine the reference recipe that will be used as the basis for product development. The second stage is the *design* stage The discussion at this stage is the formulation of Takatin products which is the result of development with the use of taro flour by 30%, katuk leaf powder by 20%, and catfish by 75%. The resulting product has the characteristics of a shape similar to dimsum in general with a brownish-green color that tends to be dim due to the use of taro flour and katuk leaf powder. The aroma produced is a typical combination of catfish and spices, with a balanced savory taste.

b. Presentation and Packaging of Takatinn Products

The product developed in this study is dimsum made from catfish with the substitution of taro flour and the addition of katuk leaves on the skin called Dimsum Takatin. This product is in the shape of a round siomay with a size of about 4–5 cm per fruit. The skin of dimsum is greenish-brown due to the use of taro flour and katuk leaves, while the filling is pale white typical of catfish. Takatin dimsum has a savory taste with a soft and chewy texture so that it can be accepted by consumers.

Takatin Dimsum products are packaged using primary packaging in the form of aluminum foil with a clear cover measuring 8 × 6 × 4 cm. This packaging was chosen because it is practical and able to protect the product from contamination during the storage and distribution process. In addition, the clear cover makes it easier for consumers to see the condition of the product directly. Product packaging is equipped with a label that serves as a product identity while providing information to consumers.

The information listed on the label includes the product name, ingredient composition, and other information related to Dimsum Takatin products.

c. The Level of Public Preference for Takatin Products

Takatin Dimsum products were tested for preference to determine the level of consumer acceptance of the developed products produced. The preference test was carried out using a sensory testing method involving panelists from the general public. The products used in the preference test are reference dim sum products and development dim sum products. The test was carried out involving 80 panelists from the general public which was held at the Auditorium of the State University of Yogyakarta (UNY) Wates Campus. Panelists provide an assessment of several sensory parameters which include taste, aroma, texture, color, appearance, and overall rating.

d. Composition and Information on the Nutritional Value of Takatin Products

Based on the results of proximate tests conducted on development dimsum products, there are several changes in nutritional composition compared to reference products. The results of the analysis showed that there was a decrease in several nutritional components, such as protein content and fat content in development products compared to reference products. The decrease in protein content in the development product was relatively small, which was around 1%, which was allegedly influenced by the use of substitute ingredients in the form of taro flour and katuk leaf powder which had a lower protein content than the ingredients in the reference product. In addition, the fat content in the development product also decreased slightly compared to the reference product. This decrease in fat content is likely influenced by changes in the composition of the ingredients in the product formulation. The energy content of development products is also slightly lower than that of reference products because it is influenced by changes in the composition of macronutrients in the product. Despite the decrease in some nutritional components, the development product showed an increase in the carbohydrate and crude fiber content. The carbohydrate content in the development product is slightly higher than that of the reference product, while the crude fiber content has increased significantly. The fiber content in the development product increased from about 4.47% of the reference product to about 7.10%, which represents an almost two-fold increase. This increase in fiber content is suspected to come from the use of taro flour and katuk leaf powder which are plant-based foods rich in fiber.

Thus, Takatin Dimsum development products have advantages in higher dietary fiber content than reference products. This higher fiber content can provide benefits for health, especially in helping the digestive process and supporting healthier food consumption patterns.

e. Selling Price and BEP (Break Even Point) of Takatin Products

In determining the selling price of Dimsum Takatin products, the mark-up pricing method is used. The use of this method aims to make it easier to determine the desired profit percentage by adding the profit value to the total production cost. The selling price of the product is calculated based on the number of products in one package so that it can provide a clearer picture of the price for consumers.

Based on the results of the selling price calculation that has been carried out, Takatin Dimsum products are set at a price of IDR 4,100 per piece or IDR 16,500 per package with

the contents of 4 pcs of dimsum. The pricing has taken into account the cost of production as well as the desired profit percentage.

Comparison of the selling price of development products is carried out by looking at the prices of dimsum products circulating in the market. Dimsum products are generally sold at a price range that varies depending on the size, number of products in the package, and the ingredients used.

4. Conclusion

Based on the results of research, data analysis, and discussions that have been carried out regarding the development of Taktin Dimsum products, it can be concluded as follows:

a. The recipe for Takatin Dimsum products was obtained through a development process by substituting 30% taro and 20% katuk leaves in the manufacture of dimsum skin and using 75% catfish as the main ingredient in the filling. The resulting products have shape, color, aroma, taste, and texture characteristics that are in accordance with the characteristics of dimsum in general.
b. The presentation of Takatin Dimsum products uses food-grade packaging in the form of aluminum foil measuring 8cm x 6cm x 4cm so that it makes it easier to present and distribute products.
c. Based on the results of the test level of public likability, Takatin Dimsum products received good assessments on the aspects of color, aroma, taste, texture, and overall, so that they can be accepted by the public.
d. Based on the results of the proxy test, Dimsum Takatin products contain a nutritional composition that includes moisture content, ash content, protein content, fat content, and carbohydrate content.
e. Based on the results of the calculation of the selling price of Takatin Dimsum products, it has a selling price of 16,500/pack with 4 pieces of dimsum per pack.
f. The Break Even Point (BEP) of the takatin product unit is 2 packages and the BEP is 19,523 rupiahs.

5. References

[1] Alifa Ramadhani, A. (n.d.). *Potential Competitive Advantage of Indonesia's Marine Resources* (Vol. 12).

[2] Anggraini, P., & Adam, A. A. (2025). Analysis of Price, Product Quality, and Customer Relationship Marketing on Salt Purchase Decisions at PT. The Light of the Great Ocean. *RIGGS: Journal of Artificial Intelligence and Digital Business*, *4*(3), 5652–5661. https://doi.org/10.31004/riggs.v4i3.2847

[3] Asti, A., Medianto Kurniawan, H., & Puspitaningtsya Junaedi, M. (2024). The use of garlic peel as a processed food for chips in the group of housewives RT 004 RW 005 Sungai Beliung Village. *Journal of Community Service of the Archipelago*, *5*(1), 933–940. https://doi.org/10.55338/jpkmn.v5i1.2873

[4] Basyir, A., Pratiwi, E., Palupi, D., & Dwi Ermawati, D. (2025). *The application of the full costing-based mark up pricing method in determining the selling price of products*. *Sec. 6*.

[5] BatuBara, I. W. S., & Nasution, A. I. L. (2023). Development Strategy in Empowering Tanjung Leidong Coastal Community Through Shrimp Management into Shrimp Crackers. *Journal of Business Economics Informatics*, 537–542. https://doi.org/10.37034/infeb.v5i2.281

[6] Berfikir, K., Quantitative, P., Zahra Syahputri, A., Della Fallenia, F., Syafitri, R., Lubis, R. N., Wulan, S., & Lubis, D. (2023). *Tarbiyah: Journal of Education and Teaching*. https://jurnal.diklinko.id/index.php/tarbiyah/https://jurnal.diklinko.id/index.php/tarbiyah/

[7] Dwi Listiarini, U., Nurrohmaton, & Lisma, N. (2024). The Effect of Counseling on the Benefits of Carrot Juice to Overcome Dysmenorrhea in Adolescent Girls at Al-Ihsan Mulia Private Junior High School. *IMPROVEMENT Medical Journal International*, *2*(4), 24–30. https://doi.org/10.61434/mejora.v2i4.261

[8] Endah Dwijayanti, Munadi, R., & Farnatubun, M. W. (2023). Proximate and Collagen Analysis on the Skin of Tawassang Fish (Naso thynnoides). *ILTEK : Journal of Technology*, *18*(02), 103–107. https://doi.org/10.47398/iltek.v18i02.124

[9] Fajarullah Bangkit Nugraha, Anggi Rizki, & Syamsul Hidayat. (2025). Analysis of Snack Consumption Habits. *PPIMAN Center for Management Science Publication*, *3*(3), 255–265. https://doi.org/10.59603/ppiman.v3i3.920

[10] Faras Arhab, M., Yunita Widyanti, A., Fernanda Alvi Yasin, M., Banowati, N., Noviaty, V., Mumpuni Adhi, P., Applied Engineering Manufacturing Technology, M., Negeri Jakarta, P., & A Siwabessy, J. G. (2022). The Influence of Cooking Techniques and Time on the Characteristics of the Maturity Level of Chicken Eggs. In *Pasundan Food Technology Journal (PFTJ)* (Vol. 9, Number 1).