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THE EFFECT OF STRIPED CATFISH (*Pangasius hypophthalmus*) MEAT FLOUR ON THE PREFERENCE LEVEL OF MACARON SHELL

Pengaruh Penambahan Tepung Daging Ikan Patin (*Pangasius hypophthalmus*) Terhadap Tingkat Kesukaan Kulit Macaron

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ABSTRACT

Striped catfish meat flour contains a valuable source of protein that can be utilized as an additive in the production of baked goods such as macaron shell. This study aims to determine the right amount of addition of striped catfish meat flour (Pangasius hypophthalmus) in making macaron shell so as to produce the most preferred product. This research was conducted from December 2024 to May 2025 at the Fishery Product Processing Technology Laboratory, Joint Building of Fisheries and Agriculture, Fishery Product Processing Laboratory, Building 2 FPIK Unpad, and Laboratory Services UPTD Testing and Application of Quality of Fishery Products Cirebon. The method used in this study is an experimental method, namely the manufacture of macaron shell which is given the addition of striped catfish meat flour with 4 different addition treatments (0%, 2.5%, 5% and 7.5%) with 25 semi trained panelists as replicates to determine the level of panelist preference for macaron shell.

Keywords: Fish Protein, Macaron Shell, Preference Level, Striped Catfish Meat Flour

ABSTRAK

Tepung dari daging ikan patin mengandung sumber protein yang layak dimanfaatkan sebagai bahan tambahan pada pembuatan produk pangan kue kering seperti kulit macaron. Penelitian ini bertujuan menentukan jumlah penambahan tepung daging ikan patin (*Pangasius hypophthalmus*) yang tepat pada pembuatan kulit macaron sehingga menghasilkan produk yang paling disukai. Penelitian ini dilaksanakan dari bulan Desember 2024 sampai Mei 2025 yang dilakukan di Laboratorium Teknologi Pengolahan Hasil Perikanan, Gedung Bersama Perikanan dan Pertanian, Laboratorium Pengolahan Hasil Perikanan, Gedung 2 FPIK Unpad, dan Laboratorium Jasa UPTD Pengujian dan Penerapan Mutu Produk Perikanan Cirebon. Metode yang digunakan dalam penelitian ini yaitu metode eksperimental, yakni pembuatan kulit macaron yang diberi penambahan tepung daging ikan patin dengan 4 perlakuan penambahan yang berbeda (0%, 2,5%, 5% dan 7,5%) dengan 25 panelis semi terlatih sebagai ulangan untuk mengetahui tingkat kesukaan panelis terhadap kulit macaron.

Kata Kunci: Kulit Macaron, Protein Ikan, Tepung Daging Patin, Tingkat Kesukaan

INTRODUCTION

Pangasius is a leading freshwater aquaculture commodity in Indonesia. Pangasius production in Indonesia continues to grow annually. Since 2008, Pangasius production has experienced a significant increase until 2013. In 2009, Pangasius production was 109,685 tons, then increased to 147,888 tons, and further increased to 229,267 tons in 2011. By 2013, Pangasius production had reached 410,684 tons (KKP, 2013; Setiawati et al., 2016).

Pangasius contains protein ranging from 13.13% to 68.60%, fat between 1.09% and 5.80%, carbohydrates 1.50%, ash ranging from 0.17% to 5.0%, and a moisture content of 59.3% to 75.5% (Oktavianawati & Palupi, 2017). The flesh is white, smooth, and thick. Per capita fish consumption in Indonesia increased from 22 kg (in 2000) to 56 kg (in 2020) (Central Bureau of Statistics, 2020). However, this figure remains low compared to other countries such as Hong Kong (71 kg/capita/year) and Iceland (90.1 kg/capita/year). In ASEAN, Indonesia ranks 6th out of 8 countries in per capita fish consumption (FAO, 2020). Despite abundant and nutritious pangasius production, public consumption is not yet optimal.

Innovation is needed to increase consumer interest in consuming catfish. Developing products based on catfish meal could be one solution to increase public consumption. Fish meal is made by removing some of the fluid or fat contained in the fish's body (Putri et al., 2022). Fish meal has the advantage of increasing utility value, extending shelf life, and can be used in various food products, such as cookies, to enhance nutritional content and optimize the use of fishery products (Putri et al., 2022). Several previous studies have added catfish meal to cat's tongue cookies (Irpan et al., 2024) and biscuits (Ernisti et al., 2018).

Macarons, a popular Italian cookie in Indonesia, are popular among teenagers due to their unique shape and flavor (Wulandari 2013; Widyastuti et al., 2023). Made from almond flour, egg whites, sugar and consists of two pieces of macaron shell with butter cream or cream cheese filling. Protein is one of the important macronutrients in the growth and development of adolescents, with a requirement of 0.85-95 g/kg body weight per day (Mahan et al., 2012; Suryandi & Widyastuti, 2015). The source of protein in macaron shells is limited, namely from almond flour and egg whites which have a relatively low amino acid content. The nutritional composition of macarons per 100 g includes water content of 6.34%, protein 7.13%, fat 8.74%, crude fiber 4.38%, ash 1.67%, and carbohydrates 72.88% (Pop et al., 2020). Referring to the SNI 01-2973:1992 standard for cookies, the protein content in macaron products still needs to be improved. Macarons with plant-based ingredients have been supplemented with red beans and soybeans (Fakhira et al., 2024) and mung bean flour (Mayasari et al., 2023). However, the use of catfish flour in macaron skins is still rarely used. The addition of catfish flour to macaron skins can affect characteristics such as appearance, aroma, texture, and taste, which impact consumer preference. This study aims to determine the optimal amount of catfish flour to produce the most preferred product and examine its effect on organoleptic characteristics.

METHODS

Place and Time

This research took place from December 2024 to May 2025. The production of catfish meat flour and macaron skins was conducted in the Fisheries Product Processing Technology Laboratory in the Joint Building of Fisheries and Agriculture, Faculty of Agriculture, Padjadjaran University. Organoleptic tests were conducted in the Fisheries Product Processing Laboratory, located in Building 2, Faculty of Fisheries and Marine Sciences. Meanwhile, proximate testing of the macaron skins was conducted in the Services Laboratory of the Fisheries Product Quality Testing and Implementation Unit (UPTD) in Cirebon, which is under the jurisdiction of the West Java Provincial Maritime Affairs and Fisheries Office.

Equipment and Materials

The main raw material for producing catfish meat flour is catfish (*Pangasius hypophthalmus*) sourced from Parakamuncang Market, Cimanggung District, Sumedang Regency, West Java Province. The raw materials for making macaron shells are almond flour, catfish meal, icing sugar, caster sugar, egg whites, cream of tartar, and salt. The equipment used includes a saucepan, electric oven, blender, thermometer, plastic triangles, spatula, mixer, macaron molds, dishcloths, baking paper, syringes, cutting boards, knives, digital scales, basins, spoons, filter cloths, and 60- and 100-mesh sieves.

Research Design

This study used an experimental method with four treatments for adding catfish meal to the macaron shells. These four treatments were tested on 25 semi-trained panelists consisting of students from the Faculty of Fisheries and Marine Sciences, Padjadjaran University. The treatment for adding catfish meal refers to the research (Irpan et al., 2024) which has been modified as follows:

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

Research Procedure

Striped Catfish Meal Preparation

The first stage is the preparation of catfish meal using a modified method from Rohmah (2017). This includes cleaning the catfish, coating it with lime juice for 30 minutes, steaming the catfish at 80-100˚C starting when the water boils for 20 minutes, separating the catfish from the bones and skin, squeezing the catfish, drying it in an oven (50-60˚C for 12 hours), grinding it with a blender, and sifting it in stages (60 mesh and 100 mesh).

Making Macaron Skins with Striped Catfish Flour

The second stage is making macaron skins with the addition of striped catfish flour, adapted from Adnyasuari et al. (2019), with some modifications. The process includes sifting almond flour and icing sugar; beating egg whites with cream of tartar and salt until foamy, then adding caster sugar and beating with a mixer; mixing the wet ingredients and dry ingredients; mixing using the fold-in technique; molding the dough; after molding, tap the dough to remove any trapped air; drying the surface of the macaron skins for 1 hour until dry; and baking in stages at 135°C for 10 minutes, then rotating the pan 180°C and baking again at 150°C. The formula used to make macaron skins with striped catfish flour can be seen in Table 1.

Table 1. Macaron Skin Formulation with Striped Catfish Flour

Ingredients	Treatment of Adding Striped Catfish Meat Meal			
	0%	2.5%	5%	7.5%
Almond flour (g)	120	120	120	120
Striped catfish meat meal (g)	0	3	6	9
Egg white (g)	86	86	86	86
Iching sugar (g)	120	120	120	120
Caster sugar (g)	86	86	86	86
Cream of tartar (g)	2.4	2.4	2.4	2.4
Salt (g)	1	1	1	1

Observation Parameters

The organoleptic ratings for macaron shells from the various treatments above were assessed, including appearance, aroma, texture, and taste. The hedonic scale used in the organoleptic assessment of macaron shells was 9 (very like), 7 (like), 5 (neutral), 3 (dislike), and 1 (very dislike). The preference level was assessed using a hedonic test followed by a Bayesian test to determine the best decision.

Data Analysis

The organoleptic test data were analyzed using a non-parametric statistical method, the Friedman test. The purpose of the Friedman test was to determine the effect of the addition of catfish meal on the level of preference for macaron shells. The formula used in the Friedman test is as follows (Sudrajat 1999 in Oktarahdiana et al., 2022):

$$X^2 = \left[\frac{12}{NK\,(K+1)}\sum_{t=1}^{k}(Rj)^2\right] - 3N\,(K+1)$$

Description:
X^2 : Friedman Test Statistic
N : Replication
k : Treatment
Rj : Total ranking of each treatment

If the addition of catfish flour is proven to affect the level of preference for the macaron shells, the test will continue with a multiple comparison test. The purpose of this test is to identify differences between treatments of catfish flour addition to the macaron shells. The selection of the best treatment that produces the most preferred macaron shells will be done using the Bayesian method.

RESULTS

Appearance

Based on the results of the preference test for the appearance of macaron skins with the addition of fish meal, the macaron skins with the addition of 5% catfish meal showed the highest average score, at 7.6, compared to the other treatments. The lowest average score was found in the treatment with the addition of 7.5% catfish meal, at 5.1. The graph of the average appearance scores for macaron skins with the addition of catfish meal is shown in Figure 1.

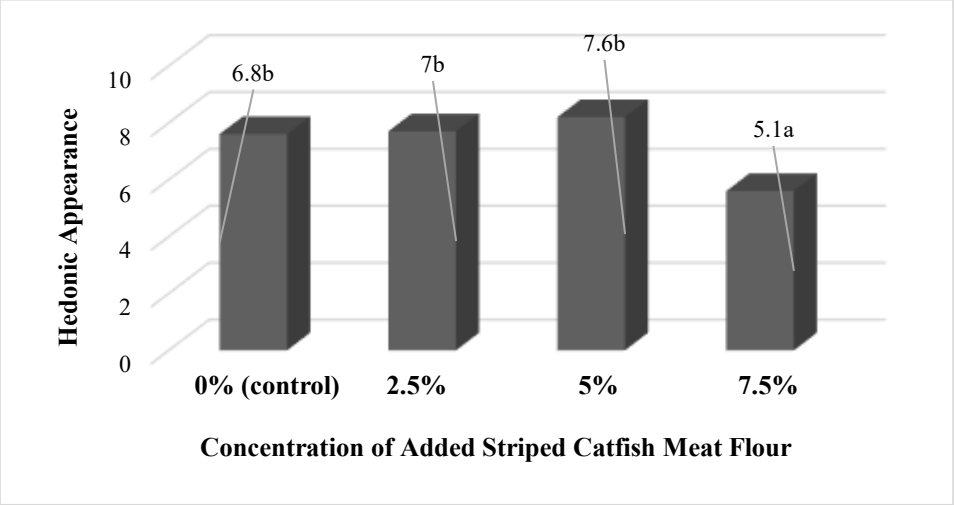

Figure 1. Average Appearance Scores for Macaron Skins

Aroma

Based on the results of the preference test for the aroma of macaron skins with the addition of catfish meal, the macaron skins with the addition of 5% catfish meal showed the highest average score, at 7.6, compared to the other treatments. The lowest average aroma score was found in the treatment with the addition of 7.5% catfish meal, at 5.4. The graph of the average aroma scores for macaron skins with the addition of catfish meal flour is shown in Figure 2.

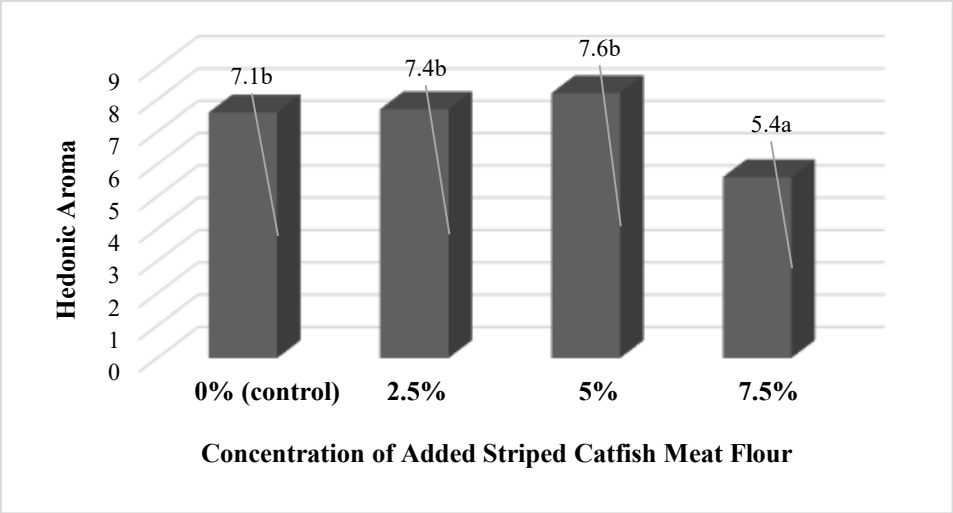

Figure 2. Average Aroma Scores for Macaron Skins

Texture

Based on the results of the texture preference test for macaron skins with the addition of catfish meal flour, the macaron skins with 5% catfish meal flour showed the highest average score, at 8.1, compared to the other treatments. The lowest average texture score was found in the 0% or control treatment with catfish meal flour, at 5.1. The graph of the average texture scores for macaron skins with the addition of catfish meal flour is shown in Figure 3.

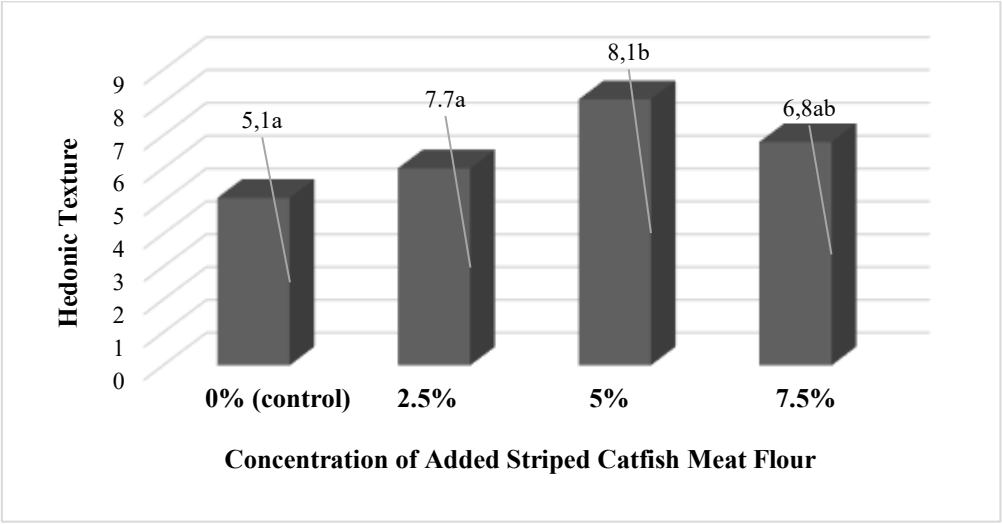

Figure 3. Average Texture Scores for Macaron Skins

Taste

Based on the results of the taste preference test for macaron skins with the addition of catfish meal flour, the macaron skins with 5% catfish meal flour showed the highest average score, at 8.2, compared to the other treatments. The lowest average flavor score was found in the treatment with 7.5% catfish meal addition, at 5.6. A graph of the average texture scores for macaron skins with catfish meal addition is shown in Figure 4.

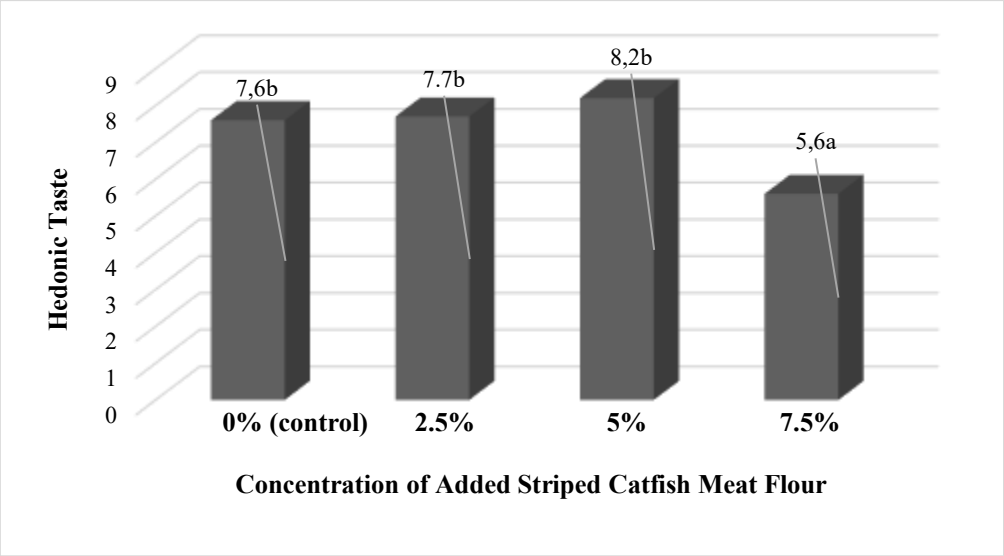

Figure 4. Average Macaron Skin Flavor Score

DISCUSSION

Appearance is an important aspect in organoleptic assessment, in choosing a product, consumers will consider the appearance of the product first and ignore other sensory attributes. The characteristics of the overall appearance of the product include color, dimension, shape, surface texture, and the level of carbonation of the product (Meilgard et al., 2006 in Tarwendah, 2017). Based on the highest level of appearance preference test, macaron skin with the addition of 5% catfish meat flour produces a brownish yellow color. Statistical tests show that the level of preference for the appearance of the macaron skin is influenced by the level of addition of catfish meat flour. This shows that the appearance of the macaron skin with the addition of 7.5% is significantly different compared to the addition of 0%, 2.5% and 5%. The more catfish meat flour added to the macaron skin, the darker the resulting color, thus reducing the level of panelist preference. The color difference in the macaron skin is influenced by the addition of catfish meat flour. During baking, a browning reaction (Maillard reaction) occurs between reducing sugars and amino acids (Sriyanti, 2011 in Putra, 2017). The addition of catfish meal, a protein rich in amino acids, increases the intensity of the Maillard reaction, resulting in the formation of melanoidin compounds, making products with catfish meal darker.

Figure 5. Appearance of the Striped Catfish Meat Flour Macaron Skin for Each Treatment

Aroma is produced by volatile compounds in a material. In general, the nose and brain are able to recognize aroma as a combination of four primary odors: fragrant, sour, rancid, and burnt (Winarno, 1997). Based on the aroma preference test, macaron skins with 5% fish meal produced a strong almond aroma and a faint catfish meal aroma. Increasing the amount of catfish meal added to the macaron skins reduced panelists' preference due to the fishy aroma of the catfish meal. The odor of catfish flour is caused by the compound trimethylamine (TMA), which is formed by the reaction of trimethylamine oxide (TMAO) with the double bonds of unsaturated fats. This breakdown of proteins and unsaturated fats is what causes the fishy odor (Farahita et al., 2012).

The quality of a product's texture is a crucial physical characteristic, as it affects the sensation when chewing (Rumpengen et al., 1985). Various texture sensations include juiciness, dryness, hardness, smoothness, and oiliness (Soekarto, 2002). Based on the highest level of texture preference, macaron skins with 5% catfish flour produced a crunchy texture on the surface and a soft interior, consistent with the general texture of macaron skins. Increasing the amount of catfish flour resulted in a hard texture, which was less preferred by panelists. Product texture is influenced by amino acids in protein, one of which is lysine. The higher the lysine content in fish meat, the more compact and firmer the resulting texture. Furthermore, proteins such as actomyosin and myosin have the ability to form gels when processed (Silaban et al., 2017). This gel forms a strong and dense network, increasing the product's hardness.

Taste is a crucial aspect influencing consumer acceptance of a product. Based on the highest level of preference, macaron skins with 5% catfish flour produced a unique blend of almond flour, a savory flavor with a nutty aroma and sweetness from sugar, along with the savory flavor of the catfish flour. The savory flavor of the catfish flour comes from glutamic acid. Catfish contains 5.14% glutamic acid (Siska, 2015). Glutamic acid is an amino acid that can create a savory taste by stimulating various types of nerves on the human tongue, resulting in an umami sensation (Susianti et al., 2020).

The Bayes method is an approach used to analyze and determine the best decision from various available options, with the aim of obtaining the most appropriate results (Nurwati, 2011). Based on the assessment weighting of the macaron skin criteria, taste turned out to be the most crucial factor in making decisions about choosing macaron skins, with a value of 0.44 indicating that 44% of panelists prioritized taste as the main criterion. The remaining 0.56 or 56% of panelists divided it into other criteria, appearance, aroma, and texture. Taste plays a

crucial role in influencing consumer acceptance of food products. Taste perception is assessed through the reaction of the taste buds to chemical stimuli (Pitunani et al., 2016). Based on calculations using the Bayesian method, the results showed that macaron skins with the addition of 5% catfish meat flour were the macaron skins most preferred by panelists.

CONCLUSION

Macaron skin with 5% added catfish meat flour produces a product that obtains the highest preference score from the panelists based on the hedonic test, with the highest average score for appearance (7.6), aroma (7.6), taste (8.2), texture (8.1). This most preferred macaron skin product has a brownish yellow color, a faint catfish aroma and still contains the aroma of almond flour, a sweet and slightly savory taste, and a crunchy surface texture and a soft interior. The panelists' assessment shows that taste is the most important organoleptic criterion in considering macaron skin products.

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