







Organoleptic Analysis and Nutritional Content of Biscuits Based on Purple Sweet Potato and Seaweed Flours

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ABSTRACT

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Development of the right formula for making biscuits based on purple sweet potato flour and seaweed flour can be used as supplementary feeding for Toddlers to meet nutritional needs and prevent malnutrition in toddlers. The research objective was to analyze biscuits' nutritional and organoleptic content based on purple sweet potato flour and seaweed flour. The research method was experiment and laboratory test. The main ingredients of the study were purple sweet potato flour and seaweed. The research variable was sensory quality (organoleptic test): taste, texture, aroma, and color; for sensory testing, all treatments would be presented to panelists, and panelists determined the most preferred one. The sample from the sensory test with the highest score (the most preferred by the panelists) was then analyzed for its chemical quality. Chemical quality included water, protein, fat, ash, carbohydrate, and total calories of biscuits. The results showed that the best formula for biscuits made from purple sweet potato flour and seaweed flour was formula E (100% purple sweet potato flour and 0% seaweed flour), with the panelists' preference for the taste of 4.2, the texture of 3.5, aroma of 4.3, and color of 4.2, out of 5. The average nutritional content obtained in biscuits already met the requirements of the Indonesia National Standard, including water content, ash content, protein content, fat content, and carbohydrate content. The highest carbohydrate, protein, and water content were detected in formula E, 70.35%, 9.70%, and 4.14%, respectively; the highest fat content was in formula B, about 16.38%.

1. INTRODUCTION

Supplementary food is nutritious food in addition to the main meal for toddlers to meet nutritional needs [1]. Supplementary food for toddlers can be in the form of food made with local food ingredients that are available and easily obtained by the community at an affordable price or food processed by manufacturers. Supplementary feeding has the aim of increasing energy and essential nutrients, as well as the purpose of providing supplementary food for recovery in infants and toddlers with malnutrition, among others, of providing food that is high in energy, high in protein, and sufficient in vitamins and minerals in stages, in order to achieve nutritional status. optimal nutrition.

Biscuits are food products that are well received by the public, including pregnant women and toddlers, because they taste good, have a long shelf life, and are easy to consume anywhere and anytime. In addition, biscuits can be a medium for improving nutrition when added with certain ingredients [2]. Local food can be used as an alternative to wheat flour, such as purple sweet potato (*Ipomoea batatas L. Poir*) and seaweed (*Eucheuma spinosum*).

Purple sweet potatoes contain higher anthocyanin pigments than other types of sweet potatoes. The high anthocyanin content causes the sweet potato to be purple; besides, it contains high nutrients and is very good to be used as a substitute for wheat flour [3]. Purple sweet potato flour rich in

resistant starch can be used as an alternative source of carbohydrates as a substitute for muffin products because of the anthocyanin content, which has added value for health [4]. The use of purple sweet potato flour and soy protein isolate to be processed into biscuits has the potential to be an appropriate Supplementary Feeding for pregnant women with Chronic Energy Deficiency than commercial biscuits [2].

Central Sulawesi Province, one of the provinces as the largest seaweed producer in Indonesia, can only utilize seven percent of the available cultivation land potential. It states that it is necessary to develop further and utilize it to maximize seaweed production [5]. Food products produced from raw materials and auxiliary materials for seaweed circulating in the market include skim milk, chocolate milk, powdered milk, ice cream, soft cheese, syrup, fish gel, yogurt, jelly, jam, pudding, and seaweed lunkhead. Processed products from research that have not been produced commercially include rice softeners, functional drinks, bread, and candy [6]. Seaweed is a nutritious food, and the fiber content (dietary fiber) in seaweed is very high.

It is hoped that the use of sweet potato flour can minimize the use of wheat flour to help reduce dependence on imported wheat. Purple sweet potato flour has a high anthocyanin content, so when the flour is substituted into food, be it bread or biscuits, it can add nutritional value to the food. Then, the utilization of seaweed can be maximized by diversifying processed seaweed products which is one of the efforts to

increase the usability and economic value of seaweed that can help in fulfilling nutrition in the human body. Seaweed has a high nutritional content, especially vitamins, minerals, and fiber. Processed products of seaweed flour can be used as a variety of snacks, including ice cream, dumplings, fish rolls, and flour.

Therefore, it is necessary to determine the proper biscuit formulation by paying attention to aspects of acceptance and nutritional needs of toddlers. The development of biscuit products using purple sweet potato flour and seaweed flour is a breakthrough in producing supplementary food for toddlers that support the growth and development of toddlers.

The research objective was to analyze biscuits' nutritional and organoleptic content based on purple sweet potato flour and seaweed.

2. METHOD

The research method was an experiment and laboratory test conducted from March 2022 to September 2022, located in Palu City, Central Sulawesi. The tools used in this research were scales, oven, baking sheet, biscuit mold, stove, and mixer. Other tools, such as a dough bowl, spatula, tablespoons, small bowls, and biscuit molds, were used. The dough bowl must be clean and free from water because the residual water attached will affect the dough's texture, and the resulting biscuit will not optimal. The main ingredients used in this study were purple sweet potato and seaweed.

The stages of research implementation were: 1) Preparing purple sweet potato flour; 2) Preparing seaweed flour; 3) Making biscuits based on purple sweet potato flour and seaweed flour with various formulas; 4) Sensory quality test (organoleptic test) of biscuits based on purple sweet potato flour and seaweed flour with various formulas; 5) Chemical quality test of biscuits based on purple sweet potato flour and seaweed flour. The purple sweet potato flour used in this research is pre-made flour and not flour that we produce ourselves. This research is a continuation of research previously carried out by our students who researched the manufacture of flour from purple sweet potato which we then modified by adding seaweed flour. We obtain seaweed flour from PT Bantimurung Indah Maros. As for the basic considerations in determining the proportion of each flour in the 5 biscuit formulas, namely the chemical composition, especially the protein content of purple sweet potato flour and seaweed flour, is very different so mathematical calculations are carried out using the algebraic equation method. Biscuit formulation in this study was based on different concentrations of seaweed flour using 4 treatment levels, namely 25%, 50%, 75%, and 100% as well as 1 control (100% purple sweet potato flour). The use of seaweed flour will replace the use of purple sweet potato flour in making biscuits

Sensory quality data collection (organoleptic test) included taste, texture, aroma, and color, carried out by sensory testing. All treatments were presented to panelists to be determined which biscuits were the most preferred. The sensory test was carried out by 30 panelists, where each panelist would evaluate the taste, texture, aroma, and color of the 5 formulas that had been prepared according to the number of panelists. To prevent bias, this sensory test was carried out in a sensory testing laboratory which is located in a quiet location and free from pollution that could disturb the panelists. The sample from the sensory test that got the highest score (the most preferred by the panelists) was then analysed for its chemical quality. Chemical quality included water, protein, fat, ash, carbohydrate, and total calories of biscuits.

Measurement of Water content Content was by the thermogravimetric method, ash content by the Dry Ashing method, analysis of protein content by the Biuret method, and analysis of Carbohydrate levels the by difference method = 100% - % (Moisture Content + Ash Content + Fat Content + Protein Content).

3. RESULTS

The formulations and figures of biscuits based on purple sweet potato flour and seaweed flour in this study are presented in Table 1.

Table 1. Biscuit formula based on purple sweet potato flour and seaweed flour

Sample code	Seaweed flour (%)	Purple sweet potato (%)
A	100	0
B	75	25
C	50	50
D	25	75
E	0	100

Table 1 and Figure 1 show the results of biscuit development using various concentrations of purple sweet potato flour and seaweed flour. Formula A used 100% seaweed, formula B used 75% seaweed flour and 25% purple sweet potato flour, formula C used 50% seaweed flour and 50% purple sweet potato flour, formula D used 25% seaweed flour and 75% purple sweet potato flour, and formula E using 100% purple sweet potato flour.

The organoleptic test results of biscuits based on purple sweet potato flour and seaweed can be seen in Figure 2.

Figure 2 shows that the formula with the most preferred taste was formula E, the most preferred texture was formula D, the most preferred aroma was formula E, and the most preferred biscuit colors were formulas D and E. Overall, the most preferred formulas were based on taste, texture, aroma, and color were formula E.

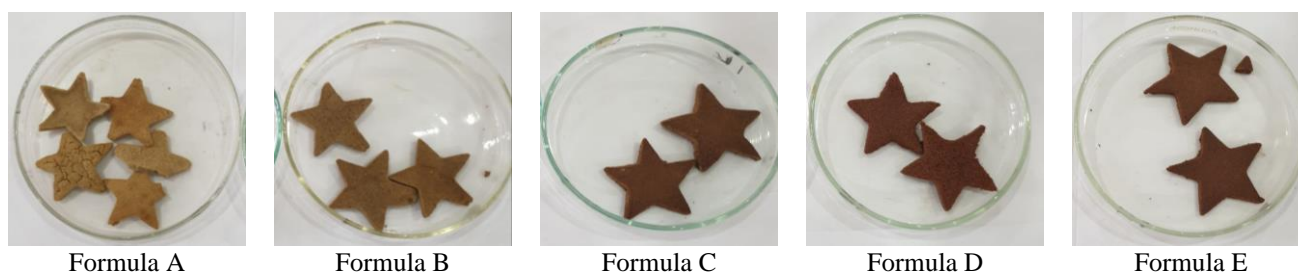


Figure 1. Biscuit based on purple sweet potato flour and seaweed flour

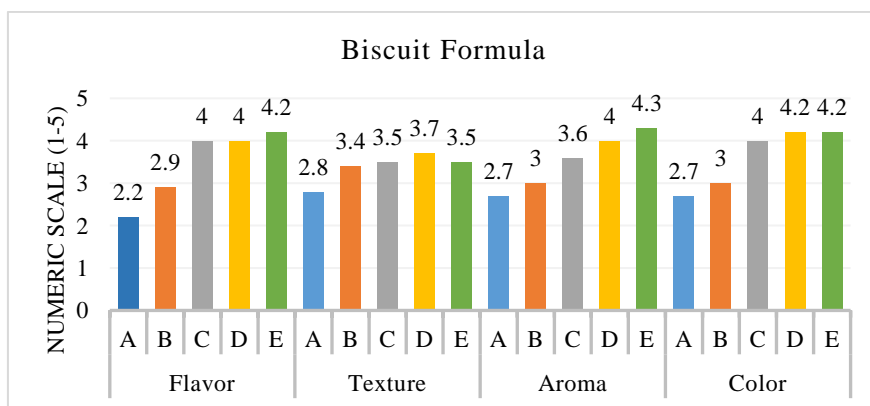


Figure 2. Organoleptic results of biscuits based on purple sweet potato flour and seaweed flour

Table 3. Nutritional content of biscuits based on purple sweet potato flour and seaweed flour

Sample	Water content (%)	Ash content (%)	Fat content (%)	Protein content (%)	Carbohydrate content (%)	Energi (100gr/Kcal)
A	2.81	19.21	15.33	3.78	58.86	388.53
B	3.08	15.20	16.38	4.45	60.89	408.78
C	3.47	11.22	15.73	5.09	64.49	419.89
D	3.85	7.35	15.28	6.71	66.82	431.64
E	4.14	2.41	13.40	9.70	70.35	440.8

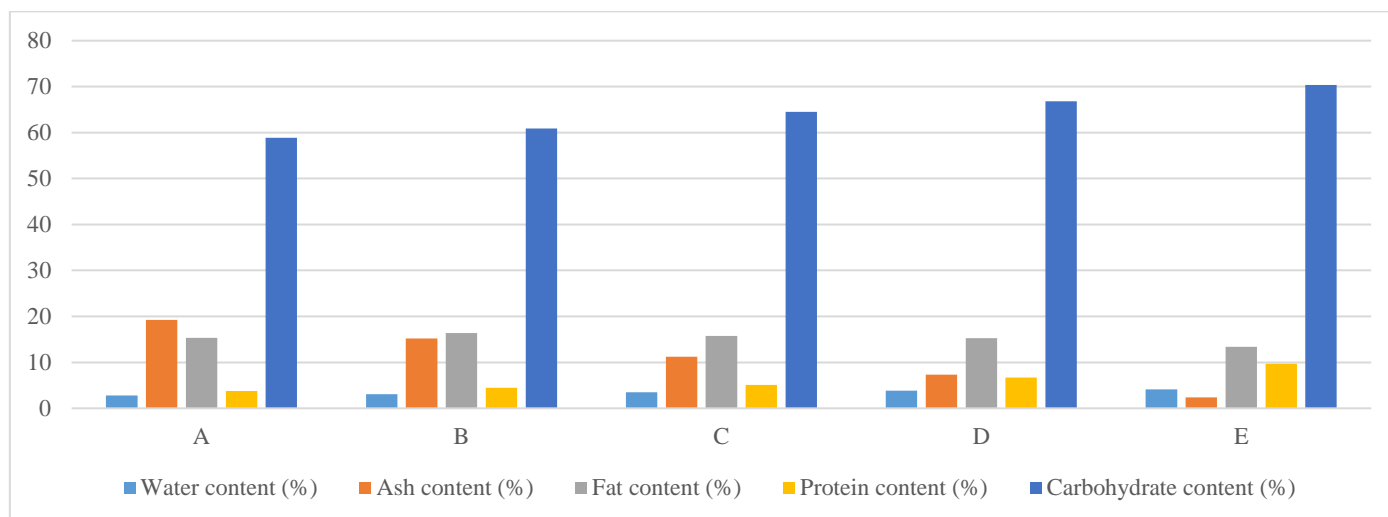


Figure 3. The nutritional content of biscuits based on purple sweet potato flour and seaweed

Test results of the nutritional content of biscuits based on purple sweet potato flour and seaweed flour are shown in Table 3 and Figure 3.

Table 2 and Figure 2 show that the formula with the highest carbohydrate content was formula E, about 70.35%. The highest protein content was formula E, at 9.70%, and the highest fat content was formula B, at 16.38%. The highest water content was found in formula E, about 4.14.

4. DISCUSSION

The results showed that the most preferred formulas based on purple sweet potato flour and seaweed flour were formulas E and D. Formula E was a formula with the main ingredient using 100% purple sweet potato flour and not containing seaweed flour. Formula D was a formula with the main ingredients using purple sweet potato flour 75% with 25% seaweed flour. The addition of seaweed flour causes

acceptance to be low. This result is in line with other studies which show that the addition of seaweed flour significantly affects the color of analog rice [7].

Taste is one of the most important attributes of the resulting biscuit. The panelists generally gave the resulting biscuits a taste value ranging from 2.2 to 4.2 (slightly dislike to slightly like). Panelists liked the taste of biscuits without seaweed flour, with a value of 4.2. The addition of seaweed flour resulted in the lowest average value of 2.2 (slightly disliked). This is because the addition of seaweed flour produced less tasty biscuits with a bland taste, so the panelists stated that they did not like it.

Overall, the panelists liked the biscuits without adding seaweed flour, with a value of 4.3 (liked), followed by biscuits with 25% seaweed flour, with a value of 4.2. Seaweed flour (*E. cottonii*) contains carrageenan, which has gel-forming properties and will affect the texture profile of food products added with seaweed flour [7]. The addition of seaweed flour with a higher concentration is thought to cause the sensory

quality of biscuits made from purple sweet potato flour to be significantly different, the color parameters would be more brownish, faded, and the texture would be harder, which causes the panelists to dislike the biscuits. Biscuits with 25% seaweed flour produced the highest overall color, aroma, and preference values compared to the addition of 50%, 75%, and 100%.

The texture is one of the most important quality indicators in biscuits. The texture of the biscuit includes crispness and hardness (hardness). Hardness is a critical factor because hardness is one of the parameters of consumer acceptance of biscuit products. This hardness is closely related to biscuit products' protein and fat content. The formula with the most acceptable texture by the panelists was formula D. The texture of the biscuit was also influenced by the flour's starch and protein (gluten) content. The main component in flour that affects the texture is protein. The protein in flour will form gluten when added to water, which makes the dough elastic and able to hold gas. A study showed that the texture of the purple yam biscuit product with the addition of the proportion of tempeh and seaweed flour showed that from the five treatments it ranged from 2.35% -3.69% (dislike or dislike) [8]. The texture of a product can be affected by its water content. The low water content in foodstuffs will make the product easier to break. The resulting biscuits have a compact and crunchy texture that the panelists like.

Aroma plays an important role in assessing the preference for food products because before tasting food, people will inhale the aroma first. The results showed that the panelists' preference level for the aroma aspect that the panelists liked the most was formula E (biscuit without seaweed flour). The results of other studies also showed that the most preferred aroma was the *gendar* cracker formula with 0% seaweed flour substitution [9]. This is because seaweed flour has a distinctive or fishy aroma, so the more imported seaweed flour is in the manufacture of food products, the level of acceptance of panelists decreases. Seaweed substitution on fiber content and organoleptic quality of seaweed cakes, it was proven that cakes treated with the addition of seaweed flour caused or brought new aromas other than normal aromas in control cakes, the presence of a fishy aroma and innate aroma from added seaweed [10]. In addition, another study showed that biscuits with the lowest 40% seaweed substitution compared to other formulas had high acceptability compared to other formulas [11]. Another study showed that biscuits with the lowest 40% seaweed substitution compared to other formulas had high acceptability compared to other formulas [12]. This is because the seaweed flour used still has a slightly fishy smell typical of the sea. There are several attempts to reduce the fishy smell typical of the sea, namely by soaking lime and adding flour to seaweed sticks (*Eucheuma cottonii*) which significantly affects the organoleptic quality of color, aroma, texture, and taste [13].

The nutritional content of biscuits based on purple sweet potato flour and seaweed flour

The results showed that the formula with the highest carbohydrate content was formula E at 70.35%. The highest protein content was formula E at 9.70%, and the highest fat content was formula B at 16.38%. The highest water content was found in formula E, about 4.14%.

Moisture content is one thing that is quite important in determining the organoleptic quality and shelf life of biscuits. The determination of water content in biscuit products is to

determine how much influence it has on organoleptic. High enough water content in food can provide opportunities for microorganisms to grow. The moisture content analysis in the resulting biscuits showed that the water content of the five treatments ranged from 2.81 to 4.14 %. The results showed that the highest water content was found in Formula E, about 4.14%, and the lowest was in formula A, about 2.81%. The analysis results of the moisture content in biscuit products have met the Indonesia National Standard, where the moisture content in biscuits is a maximum of 5% [14].

Ash content is a mixture of inorganic or mineral components contained in a food ingredient, and it can show the total minerals in a food ingredient. Food products' high or low ash content is caused by the raw materials used. The analysis of the resulting biscuits' ash content showed that the five treatments ranged from 2.41 to 19.21 %. The ash content results showed that the highest ash content was found in Formula A, about 19.21%, and the lowest was in Formula E, about 2.41%. The ash content results of the biscuits produced have met the requirements of The Indonesia National Standard (known as SNI), where the ash content of the biscuits is at least 1.6% [14]. The formula with a higher percentage of seaweed flour lowers the moisture content of the resulting biscuit. This happens because seaweed flour contains carrageenan which has a high-water absorption ability so that the more concentration of seaweed added, the lower the water content in the biscuit.

The fat content analysis in the resulting biscuits showed that the fat content of the five treatments ranged from 13.40 – 16.38%. Fat content results show that the highest fat content results are found in Formula B, about 16.38%, and the lowest was in formula E, about 13.40%. The results of the fat content of the biscuits produced met the requirements of SNI, where the fat content of the biscuits was at least 9.5% (SNI). Formula E is a formula with a protein content of biscuits that has met SNI requirements, where the protein content of biscuits was at least 9% [14]. Based on the study's results, it was seen that the ash content of the biscuits increased along with the increase of seaweed flour in the biscuits. The increased ash content produced is due to the high ash in the *Eucheuma cottonii* seaweed because the seaweed is rich in minerals.

Protein is a source of amino acids that contain elements C, H, O, and N, which are not owned by fat or carbohydrates. Protein is one of the most important food substances for the body because this substance a function as fuel in the body. In addition, proteins also function as building blocks and regulators. In most body tissues, protein is the largest component after water, and it is estimated that half or 50% of the dry weight of cells in tissues such as liver and meat consist of protein. The results of the analysis of protein content showed that the protein content of the five treatments ranged from 3.78 to 9.70%. The protein content results showed that the highest protein content was found in Formula E, 9.70%, and the lowest was in formula A, which was 3.78%.

Carbohydrates are the main source of energy needed by the body. Carbohydrates are nutrients found in foods composed of elements C, H, and O. The function of carbohydrates is also to launch the digestive system because foods that are high in carbohydrates have fiber. The results of the analysis of carbohydrate content showed that the carbohydrate content of the five treatments ranged from 58.86 to 70.35%. The results showed that the highest carbohydrate content was found in Formula E, 70.35%, and the lowest was in formula A, 58.86%. The biscuit formula that meets the SNI requirements was

Formula E, where the carbohydrate content of the biscuit was at least 70%. Carbohydrate content in biscuit products increased along with the percentage of purple sweet potato flour added. This is because seaweed flour has a fairly low carbohydrate content compared to purple sweet potato flour. Seaweed flour does not contain gluten but has a high fiber content compared to wheat flour, and the nature of the fiber reduces the gluten's ability so that the development volume is not optimal [12].

Healthy snacks can provide the right energy for activities and help meet energy needs until it is time for the main meal [15]. The criteria for healthy snacks are vitamins, protein, and dietary fiber. Snacks and fruit can be consumed between breakfast, lunch, and dinner with 10% of the total calories, which is 2,150 kcal assuming a normal body mass index. The benefits can be obtained from purple sweet potato biscuits, especially the content of nutrients that can be used as alternative foods for infants, children, and adolescents during their growth period [16].

5. CONCLUSIONS

The best formula for the biscuit from purple sweet potato flour and seaweed flour is formula E (100% purple sweet potato flour and 0% seaweed flour), with the panelists' preference for the taste of 4.2, the texture of 3.5, aroma of 4.3, and color of 4.2, out of 5. The average nutritional content obtained in biscuits meets the requirements of the Indonesia National Standard, including water content, ash content, protein content, fat content, and carbohydrate content. The highest carbohydrate, protein, and water content are detected in formula E, 70.35%, 9.70%, and 4.14%, respectively; the highest fat content is in formula B, about 16.38%.

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