

# Chemical and sensory characteristics of lenggong biscuits as local supplement for undernourished children

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## Abstract

Biscuits are foods that are quite liked by the public, generally made from flour which in some countries the price of flour is quite expensive. An innovation is needed to replace flour with other local foods that have nutritional value and other benefits if used as biscuits. This study aimed at chemical and sensory characteristics and amino acid content in biscuits made from catfish meal composites, purple yam flour and tapioca. The design used is a non-factorial complete random design. The biscuit was made by using catfish flour (24 %, 47.5%, 71 %), purple sweet potato flour (24 %, 47.5%, 71 %). All treatments added 20% tapioca and 5% moringa flour. Sensory quality analysis was performed by organoleptic test with hedonic scale 5 scale by 50 untrained panelists covering color, aroma, texture, taste, and overall acceptability. The results of the sensory test showed that the panelists preferred biscuits made with a ratio of 47.5:47.5 which is formula 2. The nutritional content of biscuits is above PMT biscuits from the government. The resulting biscuits contain 15 types of amino acids. Catfish meal, purple sweet potato meal and tapioca affect chemical and sensory characteristics.

**Keywords:** Biscuit, sensory properties, chemical properties, catfish meal, tapioca.

**Full length article** \*Corresponding Author, e-mail: [yuli.hartati@poltekkespalembang.ac.id](mailto:yuli.hartati@poltekkespalembang.ac.id)

## 1. Introduction

Bakery products are ready-to-eat processed products such as bread, biscuits, pastries, crackers and cakes that are widely consumed throughout the world. Bakery products are no longer considered a luxurious tea snack, but have become an important component of the population's food profile [1]. Biscuits are small baked products made from flour, sugar and fat, have a low moisture content usually less than 4% and so have a long shelf life of about 6 months or more[2]. The main ingredients of biscuit dough are soft wheat flour, sugar, fat, and water. It is mixed with other small ingredients (such as baking powder, skim milk, emulsifiers, and sodium metabisulfite) to form a dough containing well-fluffy gluten tissue[2]. The use of flour in biscuit dough is because flour has unique rheological properties that affect the quality of biscuits[2]. In some countries including Indonesia, flour is still imported from other countries so the price is quite expensive. There needs to be innovation to replace flour with local food ingredients but still provide good quality in the biscuits produced[3],[4]. Many food crops such as cocoyam, cassava, yam, sorghum, peanuts, soybeans, maize and bambara peanuts and others can be used to partially replace imported wheat flour used for the production of biscuits, bread and other bakery

products[5]. The nature and quantity of ingredients in the dough determine the quality of the biscuit. Several researchers have described the effect of the main ingredient in the biscuit dough system on the final product[6,7,8,9]. Several studies have been conducted to substitute flour with local local foods such as using almond flour and coconut flour[10,5] fish protein concentrate[11,5,12] peanuts and mushrooms [11,12,13]. Based on the main ingredients of biscuits, it can be seen that biscuits contain more fat and carbohydrates. To make biscuits a healthy snack for toddlers who are growing, it is necessary to add other ingredients as a source of protein. Given that Indonesia still imports wheat flour, it is necessary to make modifications to replace wheat flour with local food ingredients such as purple sweet potato flour. The basic ingredients of wheat-based bakery snacks are characterized by low content of lysine, methionine, and threonine. To increase this nutritional value wheat flour is combined with other ingredients, such as: proteins (animal and vegetable), lipids, sugars, emulsifiers, as well as processing conditions largely determine the quality of biscuits [1].

Fish that are quite popular with the public, easy to get and cheap prices are catfish. Catfish is one source of food that contains high nutritional value such as protein

(19.03%), fat (8.10%), carbohydrates (0.5%), energy (151.1 kcal / 100 grams), vitamins and minerals as well as omega 3 and omega 6 fats [14]. In addition, catfish also contain amino acids and other nutrients that are easily absorbed by the body. So far, catfish is only consumed as a side dish in daily food. Turning catfish into flour will add to the selling value of catfish. Catfish meal can be used for various food products, one of which is biscuits [14,15,16]. In addition to the addition of fish meal, the addition of purple sweet potato flour will add nutritional value to biscuits. Purple sweet potatoes contain complex carbohydrates, proteins, fats, calcium besides purple sweet potatoes contain a source of vitamins, namely vitamins A, C, B1, and B2 and the minerals contained are iron (Fe), phosphorus (P), sodium (Na), calcium (Ca) [17,18,19]. Sweet potatoes that can improve malnutrition are B6 and folic acid to optimize brain work for toddlers, and anthocyanins stored in purple sweet potatoes can block the rate of cell damage in the body [20] [21]. In addition, purple sweet potatoes also contain essential amino acids that are needed by the body [18]. Tapioca is also widely used in the manufacture of biscuits to replace flour [22,23]. Tapioca is cassava starch (*Manihot usculenta*, Crantz) in contrast to tapioca flour [22,24]. Tapioca flour is defined as a product obtained in the form of cassava starch granules, and when subjected to appropriate technological processing, it is found to form irregular, polyhedral or spherical grains [22]. Tapioca contains about 87% carbohydrates, 1.1% protein, 0.1% fat and 0.1% fiber [25]. This study aims to analyze the chemical and sensory characteristics of biscuits made from catfish meal, purple sweet potato flour.

## 2. Materials and methods

The type of research used is laboratory experimental research using a non-factorial Complete Randomized Design (RAL) with 3 treatments (Formula 1, 2 and 3). The manufacture of biscuits is carried out at the Food Technology Laboratory of the Department of Nutrition, Poltekkes, Ministry of Health, Palembang and for nutritional value analysis at the Saraswanti Indo Genetech Bogor Laboratory. The proximate values (protein, moisture content, crude fiber, fat, ash, and carbohydrates) of biscuit samples were determined using the AOAC method (1995). Analysis of water content by gravimetry, protein content using the Kjeltex method, fat content using the Weibull method, folic acid using the UPCL method, carbohydrates with by difference, and total energy with calculations. The organoleptic test was tested on 50 untrained panelists in a sensory laboratory. The scale that the hedonic test uses is 5 = very like, 4 = like, 3 = neutral, 2 = dislike, 1 = strongly dislike. The main ingredients used to make biscuits are catfish meal, purple sweet potato flour, moringa flour, tapioca. Catfish meal is made using catfish fillets dried at 70°C for 6 hours. Purple sweet potato flour is made using purple sweet potatoes originating from the Pagaralam area of South Sumatra then dried at 70 °C for 6 hours. Other ingredients are purchased at supermarkets in Palembang City. Tools used include cabinet dryers, Modena brand ovens, Philips brand mixers, spatulas, pans, biscuit molds.

## 3. Results and Discussions

### 3.1 Sensory Characteristics

#### 3.1.1 Color

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Average biscuit color score score formula 1 (3.56), formula 2 (3.68), formula 3 (3.64). The results showed that formula 2 was the most preferred formula by the panelists. Formula 2 produces biscuits that are browner compared to other formulas. Formula 2 uses more purple sweet potato flour. When the carbohydrate roasting process in purple sweet potato flour undergoes a caramelization process so that the biscuits become brown.

#### 3.1.2 Aroma

Average score value of biscuit aroma formula 1 (2.96), formula 2 (3.52), formula (3.48). The results showed that formula 2 (F2) on the aroma aspect was most preferred by the panelists. Formula 2 produces the right aroma, no fishy smell, catfish meal, and there is a fragrant aroma of purple sweet potato flour. Protein in catfish when heated will produce a distinctive aroma. With the addition of purple sweet potato flour, the resulting aroma becomes more fragrant.

#### 3.1.3 Texture

Average biscuit texture score value formula 1 (2.88), formula 2 (3.28), formula (3.24). The results showed that formula 2 (F2) on the aspect of texture was most liked by the panelists. The texture of formula 2 biscuits is crispier than formula 1 and 3. This crispier texture is due to the use of catfish meal and purple sweet potato flour with the right composition. Moreover the use of sugar in biscuit products will affect the texture of [26,27,28,29,30].

#### 3.1.4 Taste

Average biscuit flavor score value formula 1 (3.00), formula 2 (3.46), formula 3 (3.24). The flavor that the panelists liked the most was formula 2. Taste has an important role in a food product. The taste that consumers like will make the product will be consumed by consumers well. The taste of biscuits in formula 2 has the right sweetness so it is preferred. This sweetness is due to the use of purple sweet potatoes that have a sweet taste.

### 3.2 Content of Gizi Biskuit Value

Biscuit proximate test results as in Table 2.

#### 3.2.1 Protein Content

The results of the proximate test showed that biscuits made with a mixture of catfish meal, purple sweet potato flour and taipoka had a fairly high protein content of 13.30% per 100 grams of biscuits. Compared to the results of previous studies that stated biscuits with the addition of fish extract as much as 5% had a protein content of 12.50% [11]. Other research results also showed biscuits added fish meal consentrat protein levels became much higher than protein without the addition of fish protein [30,31,32,33,34,35,36]. Proteins are nitrogen-containing substances formed by amino acids. Protein serves as the main structural component of muscles and other tissues in the body. Plays a role in producing hormones, enzymes and hemoglobin [37].

#### 3.2.2 Fat Content

Fat as an important element in the process of making biscuits, the function of fat in making biscuits is as an emulsifier, flavor shaper and texture former. The fat in this

biscuit formula comes from catfish meal and margarine. Based on the proximate test table above, the fat content in catfish meal biscuits and purple sweet potatoes is 23.15%. This high fat content in addition to margarine also comes from catfish meal with a fat content of 8.1% 14. Fat in food

is needed by the body to produce energy and metabolize other nutrients. Catfish contain omega 3 and omega 6 fats which are important for children's brain development [16].

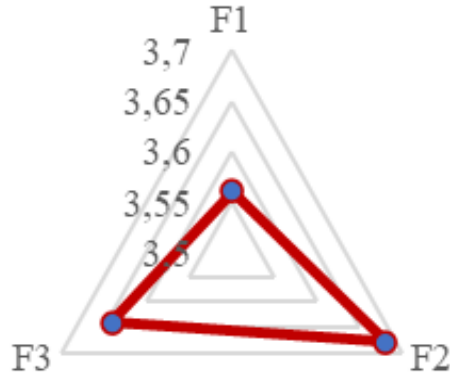


Figure 1: Average Biscuit Color Score

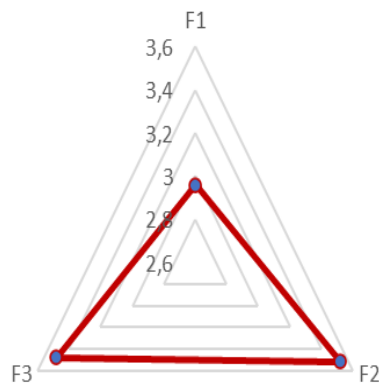


Figure 2: Average Biscuit Aroma Score

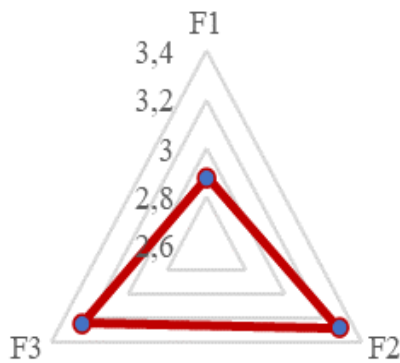
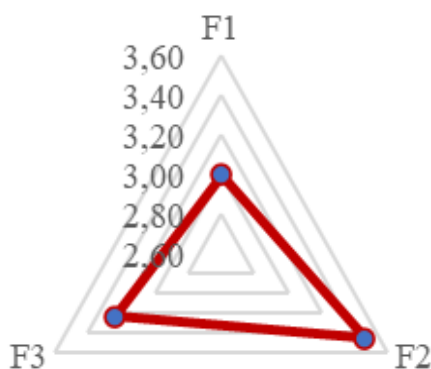


Figure 3: Average Score of Biscuit Texture Score



**Figure 4:** Average Biscuit Flavor Score

**Table 1:** Biskuit Proxymat Content per 100 Gram

Parameter	amount
Protein Content (%)	13.30
Fat level (%)	23.15
Carbohydrate Content (%)	54.08
Ash Content (%)	4.95
Water content (%)	4.52

**Table 2** Biscuit Amino Acid Content per 100 Grams

No	Amino Acid	Unit	Amount
1	L-Serin	mg / kg	6833.79
2	L-Asam Glutamat	mg / kg	18205.66
3	L-Fenilalanin	mg / kg	7413.41
4	L-Isoleusin	mg / kg	7464.2
5	L-Valin	mg / kg	7743.51
6	L-Alanin	mg / kg	7541.68
7	L-Arginin	mg / kg	8791.98
8	Glisin	mg / kg	8043.91
9	L-Lisin	mg / kg	9588.95
10	L-Asam Aspartat	mg / kg	12007.38
11	L-Leusin	mg / kg	11205.59
12	L-Tirosin	mg / kg	3985.13
13	L-Prolin	mg / kg	5636.98
14	L-Treonin	mg / kg	7874.90
15	L-Histidin	mg / kg	4141.77

### 3.2.3 Carbohydrate Content

The main source of carbohydrates in food comes from plants which are the main source of energy found in the form of starch (amylum) and sugar substances (mono and disaccharides)[18]. Based on Table 3 that the carbohydrate content in catfish meal biscuits and purple sweet potatoes is 54.08%. These carbohydrates come from purple sweet potato flour and tapioca.

### 3.2.4 Folic Acid

High folic acid content in biscuits can contribute to toddler needs of 113.38 mcg of folic acid nutritional

adequacy in toddlers (6-59 months) 65-200 mcg per day which can improve memory, improve brain nerve development and improve motor nerves.

### 3.2.5 Asam Amino

The amino acid content in the biscuits produced can be seen in Table 3. The amino acid content in biscuits is as many as 15 types of amino acids. This amino acid is very important for toddlers, especially those who are malnourished. Amino acids are organic compounds that contain amino groups and acids[38]. Amino acids are the building blocks of proteins and the end result of protein digestion. The body needs about 22 kinds of amino which among them cannot be made by the body and must be obtained from dietary supplements, namely: lysine, methionine, leucine, threonine, valine, tryptophan, isoleucine, and phenylalanine [39,37,40,41]. Animal food sources contain more essential amino acids than plant foods[40]. The combination of animal and vegetable food sources will complement each other sources of essential amino acids [38]. The amino acid Lysine serves for bone formation, hormone production and lowers serum triglyceride levels. Arginine and histidine are important for growing children up to age 5 years. FAO / UN / WHO (2013) states that arginine, lysine, histidine, glycine, isoleucine, leucine, glutamic acid and tyrosine can be used as a basis for the fulfillment of human nutritional adequacy [42]. Arginine is a non-essential amino acid that helps maintain the body's nitrogen balance, is involved in detoxification processes, maintains glucose balance, accelerates wound healing and bone repair[43]. Carnitine plays an important role in fat metabolism and energy production, in addition to maintaining heart health, weight management, sports nutrition and fertility[38]. Cysteine is a non-essential amino acid that contains sulfur antioxidant and detoxifying properties that can ward off free radicals and toxins. It also functions in DNA repair, nails, coolies, and hair[43]. Glutamine is the most abundant amino acid in the body, sometimes considered unimportant which if the body is in normal circumstances the body can synthesize glutamic acid in sufficient quantities. If the body is under stress such as illness, diet, injury or other trauma the body cannot make glutamine[39]. Lysine as an essential amino acid serves to help form collagen and repair tissues in the body. Plays a role also in producing energy, building muscle protein and tissue repair. Lysine is also needed for antibody formation, bone formation and hormone and enzyme production[39].

Phenylalanine is a precursor of the neurotransmitter norepinephrine and the hormone CCK (Cholecystokinin) which will send a message to the brain that it feels full after eating. Norepinephrine reduces hunger and helps create positive feelings and mental health. It is needed also by the thyroid gland and blood vessels [38]. Tryptophan is needed by the brain to produce serotonin, a neurotransmitter that can reduce pain, antidepressants and reduce anxiety and tension [38]. Tyrosine is important in red and white blood cell regeneration, cell and tissue development and adrenal activity, hypophysis and thyroid gland [39]. Branched chains (leucine, isoleucine, valine) are amino acids metabolized in muscles acting as nitrogen carriers to help muscles synthesize other amino acids. It also functions in circulating glucose to be used as energy and also pushes all other amino acids into the liver to build more tissue [39,44]. Deficiency of essential amino acids will lead to decreased protein synthesis in cells and tissues, especially skeletal muscle. Protein in the body is needed to: 1) digest and absorb nutrients through the small intestine, 2) transport nutrients (especially long-chain fatty acids, vitamin A and iron) and other molecules such as cholesterol and triglycerides, 3) oxidize nutrients (including fatty acids and glucose) into water and carbon dioxide. Nutritional problems that occur include deficiencies of essential amino acids and micronutrients including vitamin A, iron, zinc and folic acid[38, 41].

## 4. Conclusions

The addition of catfish meal, purple sweet potato flour and tapioca affects the sensory and chemical properties of biscuits.

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