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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

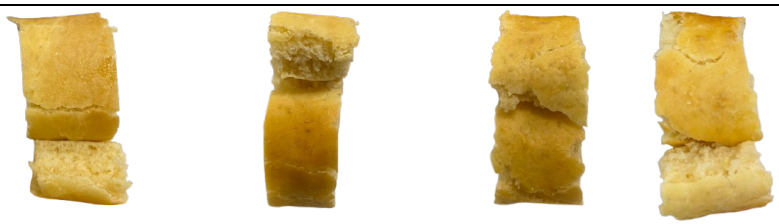
Table 9 presents substitution recipes using gurami fish meat and garut starch, with gurami fish meat comprising 10%, 20%, and 30% of the mixture, and garut starch comprising 30%. These three recipes were tested simultaneously to determine differences in sensory characteristics. The sensory characteristics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

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