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Formulation of cambete biscuits high in energy and protein as a snack for children with tuberculosis (TB)

Formulasi biskuit cambete tinggi energi dan protein sebagai snack anak penderita tuberkulosis (TB)

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Abstract

Tuberculosis (TB), particularly in children, often leads to undernutrition owing to increased metabolic demands and reduced food intake. This study aimed to evaluate the organoleptic characteristics, acceptability, and nutritional quality of cambete biscuits made from a mixture of eel and tempe flours at different concentrations. This study used a completely randomized design (CRD) with three treatment factors and three replications (2,5%, 3,7%, and 5% substitutions of eel and tempe flour), which took place in Jakarta Health Polytechnic II from April to June 2024. The biscuits were assessed using sensory (organoleptic) and hedonic tests by moderately trained panelists. Proximate analysis was performed to determine nutrient content. Data were analyzed using the Friedman test. The results showed no significant differences in color (p= 0,101), aroma (p= 0,410), taste (p= 0,306), or texture (p= 0,598) among the different flour formulations. One serving (46 g, 2 biscuits) of Cambete biscuits provides 212,14 kcal of energy, 3,88 g of protein, and is favored by 63,4% of panelists. In conclusion, this product has potential as a complementary food for children with TB owing to its high energy content and the use of locally available ingredients.

Keywords: Biscuits, eel flour, high protein snack, tempe flour, tuberculosis nutrition

Abstrak

Tuberkulosis (TB), terutama pada anak-anak, sering menyebabkan malnutrisi akibat peningkatan kebutuhan metabolik dan penurunan asupan makanan. Penelitian bertujuan untuk mengevaluasi karakteristik organoleptik, tingkat kesukaan, dan kualitas gizi biskuit Cambete yang dibuat dari campuran tepung belut dan tempe dengan konsentrasi yang berbeda. Penelitian menggunakan rancangan acak lengkap (RAL) dengan tiga faktor perlakuan dan tiga kali ulangan (substitusi tepung belut dan tempe sebanyak 2,5%, 3,7%, dan 5%) yang dilakukan di Poltekkes Kemenkes Jakarta dari bulan April-Juni 2024. Biskuit dinilai melalui uji organoleptik dan uji hedonik oleh panelis semi terlatih. Analisis proksimat dilakukan untuk menentukan kandungan gizinya. Data dianalisis menggunakan uji Friedman. Hasil penelitian menunjukkan tidak ada perbedaan signifikan pada warna (p= ,101), aroma (p= 0,410), rasa (p= 0,306), dan tekstur (p= 0,598) antara formulasi tepung yang berbeda. Satu porsi (46 g, 2 buah biskuit) biskuit Cambete mengandung 212,14 kkal energi dan 3,88 g protein, serta disukai oleh 63,4% panelis. Kesimpulannya, produk ini berpotensi digunakan sebagai makanan pendamping untuk anak-anak dengan TB karena kandungan energi yang tinggi dan penggunaan bahan yang tersedia secara lokal.

Kata Kunci: Biskuit, gizi tubercolusis, snack tinggi protein, tepung belut, tepung tempe

Introduction

Tuberculosis (TB) is a chronic infectious disease caused by Mycobacterium tuberculosis (Mtb). Indonesia is one of the countries besides India and China and has the largest TB problem in the world. Indonesia is committed to achieving TB

elimination by 2030, with a target incidence rate of 65/100,000 people and a death rate of 6/100,000 people (Barni, 2022). Tuberculosis may be caused by increased metabolic demand and decreased intake, and nutritional deficiencies may worsen the disease or delay recovery by suppressing important immune functions. In addition, tuberculosis causes an increase in energy requirements to maintain normal body functions, which is characterized by increased energy use at rest or resting energy expenditure (REE) of 10-30% of normal energy requirements. An increase in REE can cause an increase in leptin production, which can lead to eating disorders such as anorexia (Ayegua et al., 2022).

Eel fish (*Monopterus albus*) are widespread in tropical regions and are a source of proteins and minerals (Herdiana et al. 2017; Herawati et al. 2019). Eel fish can be processed into flour by grinding. The nutritional content of eel flour is higher at 76 kcal of energy, 15,79 g of protein, 1,1 g of carbohydrates, 0,9 g of fat, and 1,6 mg of iron compared to fresh eel. A mixture of eel and legume protein sources is an alternative complementary protein that contributes to the nutritional quality of these food products.

Tempe is an affordable and readily available local source of vegetable proteins in Indonesia. The protein content of tempes is higher than that of other vegetable protein sources (Widiany, 2019). Tempe has a relatively short shelf life owing to its moisture content. Therefore, tempe flour can be processed to obtain a longer shelf life. The nutrient content of tempe flour is higher at 529 kcal of energy, 54,8 g of protein, 35,5 g of carbohydrates, 23,2 g of fat, and 10,5 mg of iron compared to raw tempe.

Eel and tempe are two nutrient-rich food ingredients. The addition of eel flour affects the content of tempe produced, particularly by increasing the protein and unsaturated fatty acids. In 2022, researchers characterized eel fish and tempe powder and found that the combination of the two sources in a ratio of 1:3,5 (one eel and 3,5 tempe) can improve the quality of protein and unsaturated fatty acids. The composition of nutritional value in eel and tempe mixed flour includes 57,08% protein, 2,61% ash content, 25,05% fat, 9,38% carbohydrates, and 491,23% energy (Ngadiarti et al., 2022).

Biscuits are popular bakery products because they are made from simple, cheap, and readily available raw materials (Caleja et al., 2017). Biscuits are highly consumed because they can be enjoyed by all age groups and have high nutritional content. In general, the basic ingredients used in making biscuits are wheat flour and other ingredients such as eggs, sugar, and margarine (Haider et al., 2022). However, diversifying biscuit production by incorporating nutrient-rich ingredients, such as eel flour and tempeh, offers a promising solution for improving nutritional content, which can address nutritional deficiencies and promote healthier snack options.

The addition of eel and tempe mixed flour to biscuits is expected to produce a product with a familiar taste but a significantly higher protein content. Product diversification with eel flour has been explored previously, including fortification in biscuits (Wulandari et al., 2019) and the incorporation of tempe flour and roselle in cookie-making (Seveline et al., 2019). An in vivo study on malnourished rats confirmed the nutritional benefits of eel and tempe composite (ETC) flour.

However, this study is particularly important in the context of addressing child malnutrition, especially in children with tuberculosis (TB), who often experience poor nutritional status and require higher protein intake for recovery. The fortification of biscuits with eel and tempe flour can offer a practical, affordable, and appealing solution to increase protein consumption in children, aligning with the SNI 2973:2018 standards. According to these standards, biscuits must meet minimum requirements, such as a protein content of 4,5%, maximum acid-insoluble ash of 0,1%, and safe microbial limits (BSN (Badan Standarisasi Nasional), 2018), ensuring both nutritional adequacy and safety.

However, research on the addition of mixed eel and tempe flour to biscuits has not yet been reported, highlighting the need for studies on the organoleptic characteristics, acceptability, and microbiological quality of cambete biscuits (a mixture of eel and tempe flour). This study aimed to determine the organoleptic characteristics and levels of favorability and quality appropriate for the microbiological quality of Cambete Biscuits.

Methods

This research was experimental research using a Completely Randomized Design (CRD) with 3 treatments and 3 repetitions conducted from April to June 2024 at the Food Technology Laboratory, Taste Test of the Nutrition Department of the Jakarta Health Polytechnic II, Ministry of Health Republic of Indonesia and nutritional analysis of samples was conducted at the Bogor SIG Laboratory. This study underwent an Ethical Test conducted at the Jakarta II Health Research Ethics Commission (KEPK-PKJ II) and was declared to meet ethical principles and can be carried out with ethical number No. DP.04.03/I/KE/31/596/2024.

The sample of this research was 30 moderately trained panelists. Moderately trained panelists are familiar with the sensory attributes being evaluated, have received basic training, and understand sensory assessment guidelines (Anjani & Dwiyanti, 2013). The panelists in this research were students of Jakarta Health Polytechnic II, Ministry of Health Republic of Indonesia, who had taken the Food Technology Science course, were healthy, not color blind, not hungry, and did not have allergies to the ingredients used.

The biscuits were prepared from wheat flour, sugar, butter, eggs, baking powder, vanilla, lemon water, succade obtained from the Kramat Jati market, East Jakarta, and mixed flour obtained from the Food Technology Laboratory of Jakarta Health Polytechnic II, Ministry of Health, Republic of Indonesia. The equipment used to make cambete biscuits, namely digital scales, measuring cups, small bowls, small plates, spoons, lemon squeezers, mixers, baking sheets, toothpicks, and ovens, was obtained from the Food Technology Laboratory of Jakarta Health Polytechnic II, Ministry of Health, Republic of Indonesia. In accordance with the results of this study, the steps for making cambete biscuits from a mixture of eel and tempe flour are as follows:

Preparation of eel and tempe mixed flour

The equipment used in the process of making eel and tempe mixed flour were scales, steamer pans, basins, ovens, baking sheets, choppers, and 60 mesh sieves. Eels and tempes were used as the materials. Two kilograms of tempe (*Rhizopus Oryzae*) was obtained from a local market located in Jakarta in March 2024. The tempe was steamed for 20 min at 80°C °C. It was then dried in an oven at 60°C °C for 12 h, the dried tempe was ground, and sieved with a 60 mesh siever.

Three kilograms of eels (*Monopterus albus*) were obtained from a local market in Jakarta in April 2024. The eels were cleaned, steamed for 20 min at 80°C °C, and separated from the bones. It was then dried in an oven at 60°C °C for 12 h, and the dried eel was ground and sieved using a 60 mesh sieve. Tempe and eel flours were then mixed at a ratio of 1:3,5 (100 g of eel and 350 g of tempe).

Biscuit making

The sugars and butter were beaten with a low-speed mixer for approximately 2 min until combined, and the eggs, baking powder, and vanillin were added and mixed in a medium-speed mixer until combined. Add mixed flour and flour, which are appropriate for treatment. The solution was stirred slowly, and lemon water was added and stirred until biscuit dough was formed. Success was added and mixed until they were combined. The dough was shaped and pricked on top of the dough so that the heat was evenly distributed and baked in an oven at 160 °C for 20 min. The formulas used are listed in Table 1.

Table 1. Formulation of mixed flour in 100 g of wheat flour

Composition	T1 (2,5%)	T2 (3,7%)	T3 (5%)
Wheat flour (g)	94	91	88
Mixed flour (g)	6	9	12
Sugar (g)	37	37	37
Butter (g)	46	46	46
Eggs (g)	31	31	31
Baking powder (g)	0,25	0,25	0,25
Vanili (g)	0,5	0,5	0,5
Lemon water (g)	6,5	6,5	6,5
Succade (g)	20	20	20

In this study, we used three treatments and three replicates to provide sufficient data for statistical analysis, increase the precision of the results, and ensure that the findings are valid and reproducible.

Organoleptic test

The organoleptic test was conducted in the taste test laboratory of Jakarta Health Polytechnic II, Ministry of Health Republic of Indonesia, which

includes color, aroma, taste, texture, and the level of favorability of cambete biscuit products with the addition of eel and tempe mixed flour.

The criteria for the favorability were 5 scales, namely 1= dislike, 2= slightly like, 3= somewhat like, 4= like, 5= very like. Organoleptic tests were conducted on 30 moderately trained panelists. The inclusion criteria for panelists in this research were students of Jakarta Health Polytechnic II, Ministry of Health Republic of Indonesia, who had taken Food Technology Science courses, were healthy, and not color-blind. The exclusion criteria were hunger and allergies to ingredient use.

Nutritional analysis

Selected Cambete biscuit product samples from the organoleptic test were analyzed for macronutrients, iron, zinc, and microbiological quality at the Bogor SIG Laboratory. Macronutrient analysis consisted of energy, protein, fat, and carbohydrate content, and was analyzed using calculation, titrimetry, and gravimetry methods. Titrimetry can be used to determine the protein content using the Kjeldahl method.

Gravimetry is used to measure the content of fat and other components in food through sedimentation or evaporation, where the weight of the substance obtained is calculated to determine its concentration. Iron and zinc were analyzed using the ICP emission spectrometry.

Statistical Analysis

Data on color, aroma, taste, and texture criteria were analyzed using the Friedman test, whereas data on the level of liking criteria were analyzed descriptively by frequency. The Friedman test is a non-parametric alternative to one-way ANOVA with repeated measures. It is used to test differences between groups when the dependent variable being measured is ordinal (Nikita 2017).

Result and Discussion

Color is one part of a product's appearance and is an important sensory assessment parameter because it is the first sensory assessment trait observed by consumers (Asfi, 2017). The color produced in Cambete biscuits with the addition of eel flour and tempe flour produced color in product samples T1 yellowish brown, T2 light brown, and T3 brown. The higher the amount of mixed flour used, the darker was the cambete biscuit product. This is caused by the Maillard reaction that occurs between carbohydrates, especially reducing sugars, and amino acids in a hot atmosphere, producing a brown color in cookies (Seveline et al., 2019).

Table 2. Average value of Friedman statistical test of Cambete biscuit

Sample	Criteria	Treat-ment	Average	p-value
Cambete Biscuits	Color	T1	2,23	0,101
		T2	1,97	
		T3	1,80	
	Aroma	T1	2,12	0,410
		T2	1,88	
		T3	2,00	
	Taste	T1	2,13	0,306
		T2	1,83	
		T3	2,03	
	Texture	T1	2,10	0,598
		T2	1,90	
		T3	2,00	

Based on the results of Friedman's statistical test on the color criteria of cambete biscuits in Table 2, the results of the Friedman statistical test at the 95% confidence level showed no significant effect on panelists' favorability of cambete biscuits ($p<0,05$). The average value of the Cambete biscuit product T1 color had the highest value of 2,23, followed by T2 at 1,97 and the last T3 at 1,80.

The aroma is an important quality factor at the consumer acceptance level. The aroma is an important indicator in the food industry because it can quickly assess whether a product is acceptable (Wahyuningsih et al., 2017). The aroma has various properties, such as being fragrant, fishy, musty, and rotten. The higher the flour substitution, the higher the average of the indicators of the distinctive aroma of the ingredients used (Haris, 2015). The aroma of cambete biscuits with the addition of eel and tempe flours in the T1 product samples was neither fishy nor rancid. Similarly, the T2 and T3 samples did not exhibit fishy or rancid odors. The higher the mixed flour used, the more the cambete biscuit product smelled the rancid. This

was caused by the tempe flour used to prepare the biscuits. The rancid aroma was dominant in the soybean seeds. A rancid smell is produced by lipoxygenase, which hydrolyzes soybean fat and produces compounds that are included in the hexanal and hexacol groups that cause a rancid smell (Rahmayeni et al., 2019).

Based on the results of Friedman's statistical test on the aroma criteria of cambete biscuits in Table 2, the results of the Friedman statistical test at the 95% confidence level showed that there was no significant influence on panelists' favorability of cambete biscuit aroma (p<0,05). The average value of the cambete biscuit product aroma T1 had the highest value of 2,12, followed by T3 at 2,00 and finally T2 at 1,88.

Taste is an important criterion for assessing a food product that involves a sense of taste, namely, the tongue. Taste comes from a combination of ingredients and composition in a food product that is captured by the sense of taste and is one of the supporters of taste that supports the quality of a product (Cipto et al., 2016). The assessment of taste involves the sense of the tongue; therefore, a good taste can attract the attention of consumers to tend to like food from taste. The taste of the eel was not noticeable: in T1, the sweet aftertaste of the eel was slightly noticeable, in T2, the sweet aftertaste of the eel was slightly noticeable, and in T3, the sweet aftertaste of the eel was not noticeable.

The higher the mixed flour used, the more pronounced the eel aftertaste of cambete biscuits. This was caused by the eel flour used to prepare the biscuits. The addition of eel flour was 10 g and 20 g on the taste criteria that were most favored by panelists, whereas the least favored were biscuits with the addition of 30 g eel flour. The distinctive taste of fish causes panelists to dislike biscuits that contain high amounts of eel flour (Astuti et al. 2023).

Based on the results of the Friedman statistical test on the taste criteria of Cambete biscuits in Table 2, the results of the Friedman statistical test at the 95% confidence level showed no significant effect on panelists' favorability of cambete biscuits (p<0,05). The highest average value of cambete biscuit product taste was obtained in the T1 taste criteria at 2,13 then T3 at 2,03 and the smallest was obtained in the T2 taste criteria at 1,83.

Texture assessment in this study was conducted in the form of panelists' favorability for the hardness and crispness of the biscuits. Texture is a sensory attribute that must be considered for cookie products. The crispness of cookies is measured by whether the cookies crumble easily when bitten (Cipto et al., 2016). The crispness of cookies is influenced by flour used, flour moisture content, fat, sugar eggs, baking soda, and skim milk. Texture is influenced by the amylose-to-amylopectin ratio in wheat flour (Seveline et al., 2019). The texture produced on Cambete biscuits with the addition of eel and tempe flours was slightly crispy in the product samples T1, T2, and T3. The higher the mixed flour used, the less crispy was the cambete biscuit product. This is caused by the absence of gluten content in eel flour, although this gluten component is very important and affects the texture of the biscuits. Fitri (2017) showed that the acceptance level of biscuits decreased as more eel flour was added. The reason for the low level of acceptance of biscuits based on this texture is the gluten content in the ingredients used for making biscuits (Astuti et al., 2023).

Table 3. Results of panelists' assessment of the level of favorability of Cambete biscuits

Sample	Scale of Favorability	Treatment					
		T1		T2		T3	
		n	%	n	%	n	%
Cambete Biscuits	Dislike	1	3,3	0	0	0	0
	Slightly like	0	0	8	26,7	6	20
	Somewhat like	10	33,3	9	30	8	26,7
	Like	14	46,7	9	30	12	40
	Very like	5	16,7	4	13,3	4	13,3

Based on the results of the Friedman statistical test on the texture criteria of Cambete biscuits in Table 2, the results of the Friedman statistical test at the 95% confidence level showed no significant effect on panelists' favorability of the texture of biscuits (p<0,05).

The highest average value of the cambete biscuit product texture was obtained in the texture criteria T1 at 2,10 then T3 at 2,00 and the smallest was obtained in the taste criteria T2 at 1,90.

The level of favorability is the panelist's assessment of a product, which includes all aspects, namely color, aroma, taste, and texture. The assessment of the level of favorability of cambete biscuit products included five scales: 1 = dislike, 2 = slightly like, 3 = somewhat like, 4 = like, and 5 = very like. Based on the results of the panelists' assessment of the level of favorability of Cambete biscuits in Table 3, it shows that the results of the overall panelist assessment of the three treatments can be seen that the "like" criteria when combined with the "very like" criteria became "be liked" criteria so that the percentage of panelists mostly stated that Cambete biscuits formulated with eel flour and tempe flour had a preferred level of favorability in treatment T1 with a percentage of 63,4%, T2 43,3% and T3 53,3%. Therefore, the selected aroma of cambete biscuits with the addition of eel and tempe flours to the T1 product samples was neither fishy nor rancid. Similarly, the T2 and T3 samples did not exhibit fishy or rancid odors., The sweet taste of the eel aftertaste was not obvious, the texture was slightly crispy, and the level of favorability was 63,4%.

Table 4. Results of nutritional analysis and microbiological quality of Cambete biscuits

Sample	Cambete Biscuits /100 g	IFCT Biscuits 2017 /100 g	Cambete Biscuits /serving	IFCT Biscuits 2017 /serving
Energy (kcal)	461,18	458	212,14	210,68
Protein (%/g)	8,42	6,9	3,88	3,17
Fat (g)	18,28	14,4	8,41	6,62
Carbohydrate (g)	65,76	75,1	30,25	34,55
Iron (mg)	4,15	2,7	1,91	1,24
Zinc (mg)	1,23	0,6	0,57	0,28
Acid Insoluble Ash Content (colony/g)	0,02	-	0,009	-
TPC (colony/g)	$1,85x10^2$	-	$0,85x10^2$	-
Enterobacteriaceae (colony/g)	<10	-	<10	-
Salmonella sp. (negative/25 g)	negative	-	negative	-
Staphylococcus Aureus (colony/g)	<10	-	<10	-

Based on the results of the analysis of the nutrient content and microbiological quality of the cambete biscuits (Table 4), the macronutrient group is the main source of energy for the body. The results of the macronutrient analysis test of Cambete biscuit products obtained was nutrient content /100 g, namely 461,18 kcal of energy, 8,42 g of protein, 18,28 g of fat, and 65,76 g of carbohydrates. Meanwhile, the nutrient content of biscuits in the Indonesian Food Composition Table (IFCT 2017) has a macronutrient content /100 g, namely 458 kcal of energy, 6,9 g of protein, 14,4 g of fat and 75,1 g of carbohydrates. When compared, Cambete biscuit products have an energy content of 3,18 kcal, 1,52 g of protein, and 3,88 g of fat higher than the biscuits in the Indonesian Food Composition Table (IFCT 2017). Macronutrients are nutrients required in large quantities by the body. Macronutrients are broadly divided into three types: carbohydrates, proteins, and fat. Macronutrients are the main sources of energy for the body. The minimum test requirement for protein content in SNI 2973:2018 is a minimum of 4,5%, and cambete biscuit products met the minimum limit of protein content requirements.

Based on the Nutrition Adequacy Ratio (NAR 2019), the energy needs of children aged 0–14 years are, on average, 1500 kcal/day, and 10% comes from protein or equivalent to 37,5 g of protein per day. Snacks account for 20% of the daily protein needs; therefore, the protein requirement for snacks is 7,5 g. The nutritional content of Cambete biscuit products in one serving weighs 46 g (2 pieces), has a nutritional

content of 212,14 kcal of energy, 3,88 g of protein, 8,41 g of fat, and 30,25 g of carbohydrates. TB sufferers require high energy and protein consumption for physiological fulfillment and strengthening the immune system (Mas'ud et al., 2020; Shin et al., 2021). If the product is provided per serving twice daily, the cambete biscuit product meets the protein needs of children aged 0-14 years and is suitable for children with TB. This is in line with the WHO recommendation that each region needs to develop locally available nutrient-rich foods to accelerate the control of TB, including in children (Carwile et al., 2020).

Micronutrients are nutrients required in small amounts by the body. Micronutrients are broadly divided into two types, vitamins and minerals. The results of the micronutrient analysis of the cambete biscuit products were as follows: micronutrient content, 100 g; iron 4,15 mg and zinc, 1,23 mg. Meanwhile, the nutrient content of biscuits in the Indonesian Food Composition Table (IFCT 2017) has a micronutrient content of 100 g, namely iron 2,7 mg and zinc 0,6 mg. When compared, Cambete biscuit products have an iron content of 1,45 mg and zinc of 0,63 mg higher than the biscuits in the Indonesian Food Composition Table (IFCT 2017). The nutritional content of cambete biscuit products in one serving weighed 46 g (two pieces), had an iron content of 1,91 mg and a zinc of 0,57 mg. Zinc and iron minerals play key roles in defense against TB. They are involved in metabolic pathways, cellular and immune functions (Carwile et al. 2020).

Ash is a residual substance produced by the combustion of organic materials. The determination of acid-insoluble ash content aims to provide an overview of the mineral content contained in cambete biscuits that cannot be dissolved by acid addition. SNI 2973:2018 requires a maximum acid-insoluble ash content of 0,1% for the biscuit products. The acid-insoluble ash content of the cambete-biscuit sample was 0,02%. The acid-insoluble ash content of the cambete biscuits met the quality standards set by the SNI 2973:2018.

Microbes, especially pathogenic bacteria, can be found anywhere in the soil, water, air, plants, animals, foodstuffs, processing equipment, and even in the human body. According to SNI 2973:2018, the quality requirements for microbial contamination in biscuits, cookies, wafers, and pies products are a Total Plate Count (TPC) of a maximum of 10^4 colonies/g, maximum Enterobacteriaceae levels of 10 colonies/g, Salmonella levels of negative / 25 g, and maximum Staphylococcus aureus levels of 10^2 colonies/g (Badan Standarisasi Nasional (BSN), 2018). Based on the results of the analysis of Cambete biscuit product samples, the Total Plate Count (TPC) was $1{,}85 \times 10^2$ colonies/g, enterobacteriaceae levels <10 colonies/g, salmonella levels were negative, and staphylococcus aureus levels <10 colonies/g. The value of microbial contamination in Cambete biscuit acid met the quality standards set by the SNI 2973:2018.

Conclusion

Formulation of eel and tempe mixed flour 2,5; 3,7; and 5% in making Cambete biscuits did not significantly affect the organoleptic criteria of color, aroma, taste, and texture. The criterion for the level of favorability had a significant effect. Based on the results of the assessment of panelists, the cambete biscuit product was selected with a mixed flour formulation of 2,5% with yellowish-brown color criteria. The aroma had a neutral odor, the residual sweetness in the eel aftertaste was not perceptible, the texture was slightly crispy, and the level of liking was favored.

Cambete biscuits contain energy and protein and are favorable for use as complementary food for children with TB because they have a high energy content and the ingredients are locally available; however, they need to be consumed twice the serving size in one day to meet the protein needs of a snack for children aged 0-14 years. A further step in product development involves conducting acceptance testing with the primary target group, children, while also conducting research to determine the product's shelf life.

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