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# THE EFFECT OF STRIPED CATFISH (*Pangasius hypophthalmus*) MEAT FLOUR ADDITION AS PROTEIN ENHANCER ON THE PREFERENCE LEVEL OF SWEET CRUSTY BREAD

Pengaruh Penambahan Tepung Daging Ikan Patin (*Pangasius hypophthalmus*) Sebagai Peningkat Protein Terhadap Tingkat Kesukaan Roti Bagelen

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## ABSTRACT

Pangasius hypophthalmus is a potential source of animal protein to improve the nutritional content in food products, such as sweet crusty bread which is known to have relatively low protein content. This study aims to evaluate the effect of adding Pangasius hypophthalmus meat flour on the organoleptic characteristics of sweet crusty bread and to determine the best formulation based on the Bayes method. In thist study an experimental method was applied with 4 treatments (0%; 2,5%; 5%; 7,5%) and the parameters observed in this study are appearance, odor, taste, and texture. The data were analyzed using the Friedman test and the Bayes method. The results showed that the addition of Pangasius hypophthalmus fish meat flour had a significant effect on odor and taste ($p<0,05$), but did not have a significant effect on appearance and texture ($p>0,05$). The best formulation was obtained with the addition of 5% Pangasius hypophthalmus fish meat flour, resulting in the highest preference scores acoross all parameters: appearance (8.0), odor (7,9), taste (8,4), and texture (7,5). The analysis using the Bayes method showed that taste has the highest crierion weight of 0,55 in determining the panelists acceptance of sweet crusty bread.

**Keywords:** Meat Flour, Organoleptic Test, Pangasius hypophthalmus, Sweet Crusty Bread

## ABSTRAK

Ikan patin merupakan sumber protein hewani yang potensial guna memperbaiki kandungan gizi dalam produk pangan, seperti roti bagelen yang diketahui memiliki kandungan protein relatif rendah. Penelitian ini bertujuan untuk mengevaluasi pengaruh penambahan tepung daging ikan patin terhadap karakteristik organoleptik roti bagelen serta menentukan perlakuan terbaik berdasarkan metode Bayes. Dalam penelitian ini diterapkan metode eksperimental dengan 4 perlakuan (0%; 2,5%; 5%; dan 7,5%) dan parameter yang diamati dalam riset ini yaitu kenampakan, aroma, rasa, dan tekstur. Data dianalisis menggunakan uji Friedman dan metode Bayes. Hasil penelitian menunjukkan bahwa penambahan tepung daging ikan patin berpengaruh nyata terhadap aroma dan rasa ($p<0,05$), namun tidak berpengaruh nyata terhadap

kenampakan dan tekstur (p>0,05). Perlakuan terbaik diperoleh pada penambahan 5% tepung daging ikan patin yang menghasilkan nilai tingkat kesukaan tertinggi pada semua parameter yaitu kenampakan (8,0), aroma (7,9), rasa (8,4), dan tekstur (7,5). Hasil analisis menggunakan metode Bayes menunjukkan bahwa rasa memiliki bobot kriteria tertinggi yaitu 0,55 dalam menentukan daya terima panelis terhadap roti bagelen.

**Kata Kunci:** Ikan Patin, Roti Bagelen, Tepung Daging, Uji Organoleptik

## INTRODUCTION

Protein consumption in Indonesia is an important indicator for assessing the nutritional status and health of the community and supporting food security. Although Indonesia has diverse sources of animal protein, such as fish, daily per capita protein consumption in 2023 was recorded at only 62.33 grams. This figure represents a very small increase compared to the previous year (BPS, 2023). Long-term protein deficiency in the human body can lead to various health problems, such as stunting and impaired brain development. Furthermore, protein is closely linked to the immune system. Low protein intake can cause mucosal disorders and a weakened immune system, making the body more susceptible to diseases such as gastrointestinal and respiratory infections (Diniyyah & Nindya, 2017). This small increase in protein consumption also indicates inequality in protein consumption and dietary patterns. This situation demands innovation in local foods that are highly nutritious and widely accepted (Arza & Tirtavani, 2017).

One potential food diversification strategy is utilizing striped catfish as a nutrient-rich source of animal protein. Striped catfish has a protein content of 16.08% and is rich in essential fatty acids such as DHA and EPA, which play a vital role in brain development and heart health (Ekawati & Sabrina, 2020). In addition to its widespread availability in the market, striped catfish is also easy to cultivate, making it suitable for development as a functional food ingredient. Striped catfish can be processed into nutrient-rich fishmeal, containing up to 67.76 grams of protein and 35 mg of calcium per 100 grams. This content makes it a highly nutritious food with potential for fortification. Striped catfish fishmeal is produced from fresh fish meat that has been separated from the bones, head, and innards. The manufacturing process involves several stages: steaming, pressing, drying, and grinding (BSN, 2013).

One food product with the potential for increased nutritional value through fortification with striped catfish fishmeal is bagelen bread. Bagelen bread is a traditional Indonesian food originating from Purworejo, widely known as a sweet bread-based snack with a distinctive flavor (Permata, 2023). Bagelen bread also serves as an alternative carbohydrate source to rice and is often consumed as a hunger-busting food (Santoso, 2017). However, bagelen bread is made from wheat flour, which has a relatively low protein content, around 9.3-14.3% (Dandachy et al., 2019 in Kinasih et al., 2023). Although eggs are used as a protein source in the manufacturing process, this protein content can decrease during the baking process, as protein begins to denature at temperatures of 50-60°C (Kunsah, 2016).

Efforts to improve the nutritional value of bread products by adding local protein sources have been widely implemented. Previous research has shown that the addition of catfish and snakehead fish flour can improve the quality and preference of white bread products (Nugoho et al., 2016; Adam et al., 2020). In addition, Rahadita et al. (2024) showed that substituting flour (wheat, arrowroot, and soybean) with leaf powder (moringa and spinach) in bagelen bread as an effort to prevent stunting significantly affected protein levels and organoleptic characteristics. However, to date, no research has been found that specifically examines the use of striped catfish meat flour in bagelen bread products. Therefore, this study aims to determine the best treatment in bagelen bread formulation with the addition of striped catfish meat flour through sensory quality analysis. Thus, this research is important to answer the need for

nutritious food innovations based on local potential that are applicable and affordable. The results of this study are expected to serve as a basis for the development of processed fishery products that have added value, as part of efforts to increase community protein consumption and provide scientific information on nutritious and preferred bagelen bread formulations.

## METHODS

### Place and Time

This research was conducted from November 2024 to May 2025. The research was conducted in the Fisheries Product Processing Technology Laboratory, Joint Building for Fisheries and Agriculture, Faculty of Agriculture, Padjadjaran University, and the Fisheries Product Processing Laboratory, Faculty of Fisheries, Padjadjaran University.

### Tools and Materials

The tools used to make striped catfish meat meal include a knife, a steamer, an oven, a blender, a 60-mesh sieve, a 100-mesh sieve, a citrus juicer, a cutting board, a gas stove, a basin, ziplock bags, gloves, a scale, and a filter cloth. Meanwhile, the tools used to make bagelen include a baking sheet, a basin, an oven, a spatula, a ruler, a scale, a clean cloth, baking paper, paper labels, gloves, a tray, a measuring cup, a thermometer, a spoon, a pastry roller, and a jar. The raw materials for making striped catfish meat meal include striped catfish, lemon, and water. The ingredients for making bagelen include wheat flour, striped catfish meal, eggs, powdered milk, margarine, yeast, bread improver, salt, water, and granulated sugar.

### Research Design

This study used an experimental method consisting of four treatments involving the addition of striped catfish meal to bagelen. These four treatments were tested on 25 semi-trained panelists. The criteria for semi-trained panelists in this study were basic experience in sensory assessment of food products, experience in hedonic assessment, no impairments in the senses of taste, smell, or sight, and ability to follow research instructions effectively. The panelists were students from the Faculty of Fisheries and Marine Sciences, Padjadjaran University.

The dosage determination was based on previous research by Nugoho et al. (2016) and Oktavia (2019), which showed that adding fish meal to bread products at a concentration of 5-10% increased protein content while maintaining organoleptic acceptability. Furthermore, preliminary tests conducted on 15 semi-trained panelists showed that a 5% concentration of striped catfish meal produced the highest-rated bagel. Based on this, the treatment dosages were as follows:

Treatment A = 0% striped catfish meal
Treatment B = 2.5% striped catfish meal
Treatment C = 5% striped catfish meal
Treatment D = 7.5% striped catfish meal

### Research Procedure

#### Striped Catfish Meal Preparation

The process for making striped catfish meal was modified by Amirullah (2008) in Dewi et al. (2023). The fish were cleaned by removing the head, guts, and fins. They were then coated with lemon juice and left to stand for 15 minutes. After draining, the fish were steamed for 30 minutes at 85-90°C. The meat is separated from the bones and skin, squeezed using a sieve, and then dried in an oven at 50-60°C for 12 hours. Once dry, the fish meat is ground using a blender, sieved through a 60-mesh sieve, and then sieved again through a 100-mesh sieve to obtain a finer flour.

**Making Bagelen Bread**

Bagelen bread is made using a modified method by Kinasih et al. (2023). Wheat flour is mixed with striped catfish meat flour according to the treatment (0%, 2.5%, 5%, and 7.5%), eggs, granulated sugar, powdered milk, yeast, and bread improver. It is then kneaded for 10 minutes. Margarine and salt are added, and the dough is kneaded again until smooth. The dough is weighed into 12 grams each, rounded, and fermented for 40 minutes. The dough is then rolled out and reshaped, then fermented for 10 minutes. The dough is baked at 150-160°C for 40 minutes, then chilled for 24 hours. The bread is cut horizontally and rebaked at 100°C for 40 minutes. Next, the bread is spread with cream, sprinkled with granulated sugar, and rebaked at 100°C for 20 minutes. The formulation is shown in Table 1.

Table 1. Bagelen Bread Formulation

| Ingredients | Formulation | | | |
|---|---|---|---|---|
| | PA | PB | PC | PD |
| Cream dough | | | | |
| Margarine (g) | 30 | 30 | 30 | 30 |
| Milk Powder (g) | 10 | 10 | 10 | 10 |
| Bagelen bread dough | | | | |
| Wheat flour (g) | 200 | 200 | 200 | 200 |
| Striped catfish meal (g) | 0 | 5 | 10 | 15 |
| Eggs (g) | 40 | 40 | 40 | 40 |
| Sugar (g) | 50 | 50 | 50 | 50 |
| Milk powder (g) | 8 | 8 | 8 | 8 |
| Margarine (g) | 30 | 30 | 30 | 30 |
| Yeast (g) | 4.8 | 4.8 | 4.8 | 4.8 |
| Bread improver (g) | 0.8 | 0.8 | 0.8 | 0.8 |
| Salt (g) | 0.8 | 0.8 | 0.8 | 0.8 |
| Water (g) | 110 | 110 | 110 | 110 |

**Hedonic Test**

A hedonic test was conducted to evaluate panelists' responses regarding their level of preference for each product. The parameters assessed in this test were appearance, aroma, taste, and texture. This hedonic test was conducted with 25 semi-trained panelists. Assessments were conducted using a preference scale with a range of values: 9 (very like), 7 (like), 5 (neutral), 3 (dislike), and 1 (very dislike).

**Data Analysis**

The preference level for bagelen with added striped catfish flour was analyzed using non-parametric statistical methods, namely the Friedman test (two-way analysis of variance) with the Chi-square test. To determine the best treatment or the one most preferred by the panelists, the Bayesian method was used. This method is used to make the best decision based on several treatment alternatives, with reference to assessment criteria such as appearance, aroma, taste, and texture.

## RESULTS

**Appearance**

The results of the appetitiveness test for bagels with the addition of striped catfish meal showed that the bagels with 5% striped catfish meal had the highest average score of 8.0 compared to the other treatments. Meanwhile, the lowest average score was found in the control

treatment, at 7.0. The graph of the average appetitiveness scores for bagels with the addition of striped catfish meal is presented in Figure 1.

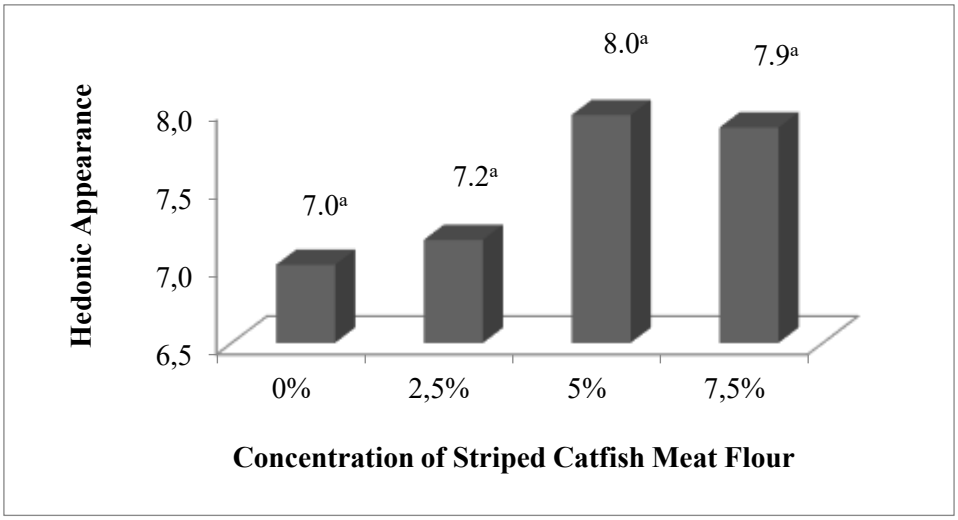


Figure 1. Average Appearance Rating for Bagels with the Addition of Striped Catfish (*Pangasius hypophthalmus*) Meal. Note: 1 = Very Dislike; 3 = Dislike; 5 = Neutral; 7 = Like; 9 = Very Like.

**Aroma**

The results of the appetitiveness test for bagels with the addition of striped catfish meal showed that the bagels with 5% striped catfish meal had the highest average score of 7.9 compared to the other treatments. Meanwhile, the lowest average value was found in the 7.5% treatment, at 5.5. The graph of the average preference levels for the aroma of bagels with the addition of striped catfish meal is presented in Figure 2.

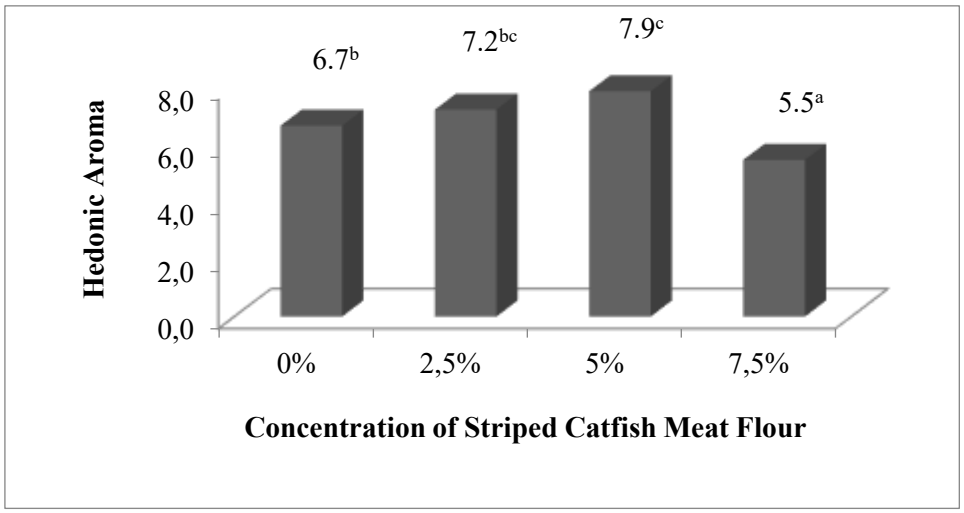


Figure 2. Average Likeability Level for the Aroma of Bagels with the Addition of Striped Catfish (*Pangasius hypophthalmus*) Meal. Note: 1 = Very Dislike; 3 = Dislike; 5 = Neutral; 7 = Like; 9 = Very Like.

**Taste**

The results of the taste preference test for bagels with the addition of striped catfish meal showed that bagels with the addition of 5% striped catfish meal had the highest average value of 8.4 compared to the other treatments. Meanwhile, the lowest average value was found in the

7.5% treatment, at 6.0. A graph of the average taste preference ratings for bagels with the addition of striped catfish flour is presented in Figure 3.

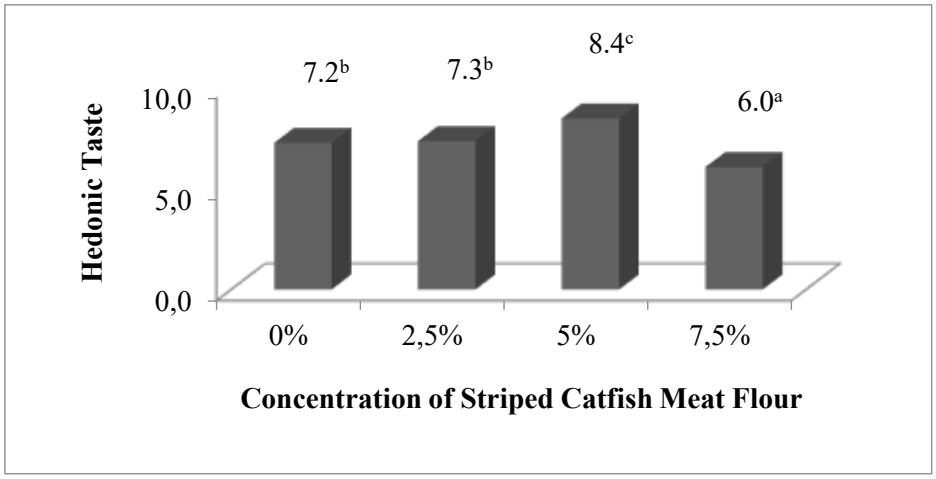


Figure 3. Average Taste Preference Rating for Bagels with the Addition of Striped Catfish Flour (*Pangasius hypophthalmus*). Note: 1 = Very Dislike; 3 = Dislike; 5 = Neutral; 7 = Like; 9 = Very Like.

**Texture**

The results of the texture preference rating test for bagels with the addition of striped catfish flour showed that bagels with the addition of 5% striped catfish flour had the highest average rating of 7.48 compared to the other treatments. Meanwhile, the lowest average rating was found in the 2.5% treatment, at 6.52. The graph of the average texture preference ratings for bagels with the addition of striped catfish flour is presented in Figure 4.

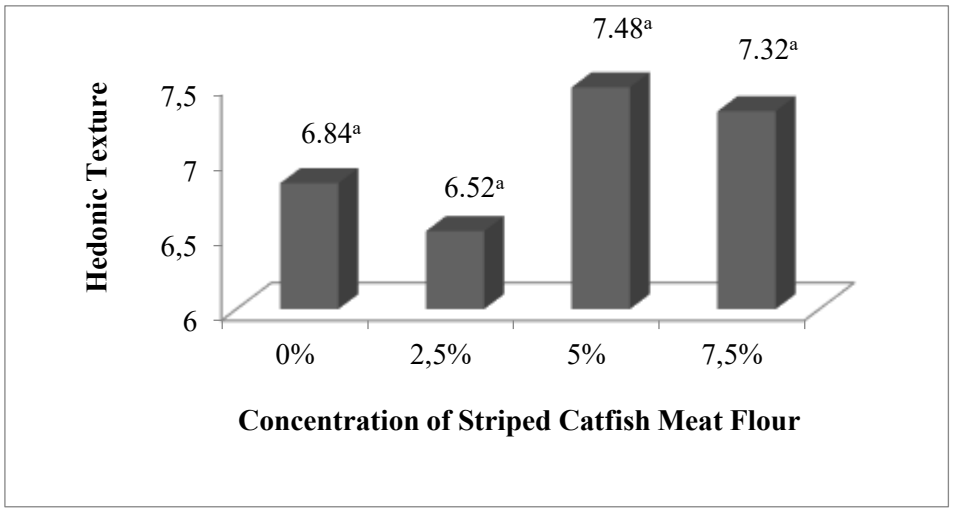


Figure 4. Average Appearance and Aroma Preference Rating for Bagels with the Addition of Striped Catfish Flour (*Pangasius hypophthalmus*). Note: 1 = Very dislike; 3 = Dislike, 5 = Neutral, 7 = Like, 9 = Very like.

## DISCUSSION

Appearance is a major factor influencing consumer acceptance (Aristyan et al., 2014). Appearance testing is conducted to assess the visual appeal of a product, as the first impression of appearance will influence consumers' decision to try and purchase the product. This is in accordance with the statement of Maligan et al. (2018) who stated that appearance is one of the

consumer's considerations when choosing to purchase food or goods and services. The results of the appearance test of bagelen bread with the addition of striped catfish meat flour (0%, 2.5%, 5%, and 7.5%) showed no significant difference between treatments ($p>0.05$) based on the Friedman test. The highest average was found in the 5% treatment (average value of 8.0) while the lowest was in the 0% control (average value of 7.0). All treatments showed a brownish yellow color with slight variations in brightness. This insignificant difference in appearance is thought to be due to the natural color of the striped catfish meal, which tends to be brownish, and the relatively small amount added, which is masked by other ingredients with more dominant compositions, such as wheat flour and eggs. This statement is supported by research by Imani (2020), which shows that the addition of striped catfish meal does not significantly affect the appearance of fried dumplings. The reason is that the natural color of the fish meal blends with the wheat flour and the low concentration of fish meal, so the results of the appearance test show no significant difference. However, if the concentration of fish meal is higher, the protein content in the dumplings will increase, and the color of the dumplings will become browner after the frying process due to the Maillard reaction. The best treatment in terms of appearance is obtained at a concentration of 5% because it produces an even yellow-brown color. Eggs contain egg yolks that contain coloring agents in the form of yellow pigments, namely xanthophyll, lutein, beta-carotene, and cryptoxanthine. These pigments are the main factors that cause bagelen bread to have a distinctive yellow color. Meanwhile, the brown color of the bagelen with the addition of striped catfish meal is thought to be due to the effects of oven baking. The Maillard reaction occurs during the oven baking process, where sugar reacts with protein at oven temperatures, resulting in a brown color on the surface of the product (Bunde et al., 2010 in Pradipta & Putri, 2015). Observations of the appearance of the bagelen with various treatments can be seen in Figure 5.

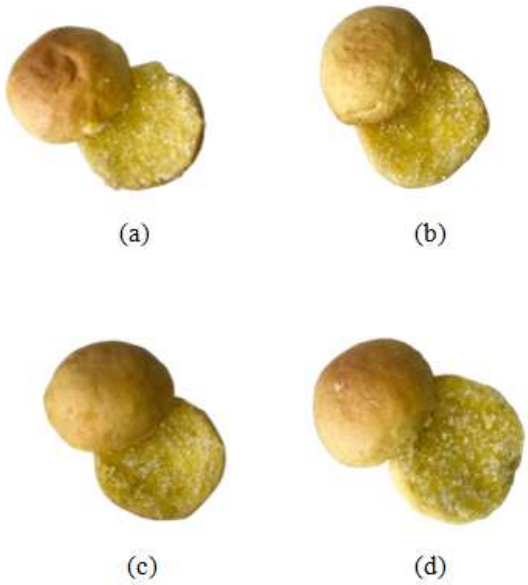


Figure 5. Bagelen with the Addition of Striped Catfish Meal. Description: (a) Without the addition of striped catfish meal; (b) with the addition of 2.5% striped catfish meal; (c) with the addition of 5% striped catfish meal; (d) with the addition of 7.5% striped catfish meal.

Aroma is a perception captured or perceived by the sense of smell in response to a product (Fransiska et al., 2019). Aroma in hedonic testing is one of the determining factors in determining the palatability of a product (Nafsiyah et al., 2022). Testing of aroma parameters

aims to ensure that food products produce odors that match the desired characteristics (Botutihe et al., 2024). The results of the Friedman test statistical analysis showed that the addition of striped catfish meat flour had a significant effect on the level of aroma preference ($p<0.05$), so a multiple comparison test was conducted. Based on the multiple comparison test, the 5% and 7.5% treatments were significantly different from the control treatment (0%), while the 2.5% treatment was not significantly different from the 0% and 5% treatments. The highest average score was 7.9 for the 5% treatment, producing a balanced blend of margarine, grilled, and fish aromas. Meanwhile, the 7.5% treatment received the lowest average score of 5.5, producing a fairly strong fish aroma and a thinner margarine aroma, making it less preferred by panelists. The fishy aroma that appears at high concentrations is considered to disrupt the product's aromatic balance. This is in line with research by Asrim et al. (2022) found that adding fish meal to sweet products can produce an overly dominant fish aroma and reduce panelist acceptance. The best treatment in terms of aroma was obtained at a concentration of 5%.

Taste is a hedonic assessment attribute that is difficult to assess because it is related to the specific characteristics of a food product and is one of the factors that influence the level of consumer acceptance of the product (Sirangelo 2019 in Breemer et al., 2021). The results of the Friedman test statistical analysis showed that the addition of striped catfish meal significantly affected the taste of bagelen ($p<0.05$). The 5% and 7.5% treatments were significantly different from 0% and 2.5%, while the 2.5% treatment was not significantly different from the 0% treatment. The addition of striped catfish meal at a percentage of 5% obtained the highest average value of 8.4, which produced a balanced combination of sweet, salty, and savory flavors. Meanwhile, the 7.5% treatment obtained the lowest average value of 6.0 and produced bagelen with a stronger fish flavor and tended to be less preferred by panelists. This is in line with research by Asrim et al. (2022) which stated that increasing the concentration of fish meal causes the fish flavor to become more dominant and decreases product acceptance. Furthermore, research by Jatmika (2013) cited in Nugoho et al. (2016) suggests that increasing the amount of fish meal in a food formulation tends to decrease panelists' preference for taste, due to the emergence of a stronger fishy flavor. The best treatment in terms of taste was achieved at a concentration of 5% because it produced the most preferred flavor balance among panelists.

Texture is one of the parameters influencing panelists' acceptance of a product (Nadimin & Fitriani, 2019). Texture plays a crucial role in determining product quality from a consumer perspective. Generally, texture is defined as the sensation of pressure felt through the mouth, especially when the product is bitten, chewed, and swallowed. It can also be measured by touch with the fingers (Dewi, 2018). The Friedman test results showed that the addition of striped catfish meal had no significant effect on the preference for the texture of bagelen ($p>0.05$), so a multiple comparison test was not conducted. The average texture value for the 0% treatment was 0%. 2.5%, 5%, and 7.5% were 6.8; 6.5; 7.5; and 7.3, respectively. All of these average values were still above the rejection limit, so the texture of the bagelen bread from all treatments was acceptable to the panelists. The best texture was obtained at a concentration of 5% with an average value of 7.5, indicating a crunchy texture and no significant change compared to the control treatment. This is due to the fine striped catfish meat flour measuring 100 mesh and does not contain gluten, so it does not change the basic properties of the bagelen bread texture (Ningrum et al., 2017). In addition, research by Permata (2023) also stated that low gluten content in flour will affect the water content and texture of the resulting product. Gluten content affects the texture of the bagelen bread, because the lower the gluten content, the harder the texture of the resulting bagelen bread. The texture of the bagelen bread that consumers like is characterized by crunchiness when broken but remains soft and not too hard (Budiarti, 2019). The gluten content of wheat flour remained the same in all treatments because

the amount of flour used remained unchanged between treatments. This resulted in a similar dough structure, resulting in a relatively uniform bagel texture in each treatment.

Based on the weighting criteria for appearance, aroma, taste, and texture of bagelen with the addition of striped catfish flour, the results showed that taste was the most important criterion determining the panelists' final decision or the primary consideration in selecting bagelen with striped catfish flour, with a criterion weight of 0.55. From the results obtained, it can be concluded that taste is the parameter with the highest criterion weight, meaning that taste is a determining factor in panelists' acceptance of the product. If the taste of bagelen with striped catfish flour is not favored by the panelists, the product will not be accepted or rejected by the panelists, even if the weighting scores for other parameter criteria are good. The results of the study, based on calculations using the Bayesian method, showed that the treatment of adding 5% striped catfish flour was the treatment most preferred by the panelists because in this treatment the taste of the striped catfish flour was quite pronounced, providing a savory flavor without overpowering the sweetness that is the basic taste of the bagelen. Meanwhile, the 7.5% treatment obtained the lowest alternative value and priority value because in this treatment, the taste of striped catfish meat flour in the bagelen bread was strengthened, resulting in bagelen bread with a fairly strong fish taste and the sweet taste in the bagelen bread was reduced

## CONCLUSION

The addition of striped catfish (*Pangasius hypophthalmus*) meat flour to bagelen bread has different effects on organoleptic parameters. Based on the results of the hedonic test and statistical analysis, it was found that the appearance and texture parameters did not show significant differences between treatments ($p>0.05$), while aroma and taste showed significant effects ($p<0.05$). The treatment with the addition of 5% striped catfish meat flour was the most preferred formulation hedonically, with the highest average value for each parameter, namely appearance (8.0), aroma (7.9), taste (8.4), and texture (7.5). The results of the Bayes method showed that taste was the criterion with the highest weight (0.55) which most determined the panelists' acceptance of the product.

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