Original Research Article

The Effect of Adding Catfish Bone Flour to Catfish Meatballs Preference Level

ABSTRACT

This research aims to determine the appropriate level of addition of catfish bone flour to catfish meatballs to produce a product preference by the panelists. This research was conducted at the Fishery Product Processing Laboratory, Faculty of Fisheries and Marine Sciences, Universitas Padjadjaran. This research used an experimental method with 5 treatments of adding catfish bone flour 0%, 5%, 10%, 15%, and 20%. The assessment of the level of preference was carried out by 20 semi-trained panelists. This research observes organoleptic (appearance, aroma, taste, and texture) and physical (folding test). Statistical analysis of this research used non-parametric statistics Friedman test, followed by a multiple comparison test, and determined the best treatment using the Bayes method. The results of statistical analysis and Bayes showed that the addition of 10% catfish bone flour to catfish meatballs was the best treatment preferred by the panelists.

Keywords: Catfish, fish bone flour, fish meatballs, preference level.

1. INTRODUCTION

Catfish is one of the freshwater fish favored by the people of Indonesia. Catfish has a characteristic of taste, affordable price, neutral aroma, and meat without fine spines, so it can be used as raw material for processed fishery products [1]. Catfish meat is a part that is often used as processed food [2]. The processing triggers the existence of waste that has not been utilized optimally, such as fish bones.

Fish bones are solid waste containing elements of calcium, phosphorus, and collagen protein-forming materials [3]. The high calcium content of fish bones shows that it can be used as a source of calcium [4]. Fish bones can be processed into flour first so that when applied, it is easier and can be added to processed foods.

Processed fishery products that have the opportunity to be developed to add nutritional value are fish balls [5]. The advantage of fish balls over other fish jelly products is that fish balls are easy to find and favored by people of all ages [6].

Fish bones are used to reduce waste that has not been utilized optimally. Adding catfish bone flour to catfish meatballs will affect the preference level. The fortified products produced must be liked by consumers, so it is necessary to do this research to find the best composition for adding fishbone flour.

Comment [A1]: Please add a few comments about the background of this title, so that readers can understand the outline of this research

Comment [A2]: Please enter production data about catfish. in areas where consumption of catfish is highest because to get a large number of catfish bones requires a lot of production. then how do you get a large number of bones while consuming catfish, fish bones are also eaten, when the frying method is dry, please provide a comment or an argument can be added

2. MATERIAL AND METHODS

2.1 Time and Place

This research was carried out in June-July 2022. The making of catfish bones and catfish meatballs and assessment of the level of preference was carried out at the Fishery Product Processing Laboratory, Faculty of Fisheries and Marine Sciences, Universitas Padjadjaran.

Comment [A3]: Where do the fishbones come from?

2.2Tools and Research Material

The research materials used were catfish bones, catfish meat, tapioca flour, shallots, garlic, pepper, salt, and ice cubes. The tools used in this research are gas stoves, digital scales, cutting boards, pressure cookers, blenders, sieves, electric ovens, knives, containers, food processors, and pans. The tools used for product assessment are score sheets and paper plates.

Comment [A4]: In this study, what was added besides catfish bone meal, was the fish meat also added?

2.3Research Methods Dan Procedures

The method used in this research is an experimental method, with 5 additional treatments of catfish bone flour, namely 0%, 5%, 10%, 15%, and 20%. The assessment of the level of preference using a hedonic scale was carried out by 20 semi-trained panelists [7]. These panelists are students of the Faculty of Fisheries and Marine Sciences, Universitas Padjadjaran.

Comment [A5]: This research method refers to whose research, please add the source

2.3.1 Procedure fishbone flour

Fresh fish bones are prepared then, cut, and then washed with running water, steamed for 10 minutes, cleaned again using running water, then boiled for 60 minutes at 100ºC, then cut the bones into small pieces, put in a pressure cooker over high heat until sound, then use low heat for 180 minutes, then dried using an oven at 120ºC for 50 minutes, grind the fish bones using a blender and then sieve using a sieve.

Comment [A6]: Catfish bones have small and fine fish bones, is it by heating at a temperature of 100°C and followed by an autoclave the minerals are not damaged, what I want to emphasize in this study is the hedonic test or the concentration of bone meal filler, please add a reference to whose research?

2.3.1 Procedure fishball

The catfish is prepared and then cleaned using running water, the meat is separated from the bones and skin, the fish meat in the form of a fillet is crushed with a meat grinder, and the meat is mixed with salt and ice using a food processor until the dough is sticky, then add flour and other spices. Maintain a maximum temperature of 10ºC, and the dough is crushed by hand. The mold is soaked in warm water at 40-70ºC for 10-20 minutes, then boiled in boiling water at 90-100ºC until the meatballs float, then drained until cool.

2.4Parameters Observation

The parameters observed for the treated catfish meatballs were organoleptic and physical. The organoleptic parameters observed included appearance, aroma, texture, and taste using the hedonic test (level of preference). The physical parameter observed was the folding test.

Comment [A7]: Physical parameters observed are folding test why not add a bite test?

2.4.1 Preference level (Hedonic test)

The hedonic test is a way to determine the level of preference for an object to be studied. Parameters observed were aroma, texture, color, and taste in catfish meatballs. The hedonic

scale starts from 1-9, which is very much dislike (1), dislike (3), neutral (5), like (7), and very like (9) (Soekarto, 1985). Parameters observed were aroma, texture, color, and taste in catfish meatballs.

2.4.2Folding test

The folding test is used to determine the strength and elasticity of the gel and is commonly used in industry because it is simple and fast [8]. Testing is done by the folding test, which can determine the level of elasticity. The folding test scale starts from 1-5, which is crushed when pressed by a finger (1), cracked when folded once (2), slightly cracked when folded once (3), does not crack when folded once (4), does not crack when folded once folded twice (5).

Comment [A8]: The method is not added

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2.5Data Analysis

$$X^2 = \frac{12}{NK(k+1)}\sum_{d=1}^{k}(Rj)^2 - 3N(K+1)$$

Description:
X^2 = Statistic Friedmantest
N = Repetition
Rj^2 = Total ranking of each treatment
K = Treatment

If there are the same numbers, the correction factor (FK) is calculated using the following formula:

$$FK = 1 - \frac{\sum T}{NK\,(K2-1)} \qquad Ho = \frac{X2}{FK}$$

Description:
T = N (t^3-t)
t = The number of observations that are the same for one rank
N = The number of the same observation values for one rank with the same t value

Multiple comparison test is defined by the following formula:

$$|Ri - Rj| \leq Z\left[1\frac{a}{k(k+1)}\right]\sqrt{\frac{bk(k+1)}{6}}$$

Description:
$|Ri - Rj|$ = Difference in average ranking
Ri = Average rating from sample to i
Rj = Average rating from sample to j
α = Experiment wise error rate at 0,05
b = Amount of combined observation data
k = Number of treatments
Z = Values in Table Z for Multiple Comparison

3. RESULTS AND DISCUSSION

3.1 Preference level

3.1.1 Appearance

Appearance parameters will be a consideration for panelists in assessing a food product. Assessment of the level of preference for appearance includes color, size, shape, texture, level of purity, and product carbonation [9].

Table 1. The average result apperance of catfish meatballs based on the addition of catfish bone flour

Addition Catfish Bone flour (%)	Median value	Average
A (0)	7	6,6[a]
B (5)	7	6,5[a]
C (10)	7	6,7[a]
D (15)	7	6,3[a]
E (20)	7	6[a]

Note: The average value followed by the same letter was not significantly different according to the multiple comparison test with (P<0.05)

Based on the results of statistical analysis in Table 1, it shows that the addition of catfish bone flour has no effect on the level of preference for the appearance of catfish meatballs. This is because the bone flour produced is slightly brownish white so that the catfish meatballs produced have a relatively the same color, which is opaque white and has an imperfect round shape. The appearance of catfish meatballs added with catfish bone flour is presented in Fig 1.

The 10% treatment had the highest average value and the 20% treatment had the lowest average value. This happens because the fishbone flour is not evenly distributed in the dough and causes the brightness level to decrease [10]. The color change in catfish meatballs is thought to be because the resulting catfish bone flour is slightly brownish white. This brown color is influenced by the drying process in the oven so that the Maillard reaction occurs [11].

Comment [A10]: Please add references to support your research results

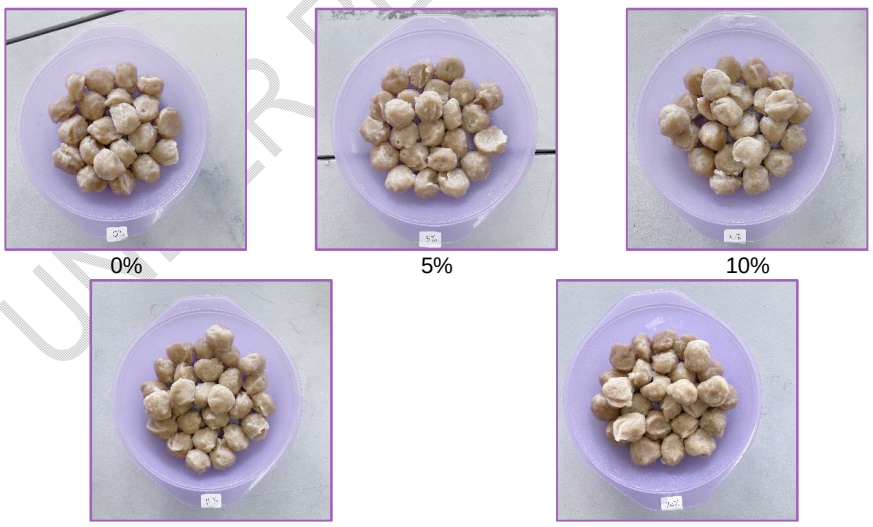

Fig 1. The appearance of bakso ikan lele dengan penambahan tepung tulang ikan lele

3.1.2 Aroma

The aroma's parameters can determine the food's delicacy [12]. Aroma assessment is done by smelling the product directly, with odors that the nose and brain can accept, namely sour, fragrant, rancid, and charred [11].

Table 2. The average result aroma of catfish meatballs based on the addition of catfish bone flour

Addition Catfish Bone flour (%)	Median value	Average
A (0)	5	6,2[a]
B (5)	5	6,3[a]
C (10)	7	6,9[a]
D (15)	7	6,7[a]
E (20)	7	6,6[a]

Note: The average value followed by the same letter was not significantly different according to the multiple comparison test with (P<0.05)

The statistical analysis results in Table 2 show that the addition of catfish bone flour does not affect the level of preference for the aroma of catfish meatballs. This is because catfish bone flour has a neutral aroma and the fishy smell is not too strong but rather a characteristic odor of dry bones. The effect of the aroma on fish balls is caused by the presence of spices added to the fish ball mixture [13]. The preferred fish balls generally have a distinctive taste of the fish used in the dough [14].
The 10% treatment had the highest average value on the level of preference for the aroma of catfish meatballs. Fishbone flavor can enhance the fish's distinctive aroma. The addition of fishbone flour is increasing, and the aroma is getting stronger [10].

Comment [A11]: Please add references to strengthen your argument not only present the data but also need to discuss why and why

3.1.3 Taste

The taste parameter determines the level of consumer acceptance. If other result parameters are liked, but the taste parameter is not liked, then the product is rejected [7]. Taste assessment uses the sense of taste or tongue [10].

Table 3. The average result taste of catfish meatballs based on the addition of catfish bone flour

Addition Catfish Bone flour (%)	Median value	Average
A (0)	7	6,7[b]
B (5)	7	6,6[b]
C (10)	7	6,9[b]
D (15)	5	5,4[a]
E (20)	5	4,7[a]

Note: The average value followed by the same letter was not significantly different according to the multiple comparison test with (P<0.05)

The statistical analysis in Table 3 shows that the addition of catfish bone flour affects the preference for the taste of catfish meatballs. The 10% treatment had the highest average value, meaning that the panel liked the addition of 10% fishbone flour to fish balls. This shows that the addition of fishbone flour has a good taste.
The panelists less favored the treatment of 15% and 20%. Increasing the addition of fishbone flour can reduce the taste of fish balls [15]. Increasing the concentration of fishbone flour will increase calcium and phosphorus content [16]. Calcium and phosphorus content causes the aftertaste to be slightly chalky [17]. The lime taste causes the level of taste preference to decrease due to the high calcium and phosphorus content [18].

Comment [A12]: There must be additional analysis related to the nutritional content of fish balls with the addition of catfish bone meal

3.1.4 Texture

Texture parameters can determine the panelists' acceptance of the level of elasticity or suppleness of food products [1]. Texture assessment is done by the sense of touch.

Table 4. The average result texture of catfish meatballs based on the addition of catfish bone flour

Addition Catfish Bone flour (%)	Median value	Average
A (0)	7	6,4[b]
B (5)	7	6,5[b]
C (10)	7	6,6[b]
D (15)	5	5,3[a]
E (20)	5	4,6[a]

Note: The average value followed by the same letter was not significantly different according to the multiple comparison test with (P<0.05)

The results of the statistical analysis in Table 4 show that the addition of catfish bone flour has an effect on the level of preference for the texture of catfish meatballs. The 10% treatment had the highest average value, meaning that the panelists liked the addition of 10% fishbone flour to fish balls. This shows that the addition of 10% fishbone flour did not affect the texture of catfish meatballs.
The 20% treatment had the lowest average value, meaning that the panelists did not like it. The texture produced in the 20% treatment was more rigid than the other treatments. The increase in the addition of fishbone flour resulted in a hard texture. The addition of fishbone flour to food products can reduce gluten. Gluten plays an essential role in building dough structure [19]. The decrease in gluten is due to the presence of calcium and phosphorus so that the bonding power of the dough built by gluten is less fused, resulting in a more rigid and less flat texture [15].

3.2 Decision making with Bayes method

Bayes method is one of the techniques used to analyze the best decision-making from some treatments aimed at producing optimal results based on the highest value of each treatment [20].
The results of the calculation of the weight criteria for the appearance, aroma, taste, and texture of catfish meatballs can be presented in Table 5. Based on the calculation results, the appearance criteria weights have the largest value of 0.49. This figure shows that the panelists consider the appearance criteria more to assess catfish meatball products. Determination of the essential appearance criteria, followed by calculating the appearance of each treatment.
The results of calculating the weight of the criteria and determining the best treatment on the criteria for appearance, aroma, taste, and texture are presented in Table 6. Based on the results of Bayes' calculations, it is known that the addition of fishbone flour by 10% is the most preferred treatment with an alternative value of 7 and a priority value of 19.76. Priority values and alternative values are generated to make optimal decisions by considering various criteria [20].

Table 5. The weight value of the catfish meatball criteria

Criteria	Weighta of criteria
Appearance	0,49

Aroma	0,29
Taste	0,05
Texture	0,18

Table 6. The decision matrix for the assessment of catfish meatballs using the Bayes method

Treatment (%)	Criteria				Alternative value	Priority value
	Appearance	Aroma	Taste	Texture		
A (0)	7	5	7	7	6.43	18.14
B (5)	7	5	7	7	6.43	18.14
C (10)	7	7	7	7	7	19.76
D (15)	7	7	5	5	6.55	18.48
E (20)	7	7	5	5	6.55	18.48
Weight	0.49	0.29	0.05	0.18	0.35	1

3.3 Folding Test

The folding test is a physical test that aims to determine the level of elasticity [21]. Elasticity is the force required to return to its original shape. The folding test results are directly related to the gel's strength [13].

Table 7. The average result folding test of catfish meatballs based on the addition of catfish bone flour

Addition Catfish Bone flour (%)	Median value	Nilai Rata-rata
A (0)	4	$4,2^{b}$
B (5)	4	$4,3^{b}$
C (10)	4	$4,35^{b}$
D (15)	4	$4,15^{b}$
E (20)	4	$3,55^{a}$

Note: The average value followed by the same letter was not significantly different according to the multiple comparison test with (P<0.05)

The results of statistical analysis showed that the addition of catfish bone flour affected the elasticity of catfish meatballs. Table 7 shows that treatment E has the lowest average value and is significantly different from treatments A, B, C, and D. This is due to the increasing addition of fishbone flour to reduce the elasticity of catfish meatballs. The addition of bone flour causes an anti-elastic reaction that reduces the elastic properties of gluten, causing a food product to harden [19]. This is due to the presence of calcium and phosphorus in fishbone flour resulting in a less compact dough that the resulting product is harder [17].

Comment [A13]: Please add references in concluding this research

4. CONCLUSION

Based on the research results, it can be concluded that catfish bone flour affects organoleptic and physical characteristics. The calculation results of the Bayes method showed that the addition of 10% catfish bone flour was the best treatment preferred by the panelists. The results of the assessment of the average preference level of 10% treatment are appearance 6.7 (like), aroma 6.9 (like), taste 6.9 (like), texture 6.6 (neutral-like), and 4-fold test, 35 (no cracks when folded once).

Comment [A14]: There should be further research related to the physico-chemical test of catfish flour meatballs

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