QUALITY ANALYSIS OF CATFISH FLOUR (*Pangasius sp.*) AND RED BEAN FLOUR (*Phaseolus vulgaris*) BISCUITS AS INSTANT MP-ASI HIGH PROTEIN FOR CHILDREN (1-2 YEARS OLD)

Widi Hastuti [1)], Dandi Sanjaya[2)], Mona Fitria[3)], Mamat Rahmat[4)]
[1,2,3,4)] Program Studi Sarjana Terapan Gizi Jurusan Gizi Poltekkes Kemenkes Bandung,
Email: widihas77@gmail.com, dandisanjaya48@gmail.com, monafitria1985@gmail.com, mamat@staff.poltekkesbandung.ac

Abstrak, Background: Riskesdas 2018 shows 4.5% of 1-2year old children experience poor nutritional status. The reason is the low quality of MP-ASI and inappropriate parenting. Local foods such as catfish and red beans can be made MP-ASI. Catfish is a freshwater fish with high protein (12-17.5%) and low fat (0.9-1.2%) with a production of 437,111 tons. Red beans are a source of vegetable protein (22%) with a production of 67,876 tons.
Methods: The catfish and red beans were made into flour, then formulated as MP-ASI biscuits. This study aims to determine the organoleptic properties (color, aroma, taste, texture, and overall) and nutritional content (energy, protein, fat, carbohydrates, and iron) of MP-ASI biscuits. The design of this research is an experimental study. Product quality analysis includes organoleptic properties, macronutrients, and iron. Organoleptic test using the hedonic test on 3 biscuit formulations with a ratio of catfish flour and red bean flour, namely F1 (35%: 65%), F2 (40%: 60%), and F3 (45%: 65%).
Result: The results of the organoleptic test by 30 panelists showed that the best formula was F1 with an average score of color (5.7), aroma (5.3), taste (5.1), texture (5.4), and overall (5.5). Each serving of MP-ASI biscuits (50 g) contains 173.2 kcal of energy, 30.4 g of carbohydrates, 4.7 g of protein, 3.5 g of fat, and 0.07 mg of iron (Fe). The selling price per serving weighing 50 g (5 pieces) is Rp. 4.237.
Conclusions: This MP-ASI biscuit can be used as a snack for children (1-2 years), but it has a slightly fishy and slightly unpleasant aroma and a slightly hard texture, so it is hoped that it can be improved in future research.

Keywords: MP-ASI Biscuits, Patin Fish Flour, Red Bean Flour, children aged (1-2 years), and organoleptic tests

Background

Indonesia's nutrition concerns are becoming more complex each day. In 2018, the Riskesdas study found that 4.5% of children aged 1-2 years had poor nutritional status.[1] The unfinished treatment of undernutrition and malnutrition has resulted in the rise of a new nutritional problem: overnutrition.[2] Cases of undernutrition, malnutrition, and overnutrition in children in various regions attest to this. One of the direct factors that influence nutritional status is food intake.

Children's growth and development continue to accelerate after six months, thus diets rich in macronutrients such as carbs, proteins, and fats, as well as micronutrients such as vitamins and minerals, are required. Because the nutrients in breast milk are no longer sufficient, more sophisticated food intake is required to meet nutritional needs. MP-ASI should be administered to a child as soon as he turns 6 months old to meet his nutritional demands and to aid in the transition from exclusive breastfeeding to family meals. MP-

ASI is a supplement to breastfeeding that is given to children once they reach the age of six months because breast milk is no longer able to supply their nutritional needs.[3]

The food used in the production of MP-ASI should be nutritious and healthy, and it should be cheap and widely available in the local region.[4] Homemade MP-ASI for children aged 1-2 years old can be manufactured with easily obtainable resources, such as local food. Local food is food that is consumed by local people based on their potential and local wisdom.[5]

In Indonesia, there are many different varieties of indigenous food, ranging from vegetables to various sorts of fish. Indonesia is a vast country with a lot of water and might be a good market for fisheries products. Catfish (*Pangasius sp.*) is a freshwater fish that is widely consumed in Indonesia. Catfish production in Indonesia reached 437,111 tons in 2016, according to data from the Ministry of Marine Affairs and Fisheries of Indonesia. It is in accordance with the fact that catfish consumption is increasing year after year. This growth began in 2014 and continued for a total of 21.9% from 2014 to 2017.[6] Shredded catfish, fish crackers, fish balls, and fish sausages are among the processed catfish goods available so far.[7]

Indonesia is a country with abundant potential for beans, in addition to its fisheries potential. Indonesians have been cultivating beans for hundreds of years.[8] Red beans are one of the high potential beans in Indonesia (*Phaseolus vulgaris*). Because 100 grams of dry red beans contain roughly 22 grams of protein, they are a type of food source of vegetable protein. According to BPS-Statistics Indonesia, red bean production in 2017 was 67,876 tons with a 13,064-hectare producing area.[9]

Biscuits are one type of supplemental food provided to children aged 1-2 years. Supplemental food biscuits for breast milk (MP-ASI) are roasted supplementary foods for children aged 6 to 24 months that can be eaten directly or smashed with the addition of water, milk, or other fluids appropriate for the age and digestive organs of children. There are numerous types of MP-ASI biscuits on the market, most of which are derived from wheat flour; thus, it is vital to develop MP-ASI goods that use local food ingredients as the primary ingredients. Its goal is to lessen reliance on flour. MP-ASI Biscuits No. 01-7111.2-2005 has been regulated in SNI, which needs an energy level of 4 kcal/g, 6% protein, 6-18% fat, and 7.5% carbohydrates.[10]

As a result, the researchers took the initiative to turn these items into biscuits as supplementary foods by including local food elements such as catfish and red beans. According to a study on MP-ASI made from catfish by Kawiji et al. (2019), the level of protein fulfillment according to the Indonesian National Standard (SNI) was obtained by a formula with the addition of 10% catfish to 100 g of ingredients,[11] however the fat content of MP-ASI was low. The product has not met the SNI standard. According to Tiencheu et al. (2016), the proportion of red bean-based MP-ASI with the best sensory responses from the panelists was 20% of the total 100 g of ingredients.[12] As a result, adjustments to the fat level of MP-ASI biscuits were made in this study, bringing it in accordance with SNI, which is 6%. MP-ASI biscuits are made using oven technology. The nutritional value of the recipe is based on the Indonesian National Standard for MP-ASI Biscuits and the 2019 Nutritional Adequacy Rate, which is 1350 kcal, 20 g protein, 45 g fat, calcium 650 mg, phosphorus 460 mg, iron 7 mg, and zinc 3 mg for children aged 1-2 years.[13] The focus of this research was to see how the addition of catfish flour and red bean flour to MP-ASI biscuits affected their organoleptic quality, nutritional value (carbohydrates, protein, and fat), and iron content.

Method

The experimental methodology employed in this research was a Completely Randomized Design (CRD) with independent variables of catfish flour and red bean flour formulations of 35%:65%, 40%:60%, and 45%:55%. The level of preference, nutritional value, and iron content of MP-ASI biscuits were all included as dependent variables in this study.

The tools used in making biscuits are basin, winnowing, blender, filter, oven, spoon, fork, digital food scale, baking sheet, bowl, spatula, pan, plate, cutting board, and mixer. The tools used in the organoleptic test are organoleptic test forms, pens, paper pins, and souvenirs. The materials used in this study were catfish flour, red bean flour, wheat flour, milk powder, egg yolks, powdered sugar, margarine, and baking powder.

The catfish utilized is a Siamese catfish (Pangasius sp.) since it has thick meat and high nutritious content. The portion used is fish meat

that has been removed, and it is said to offer the best outcomes in the biscuit-making process.
The production of catfish flour is based on Apriliana (2010), which has been modified. The first step in making catfish flour is to cook the fish until it is soft enough to remove the thorns and fat. After that, shred the fish meat into a subtle shape and bake it for about 3 hours at 100°C, flipping it upside down for a while to prevent it from burning. To make it easier to puree in a blender, make sure the fish meat is dry. Meat that has converted into flour is sifted over a 100-mesh screen and stored in a dry, well-sealed container[14].

The red bean used is arrowroot beans (Phaseolus vulgaris) because of its large size and high nutritional content. The portion taken is the epidermis-peeled seeds, which are considered to yield the best results in the biscuit-making process. Red bean flour is made according to a modified version of Irmawati's (2013) method. To make red bean flour, soak the red beans for 48 hours to remove tannins, which are antinutrients. The water used for soaking is changed every 6 hours, and the beans are cleaned to avoid sourness. The red beans are then scraped from their skins and sun-dried. The dried beans are pounded in a flour mill and sorted through a 100-mesh sieve to produce fine flour.[15] MP-ASI biscuits are produced from the primary ingredients of catfish flour and red bean flour.

Damayanti's (2020) approach is used to make biscuits, which includes all ingredients being weighed using a digital scale in accordance with the formulation design created. To begin mixing the ingredients, combine all flour, milk powder, baking powder, and vanilla in a single container and mix thoroughly. In a separate bowl, mix the egg yolks and sugar until it turns a slightly pale color. Stir the flour mixture into the egg yolk and sugar mixture until it is evenly distributed. After that, add the margarine and mix until well blended.

The next step is to shape the dough into the pan that has been prepared. The pan used is a small rectangular sagon cake pan with dimensions of around 5 cm x 2 cm x 0.5 cm for length, breadth, and height. After molding the dough, place it in a preheated oven set at 110°C. Bake the biscuits for about 45 minutes and check periodically to make sure the biscuits are not burnt.

The organoleptic test carried out on biscuits substituted with catfish flour and red bean flour was a hedonic test that included color, aroma, taste, texture, and overall. The hedonic scale utilized is 1-7, with (1) Strongly Dislike, (2) Dislike, (3) Slightly Dislike, (4) Neutral, (5) Somewhat Like, (6) Like, and (7) Strongly Like. This test was conducted by a moderately trained panel of 30 persons who were hosted in the researcher's house during the Covid-19 outbreak, while still prioritizing 3M health regulations.

Carbohydrate, protein, fat, and iron levels were analyzed using the Luff-Schoorl, Kjeldahl, Soxhlet, and spectrophotometry methods at the Food Technology Laboratory, Faculty of Engineering, University of Pasundan Bandung. The data from the organoleptic test were analyzed using a statistical test in the form of the Kruskal Wallis test.

This research has received ethical approval from the Health Research Ethics Commission of the Health Polytechnic of the Ministry of Health Bandung under No. 10/KEPK/EC/1/2021 on January 24, 2021.

Result

The effect of catfish flour and red bean flour substitution on the organoleptic properties of biscuits can be seen in Figure 1. Figure 1 shows the results of the organoleptic test of biscuits using catfish flour and red bean flour substitutions, which achieved the best average results, namely the formula F1 (35% Catfish Flour: 65% Red Bean Flour). A significant value of (0.00) < (0.05) was obtained based on the results of the normality test for color, aroma, taste, texture, and overall data, indicating that the data is not normally distributed, and therefore the One Way Anova test cannot be used to evaluate it. As a result, the data was tested with a 95% confidence level using the non-parametric Kruskal Wallis test.

The results of the Kruskal Wallis test showed that the significance values for each organoleptic trait were color (p=0.136), aroma (p=0.739), taste (p=0.695), texture (p=0.278), and overall (p=0.178). All aspects of organoleptic qualities have a p>α value, indicating that the three recipes' organoleptic test results are not significantly different.

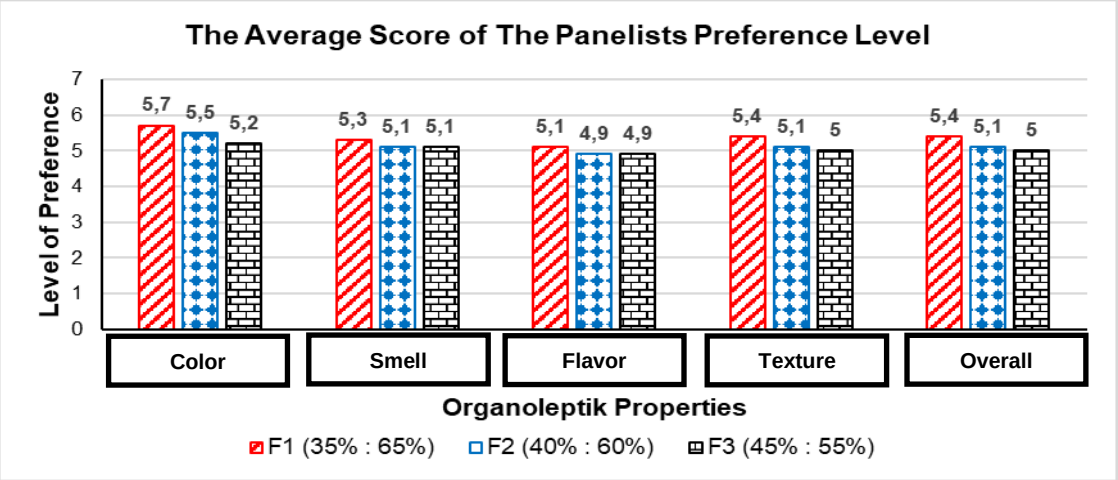

Figure 1. The Average Score of The Panelist preference Level

Nutritional Value of MP-ASI Biscuits

The results of the proximate analysis on the nutritional value of MP-ASI biscuits that received the best organoleptic assessment including carbohydrates, protein, fat, and iron can be seen in table 1. MP-ASI biscuits with catfish flour and red beans flour provide 8-10 servings per batch. MP-ASI biscuits with catfish flour and red bean flour weigh 50 g per serving. The contribution per serving of MP-ASI biscuits including catfish flour and red bean flour was calculated using SNI quality standards and the nutritional value of the biscuits' quality requirements. The contribution of MP-ASI biscuits catfish flour and red bean flour to the quality criteria of SNI per serving of 50 g contains energy not less than 4 kcal/g (200 kcal/50 g), carbs not more than 30% (15 g/50 g), protein not less than 6% (3 g/50 g), and fat between 6-18% (3-9 g/50 g). As a result, the MP-ASI biscuits containing catfish flour and red bean flour do not meet the quality standards for MP-ASI biscuits specified in SNI 01-7111.2-2005.

Table 1. Analysis of Iron (Fe) MP-ASI Biscuits Catfish Flour and Red Bean Flour Per 50 Grams

Treatment (Catfish Flour: Red Beans Flour) (%)	Nutritional Value*				Energy (kcal)
	Carbohydrate (g)	Protein (g)	Fat (g)	Iron (mg)	
F1 (35%:65%)	30,4	4,75	3,55	0,07	173,25

**Laboratory Test Results*

Discussion

Organoleptic Test

Based on the results of organoleptic tests conducted on three biscuit formulations with the substitution of catfish flour and red bean flour, the panelists favored the formula F1 in terms of color, aroma, taste, texture, and overall (35% Catfish Flour:65% Flour Red beans). The color of F1 was preferred by the majority of panelists because the biscuits were lighter yellow-brown in color than formulations F2 (40%:60%) and F3 (45%:55%), which were darker yellow-brown in color. The three MP-ASI biscuit recipes have a yellow-brown tint with varying degrees of brightness from light to dark. The color is created by the caramelization process during the roasting process and drying effect.[17] Organoleptically, the panelists' preference rating declined as more catfish flour was added. The darker the hue of the MP-ASI biscuits, the lower the panelists' preference for them.

The aroma of MP-ASI biscuits in all formulas, both F1, F2, and F3 with the respective ratios of catfish flour and red bean flour (35%:65%), (40%:60%), and (45%:55%) generally accepted by the panelists. It is because the fishy aroma from catfish flour is not very smelly. The

process of steaming and roasting reduces the fishy aroma. In addition, the unpleasant smell of red bean flour is also not very smelly. The aroma of red beans is also reduced by soaking them for 48 hours and then drying them for three days.

Based on the results of the organoleptic test, the more catfish flour was added, the panelists' preference level decreased. It is due to the fishier smell (the aroma of catfish flour), but the aroma in each formulation is not so different.

In terms of taste, panelists favor F1 biscuits over other formulations since they have a less fishy flavor. The biscuits, however, had a sour taste, according to some panelists. The sour flavor could be due to the presence of phytic acid in red bean flour. The peeling procedure causes an increase in phytic acid levels in red beans. As one of the elements of protein, phytic acid accumulates in the cotyledons of beans.[18]

Organoleptically, the panelists' liking level declined as more catfish flour was added. The addition of extra catfish flour, which made the taste of MP-ASI biscuits more fishy and bitter, caused the panelists' liking for MP-ASI biscuits to decline. It generates a less appealing impression on the panelists, lowering their preference level.

Differences in the hardness and crispness of biscuits are directly related to differences in the fundamental ingredient composition, particularly the composition of amylose and amylopectin. The presence of large levels of amylose in a component might boost the crispness of the resulting biscuit. It is because the amylose in the substance may make more hydrogen bonds with water. The water evaporates and creates a space in the ingredients during baking, making the biscuits crunchier. As a result of the decreased volume of biscuits and greater substitution of red beans flour, the hardness of the biscuits increased. Reduced gluten content causes a drop-in volume expansion rate, resulting in a decrease in gas obtained.[19] The more catfish flour used, the harder the texture of the MP-ASI biscuits.

In terms of *overall*, MP-ASI tended to be similar and difficult to differentiate. The panelists' preference for the overall aspect declined as more catfish flour was added. The drop in panelist preference for MP-ASI biscuits was caused by various formulations of catfish flour and red bean flour, which influenced the quality of the end product in the shape of biscuits, hence affecting the panelists' overall preference level.

Biscuits Nutritional Value

Biscuits with added catfish flour contain a variety of health-promoting functional ingredients, such as protein, fat with omega 3, vitamins, minerals, and taurine. Amino acids found in protein have high digestibility and quality, and the digestive organs of fish that contain peptides, vitamins, and minerals, are helpful to one's health.[20]

According to the Recommended Dietary Allowances (2019), nutritional intake for children aged 1-2 years should consist of 1350 g of energy, 20 g of protein, 45 g of fat, and 215 g of carbs.[13] When assessing the nutritional adequacy of MP-ASI biscuits with catfish flour and red bean flour for children aged 1-2 years, 25.6% of the product can contribute calories, 28.3% carbohydrates, 47.5% protein, and 15.7% fat per 100 g of product. As a result, 50 g of MP-ASI biscuits can cover the nutritional needs of children aged 1-2 years. In addition to the breast milk provided by the mother, children aged 1-2 years require supplementary food to help fulfill their daily nutritional demands. The supplementary meal is MP-ASI, which is high in calories and has a texture appropriate to the child's physiological condition. The texture can take the form of porridge or biscuits. These results are in line with Widi Hastuti's research, which shows that the biscuit product contains 29.1 grams of high protein in 100 g.[21]

The iron (Fe) level of MP-ASI biscuits made using catfish flour and red bean flour does not fulfill the Ministry of Health of the Republic of Indonesia's MP-ASI production criteria. Whereas the primary ingredients, catfish and red beans, are iron-rich (Fe). According to Sembiring's (2020) research, the drying process utilizing a high-temperature oven causes a loss of iron content in products.[22]

Conclusion

The produced MP-ASI biscuit formula used in the main study were F1 (35%:65%), F2 (40%:60%), and F3 (45%:55%). Based on the organoleptic test, the panelists' overall preference level for the MP-ASI biscuits with catfish flour and red bean flour generated the highest output in F1 (35%:65%). MP-ASI biscuits with catfish flour and red bean flour have an energy value of 345.6

kcal/100g, 60.9% carbohydrates, 9.5% protein, and 7.1% fat. The protein value of the MP-ASI biscuits with catfish flour and red bean flour was 9.5% more than the protein content of the normal MP-ASI biscuits, which was 7%. The iron content (Fe) of MP-ASI biscuits with catfish flour and red bean flour was 0.15 mg/100 g, meeting 2.14% of the daily needs of children aged 1-2 years. MP-ASI biscuits with catfish flour and red bean flour costs Rp4,237, - per serving and weigh 50 g.

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