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Effect of Adding Champignon Mushrooms (*Agaricus bisporus*) on Organoleptic Characteristics and Level of Preferences Tilapia Fish Nuggets

¹Evi Liviawaty, ²Dinda Lestari Putri, ³Wanda Sri Rahayu, ⁴Rif'atus Solihah, ⁵Nicka Kairunisa Octaliani

¹Lecturer Staff, Department of Fisheries, Padjadjaran University, Indonesia

^{2, 3, 4, 5}Undergraduate Student of Fisheries Study Program, Padjadjaran University, Indonesia

Corresponding Author: **Rif'atus Solihah**

Abstract

Tilapia is a type of fish with high protein and low fat content. Tilapia fish meat can be used as a base for nuggets to increase the nutritional value, especially the protein in the nuggets. Apart from the nutritional content found in fish, the human body also needs additional fiber, such as the fiber contained in champignon mushroom (*Agaricus bisporus*). The aim of this research was to determine the organoleptic characteristics of tilapia fish nuggets with the addition of champignon mushroom and to analyze the level of panelists' preferences for tilapia fish nuggets with the addition of champignon mushroom at different concentrations, as well as determining the best formulation. The research method used is an experimental method and data collection techniques using subjective assessment of Organoleptic Tests (level of preferences) taken from the results of the panelists' assessments which include assessing the appearance, aroma, taste and texture of tilapia fish nuggets with four different treatments (Treatment A (0%), Treatment B (10%), Treatment C (15%), and Treatment D (20%)).

Next, the data was analyzed using the Kruskal Wallis Test on 4 treatments with 20 semi-trained panelists which were also used as replications. The level of panelists' preferences test was assisted using Bayes method calculations. The scale for measuring the level of preference is with a value rate of 1-9. The results of the research showed that the average value of the level of preferences for the organoleptic test characteristics of the panelists for tilapia fish nuggets with four different treatments was that there were no significant differences in appearance, aroma and taste in each treatment. However, there were real differences in texture in each treatment. Of the four treatments, the best treatment was preferred by the panelists based on the average value of preference level (organoleptic) using the Bayes method calculation, namely fish nuggets with the addition of 20% champignon mushroom (Treatment D). This treatment produces tilapia fish nuggets with good and effective appearance, texture, aroma and taste compared to treatment A (0%), treatment B (10%), or treatment C (15%).

Keywords: Fish Nugget, Champignon Mushroom, Fortification, Hedonic Test

1. Introduction

Fish is a source of animal protein that comes from fisheries. The bioavailability of protein from fish is around 5-15% higher than vegetable protein sources. The protein content in fish is in the form of complete essential amino acids so that it can meet the nutritional needs of the human body. Another nutritional composition of fish is in the form of fatty acid content. One of the fatty acids found in fish is omega-3 fatty acids (Elavarasan, 2018). One of the fish that has high nutrition is Tilapia. Tilapia fish (*Oreochromis niloticus*) is liked by many people because tilapia fish has a delicious taste and thick flesh. Tilapia has good nutritional content such as protein of 43.76%, water content of 79.44%, fat content of 7.01%, ash content of 6.80% per 100 grams of tilapia weight (Kusmini *et al.*, 2015).

In one tilapia fish, it turns out there is a lot of protein and folic acid which are good for the body. Apart from that, tilapia also contains lots of vitamin B12, phosphorus, selenium and potassium. The benefits obtained by this nutrition include maintaining cholesterol, preventing cancer, and increasing the body's immunity. Tilapia has meat that tastes sweet and has a crunchy texture (Syadeto *et al.*, 2017). Tilapia has a bland taste so it is easy to process into processed fish products such as nuggets. The use of tilapia in making nuggets can be used as an alternative to diversify processed fish products.

Fish nuggets are a food diversification product that is popular with the public. Nuggets are processed ground meat, added with a binder and mixed with spices, then coated with egg white (batter) and breadcrumbs (breading), then pre-frying, then packaged and frozen to maintain quality (Mawati *et al.*, 2017). Apart from the nutritional content found in fish, the body also needs fiber, such as the fiber contained in champignon mushrooms (*Agaricus bisporus*). Mushrooms have a fiber content reaching 7.4-24.6% (Maulana, 2012). The fiber contained in mushrooms is fiber which can function as a prebiotic. It is known that prebiotics are very important for the human body, namely they have good benefits for the human digestive system (Apriani *et al.*, 2022).

Champignon mushrooms have a soft texture when cooked, so adding champignon mushrooms to the nuggets is expected to give the nuggets a chewy texture. Apart from that, mushrooms also naturally contain high levels of glutamic acid which gives a savory taste to food so they can be used as an additional ingredient in making tilapia fish nuggets so that the resulting taste is more savory (Praptiningsih, 2017) and has a distinctive slightly sweet aroma resembling meat (Achmad *et al.*, 2011). Based on this description, it is hoped that the combination of tilapia with champignon mushrooms in making nuggets can improve the quality and organoleptic characteristics of fish nuggets. So it can be a food that contains high nutritional value.

2. Materials and Methods

Time and Place of Research

This research was carried out on October 24 2023 at the Secretariat of the Fisheries Product Processing Technology Forum and Science Studies (Fortification) Floor 2, Joint Agriculture-Fisheries Building, Padjadjaran University Jatinangor-Sumedang West Java Indonesia.

Research Tools and Materials

The tools used in this research consist of: *food processor*, knife, cutting board, steaming pan, nugget mold, basin, blender, stove, scales. The dough ingredients used in this research were tilapia (*Oreochromis niloticus*) fillets obtained from Griya Jatinangor, Sumedang Regency, eggs, onions, garlic, salt, ground pepper, tapioca flour, breadcrumbs, ice water, while the nugget coating material used namely, bread flour, eggs, and wheat flour and water.

Research methods

The method used in this research is an experimental method with the design used being the Kruskal Wallis Test with 4 treatments with 20 semi-trained panelists which are also used as replications. If the calculated C is > from C table at the 5% level, then the test continues to multiple comparisons to see the real differences between the 4 treatments, while to determine the level of preferences using the Bayes method to determine the best treatment according to the panelists. The panelists in this research consisted of UNPAD Fisheries students specializing in Fishery Product Processing Technology. The test carried out was an Organoleptic Test in the form of a Hedonic Test to analyze the level of panelists' preferences for Tilapia Fish Nugget Products (*Oreochromis niloticus*) which were added with champignon Mushrooms (*Agaricus bisporus*) on a scale of 1-very dislike to 9-very like. The percentage of addition of champignon mushrooms (*Agaricus bisporus*) based on the

weight of fish flesh is as follows:

Treatment A = Addition of 0% Champignon Mushroom
 Treatment B = Addition of 10% Champignon Mushrooms
 Treatment C = Addition of 15% Champignon Mushrooms
 Treatment D = Addition of 20% Champignon Mushrooms

The formulation of ingredients in making tilapia fish nuggets with the addition of champignon mushrooms is based on the modified formulation of Nugroho (2003).by the author can be seen in Table 1.

Table 1: Formulation in Making Nuggets for Each Treatment

Material	Treatment			
	P.A	PB	PC	PD
Nugget Dough Ingredients (gr)				
Tilapia (grams)	100	100	100	100
Tapioca flour (grams)	13	13	13	13
Breadcrumbs (grams)	13	13	13	13
Egg (grain)	1	1	1	1
Salt (tsp)	1.5	1.5	1.5	1.5
Onions (grams)	50	50	50	50
Garlic (grams)	1.6	1.6	1.6	1.6
Pepper (grams)	1	1	1	1
Ice cube water	Enough	Enough	Enough	Enough
Champignon Mushrooms (grams)	0	10	15	20
Coating Material (gr)				
Bread/bread flour (grams)	100	100	100	100
Wheat flour (grams)	50	50	50	50
Egg (grain)	1	1	1	1
Water (ml)	30	30	30	30

Procedure

Making tilapia fish nuggets (Nugroho, 2003) which has been modified by the author as follows: making nuggets begins with preparing all the ingredients and equipment. Tilapia fillets were put into each treatment container. Then, the fish flesh from the four treatments was crushed using a food processor. After that, add eggs, salt, tapioca flour, bread flour and crushed onions, garlic and pepper into each container. Next, knead all the ingredients until they form an evenly mixed dough, once evenly mixed, add the champignon mushrooms which have been chopped according to the treatment percentage. Put each of the four doughs in a different baking dish and steam for 30 minutes. After that, the four pieces of dough that have been steamed are then cut into cubes. Next, each nugget treatment was given a coating by mixing wheat flour, eggs and water. Then the cut nuggets are coated with coating mixture then rolled in fine bread flour, then put back into the coating mixture and roll the nuggets again using unground bread flour. Fish nuggets with four different treatments are ready to be fried.

Sampling

Samples of fish nuggets with four different treatments that had been fried and ready to be served were then stored in different sample containers. The number of each sample is considered to be tested by 20 panelists.

Observation

The parameters observed in this research were organoleptic characteristics or sensory assessment and the level of panelists' preferences of tilapia fish nuggets with the

addition of champignon mushrooms. This organoleptic test was carried out with 20 semi-trained panelists, with panelists' favorability scores ranging from 1-9. Sensory assessment is carried out using a hedonic test where the parameters tested are color, texture, taste, appearance and aroma.

3. Results and Discussion

Organoleptic Test

Organoleptic is a test of food ingredients based on likes and desires for a product. Organoleptic testing, also known as sensory testing or sensory testing, is a testing method that uses human senses as the main tool for measuring product acceptability. The senses used in organoleptic tests are the sense of sight/eyes, the sense of smell/nose, the sense of taste/tongue, the sense of touch/hands (Gusnadi *et al.* 2021) [4]. This test is intended to determine the sensory acceptance of the product produced including color, appearance, aroma, taste and texture. In this test, panelists are asked to provide responses in the form of likes or dislikes which are visualized with the number 1 as the lowest value to 9 as the highest value (Wulandari 2013) [12]. Meanwhile, a questionnaire is a tool in the form of a list of questions that must be filled in by the person (respondent) who will be measured (Suryono *et al.* 2018) [10]. The organoleptic test used is the hedonic scale test which is a test of the level of panelists' preferences for appearance, texture, taste and aroma.

Appearance

Appearance parameters are one of the first factors that consumers look at when choosing food and assessing quality. The results of the appearance test using the Kruskal Wallis Test showed that C count < C table with a C count value of 2.112 and C table with a 5% level of 7.815, which means that there was no real difference in appearance in each treatment. Champignon mushrooms do not make a difference to tilapia fish nuggets because the champignon mushrooms added to each treatment are cut or chopped in small sizes so that they do not change the shape or color of the tilapia fish nuggets. The results of multiple comparisons can be seen in Table 2.

Table 2: Average Organoleptic Test on the Appearance of Tilapia Fish Nuggets with the Addition of Champignon Mushrooms

Addition of Champignon Mushrooms (%)	Median	Average Appearance
0	7	43.3a
10	7	39.9a
15	7	44.3a
20	8	34.6a

Note: Numbers accompanied by the same letter indicate that they are not significantly different according to the multiple test at the 5% level

Based on the results of organoleptic average calculations on appearance, it shows that the nuggets have relatively the same color and are difficult to differentiate, namely white on the inside and brownish orange on the outside so that the addition of champignon mushrooms to tilapia fish nuggets affects the appearance and color of all treatments has no effect on panelists' preferences. Oyster mushrooms have a pure white color, so the resulting nuggets have relatively the same appearance and color and are difficult to differentiate.

This shows that the addition of mushrooms up to a percentage of 20% is still acceptable to the panelists.

Aroma

Aroma is an important factor for consumers in choosing food, according to (Winarno, 2004) [11] stating that the deliciousness of food is determined by the aroma of the food. Aroma is also one of the criteria for acceptance of a product by consumers. The results showed that the addition of champignon mushrooms to tilapia fish nuggets had no significant effect on the aroma of the nuggets. This is because champignon mushrooms do not have a sharp odor. It can be seen that based on calculated C < from C table with a calculated C value of 2.486 and C table with a 5% level of 2.764, where if calculated C < C table means there is no real difference. The results of multiple comparisons can be seen in Table 3.

Table 3: Average Organoleptic Test on the Aroma of Tilapia Fish Nuggets with the Addition of Champignon Mushrooms

Addition of Champignon Mushrooms (%)	Median	Average Appearance
0	7	44.9a
10	7	44.2a
15	7	35.5a
20	7	37.5a

Note: Numbers accompanied by the same letter indicate that they are not significantly different according to the multiple test at the 5% level

Based on the results of organoleptic average calculations on aroma parameters, it shows that nuggets with the addition of champignon mushrooms have the same aroma as fish nuggets in general, namely a typical fish smell. In fact, the addition of champignon mushrooms does not affect the aroma of the tilapia fish nuggets. This is in line with Oktaviana's (2019) [7] research on analog meat nuggets based on gluten flour and cowpea flour with the addition of champignon mushrooms. Where, the addition of champignon mushrooms to analog meat mushrooms did not provide any real difference. This is caused by the aroma of champignon mushrooms which do not have a distinctive aroma that can influence the aroma of tilapia fish nuggets. The aroma of spices such as garlic, pepper and others can function as an aroma enhancer in the resulting product due to the content of volatile oils and oleoresin oil (Erawati 2001) [2].

Flavor

According to Fellows (2000) [3], taste is a factor that plays an important role in determining a consumer's final decision to accept or reject a food. Based on research that has been carried out on taste parameters, there is no real difference. This means that adding champignon mushrooms to tilapia fish nuggets does not affect the original taste of the nuggets. This can be seen based on calculated C < from C table with a calculated C value of 6.1792 and C table with a 5% level of 6.7654. This is caused by the low percentage of added fungal content in the tilapia fish nuggets which causes a strong fish taste. Apart from that, the process of cutting mushrooms that are too small is one of the factors where you don't feel the mushrooms on the nuggets. The results of multiple comparisons can be seen in Table 4.

Table 4: Average Organoleptic Test on the Taste of Tilapia Fish Nuggets with the Addition of Champignon Mushrooms

Addition of Champignon Mushrooms (%)	Median	Average Appearance
0	6	49.0a
10	7	31.0a
15	7	42.5a
20	7	39.6a

Note: Numbers accompanied by the same letter indicate that they are not significantly different according to the multiple test at the 5% level

Based on the results of organoleptic average calculations on taste parameters, it shows that the nuggets have the same taste, namely quite delicious and taste like fish. The addition of champignon mushrooms does not actually affect the taste of the tilapia fish nuggets. This is in line with research by Naufal (2016) [6] regarding the comparison of the use of types of mushrooms, oyster mushrooms and champignon mushrooms, on the quality of dragon feet. Where, the addition of champignon mushrooms and oyster mushrooms to the dragon's feet makes no difference to the taste.

Texture

The texture of a food is an element that also determines taste because sensory sensitivity is influenced by consistency or texture. According to Sari (2015), texture is one of the organoleptic characteristics that influences the panelists' acceptance of food, as well as influencing the appearance of the food. The results of the texture test using the Kruskal Wallis test showed that C count > C table with a C count value of 8.1425 and C table with a 5% level of 7.815, which means that there was a real difference in texture in each treatment. Then, the test continues with multiple comparisons. The results of multiple comparisons can be seen in Table 5.

Table 5: Average Organoleptic Test on the Texture of Tilapia Fish Nuggets with the Addition of Champignon Mushrooms

Treatment	Average	C	D	B	R	Notation
C	34.2	-	-	-	6.1307559	a
D	34.5	0.3	-	-		a
B	40.9	6.7	6.4	-		b
A	52.5	18.3	18.0	11.6		c

Note: Numbers accompanied by the same letter indicate that they are not significantly different according to the multiple test at the 5% level

Based on the multiple comparison test above, treatment C (addition of 15% champignon mushrooms) is not significantly different in texture from treatment D (addition of 20% champignon mushrooms). However, treatments C and D were significantly different in texture from treatment B (addition of 10% champignon mushrooms) and treatment A (addition of 0% champignon mushrooms or control treatment). Then treatment B (addition of 10% champignon mushrooms) was also significantly different in texture from treatment A (addition of 0% champignon mushrooms or control treatment). This difference is because the addition of champignon mushrooms affects the texture. The more additions, the chewier the texture of the nuggets. In accordance with the opinion of Elleuch *et al.* (2011) [1], champignon mushrooms are able to increase the oil holding capacity, capacity holding water, emulsification and gel formation. So it can be said that champignon mushrooms are

able to modify and improve the texture (Pinero *et al.* 2008) [8]. According to Apriliani (2010) in Iqbal *et al.* (2016) [5], the softness or hardness of a product is influenced by the presence of water in that product.

Levels of Preferences

The level of preferences test is a test carried out to find out how much someone likes or dislikes a food or drink product. Based on the calculation of the weight criteria for appearance, aroma, taste and texture of tilapia fish nuggets with the addition of champignon mushrooms, the results show that taste assessment is the priority criterion to be able to determine the final decision of the panelists in choosing which fish nugget product with the addition of champignon mushrooms is preferred with the weight of the taste criteria. of 0.316.

This level of preferences test was carried out using the Bayes calculation method, where the results of the calculation stated that tilapia fish nuggets with the addition of champignon mushrooms had the highest alternative value of 7.263 in the treatment of adding 20% champignon mushrooms. With these results, it can be stated that tilapia fish nuggets added with 20% champignon mushrooms were the most preferred nuggets by the panelists among the other treatments. The decision matrix for evaluating tilapia fish nuggets with the addition of champignon mushrooms can be seen in Table 6.

Table 6: Decision Matrix for Evaluation of Tilapia Fish Nuggets with the Addition of Champignon Mushrooms

Addition Mold (%)	Criteria				Alternative Value
	Appearance	Aroma	Flavor	Texture	
0	7	7	6	7	6,684
10	7	7	7	7	7
15	7	7	7	7	7
20	8	7	7	7	7,263
Criteria Weight	0.263	0.211	0.316	0.211	

Note: The highest alternative value with a value of 7.263 is found in the 20% treatment, the highest criteria weight value is found in taste (0.316)

4. Conclusion

Based on the research results, it can be concluded that, the average value of the level of preferences for the characteristics of the panelists' organoleptic tests on tilapia fish nuggets with four different treatments using the Kruskal Wallis Test (multiple comparisons) with a C table level of 5%, namely that there is no significant difference in appearance, aroma and taste in each treatment of tilapia fish nuggets. However, there were real differences in the texture of each tilapia nugget treatment. Of the four treatments, the best treatment was preferred by the panelists based on the average value of level preferences (organoleptic) using the Bayes method calculation, namely fish nuggets with the addition of 20% champignon mushrooms (Treatment D). This treatment produces tilapia fish nuggets with good and effective appearance, texture, aroma and taste compared to treatment A (0%), treatment B (10%), or treatment C (15%).

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