Original Research Article

Addition of Nilem Fish Protein Concentrate to Find its Preferred Level in Cakwe

ABSTRACT

Nilem fish (*Osteochilus hasselti*) are native Indonesian fish that live in freshwaters, such as rivers and swamps. This research aims to determine the right level of nilem fish protein concentrate addition to the preferred level of cakwe. The design is using a non-factorial Completely Randomized Design (CRD), with four levels of treatment like 0% or without the addition of nilem fish protein concentrate, 2.5% addition of nilem fish protein concentrate, 5% addition of nilem fish protein concentrate, and 7.5% addition of nilem fish protein concentrate. The parameters tested are organoleptic showing color, aroma, texture, and taste carried out by 20 semi-trained panelists. The results showed that cakwe with 5% nilem fish protein concentrate is mostly preferred by consumers with organoleptic values (color 6.9, aroma 7.3, texture 6.5, and taste 7.3).

Keywords: Cakwe; fish protein concentrate; nilem; preference level

1. INTRODUCTION

Protein is an essential nutrient for human body, especially for developing and repairing body tissues. Therefore it is necessary to fulfill nutritional quality of protein in the food supply. In general, animal protein has most suitable amino acid structure for human needs [1]. One good source of animal protein is fish [2] nilem.

Nilem fish (*Osteochilus hasselti*) is a native Indonesian fish that lives in freshwaters, such as rivers and swamps [3]. Nilem is a freshwater fishery commodity with potential value for cultivation because it has advantages, including a relatively easy cultivation technique and a very delicious meat taste [4]. Fish farming is less than that of other consumption fish because nilem fish has many spines, thin meat and a substantial portion of gonads so that nilem fish is less desirable for direct consumption [5]. Therefore, it is necessary to promote processed fishery products, one of which is fish protein concentrate flour.

Fish protein concentrate (FPC) is a product produced by removing air and fat from fish meat, thereby increasing the concentration of protein and other nutritional ingredients [6]. The advantages of FPC are that it has a long shelf life and is more flexible in its use [7], besides having very high protein. The use of FPC as an additional ingredient in the manufacture of low protein food products can be an alternative for processing fishery products to improve the nutritional quality of protein.

Cakwe is one of the snacks that is quite popular and is favored by children to adults. It has low nutritional protein content. The addition of nilem fish protein concentrate to cakwe is expected to increase the nutritional protein value of cakwe.

2. MATERIAL AND METHODS

2.1 Place and Time

The research was conducted from March 2019 to January 2020 at the Laboratory Fisheries Product Processing, Faculty of Fisheries and Marine Science, Padjadjaran University, Indonesia.

2.2 Materials and Tools

The tools used in this research are digital scale, knife, cutting board, food processor, spoon, basin, pan, baking sheet, glass jar, measuring cup, cloth, oven, blender, sieve, rolling pin and frying pan. The materials used in this research are nilem fish, hexane, $NaHCO_3$, water, wheat flour, baking powder, baking soda, instant yeast, cooking oil, salt and sugar.

2.3 Research Methods

The level of preference for cakwe was analyzed by Friedman's non-parametric statistical method consisting of 4 treatments and 20 semi-trained panelists as a test. The treatment of adding nilem fish protein concentrate in cakwe is as follows:

Treatment A (control) : 0% or without the addition of nilem fish protein concentrate.
Treatment B : 2.5% addition of nilem fish protein concentrate.
Treatment C : 5% addition of nilem fish protein concentrate.
Treatment D : 7,5% addition of nilem fish protein concentrate.

The formulation of materials for making cakwe is shown in Table 1.

Table 1. Formulation making cakwe

Materials	Treatment			
	A (0%)	B (2.5%)	C (5%)	D (7.5%)
Flour (g)	100	100	100	100
Fish protein concentrate (FPC) (g)	0	2.5	5	7.5
Yeast powder (g)	1.2	1.2	1.2	1.2
Baking powder (g)	0.8	0.8	0.8	0.8
Baking soda (g)	0.8	0.8	0.8	0.8
Salt (g)	2	2	2	2
Sugar (g)	1.2	1.2	1.2	1.2

The procedure for making cakwe by adding nilem fish protein concentrate is based on Irmadona [8] with slight modifications as follows as:

- Mix warm water, yeast, and sugar, then let stand until foamy.
- Dry ingredients such as wheat flour, nilem FPC flour, baking powder, baking soda, and salt are mixed.
- The yeast dough is mixed with the dry ingredients, then stir, and then add the remaining water.
- Add enough oil then knead the cakwe dough until all the ingredients are perfectly emulsified.
- Leave the cakwe mixture until it expands for about 1.5 hours.
- Shape the cakwe dough as per need.
- Fry the cakwe dough until it expands.

2.4 Parameter Observed

The parameters observed in this research are the organoleptic characteristics of cakwe, including color, aroma, texture and taste. Organoleptic characteristics were tested using a hedonic test with 20 semi-trained panelists consisting of students from the Faculty of Fisheries and Marine Sciences, Padjadjaran University, Indonesia.

2.5 Data Analysis

Organoleptic observation data were analyzed using non-parametric statistics, namely two-way variant analysis of Friedman's test. The Friedman test was conducted to determine effect of treatment of the addition of nilem fish protein concentrate on the level of preference. The Friedman's Test formula is as follows:

$$X^2 = (\frac{12}{nk\ (k+1)} \sum_{i=0}^{n} (Rj)^2) - 3n\ (k+1)$$

Description:
X2 : Friedman Test Statistics
N : Repeat
K : Treatment
Rj : Total ranking of each treatment

The Bayes method was used to determine the best treatment by considering four parameters (color, taste, aroma and texture). The Bayes test results will show that the highest priority value element is the one most preferred by the panelists. The Bayes equation is as follows:

$$XG = \sqrt[n]{\sqcap . Xi}$$

Description:
XG : Geometric average
⊓ : Permutation
N : Number of panelists
Xi : Rating from the 1st panelist

3. RESULTS AND DISCUSSION

The organoleptic test results on color, aroma, taste, and texture of cakwe with the addition of nilem fish protein concentrate were as follows.

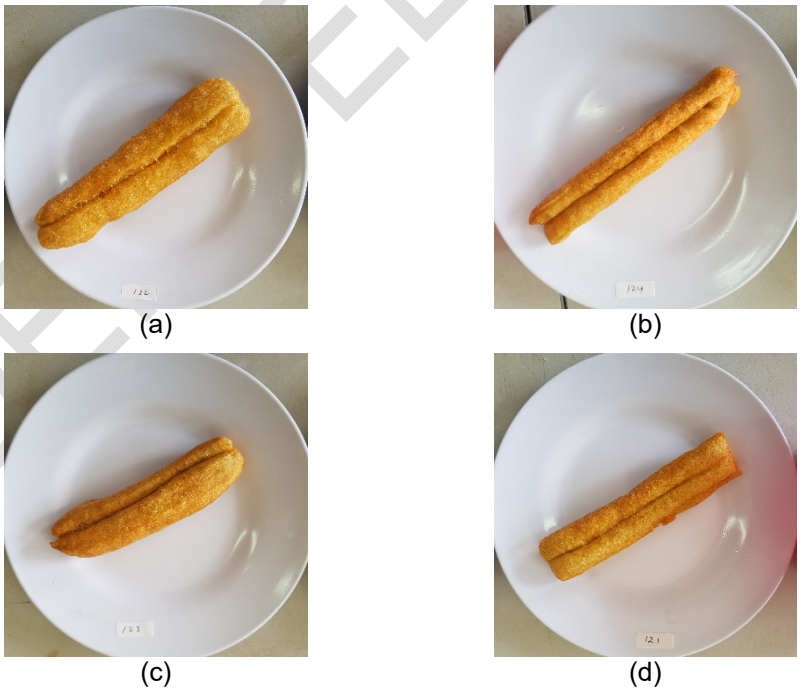
(a) (b) (c) (d)

Fig. 1. Cakwe with the treatment of adding nilem fish protein concentrates
(a) 0% or without the addition of nilem fish protein concentrate, (b) 2.5% addition of nilem fish protein concentrate, (c) 5% addition of nilem fish protein concentrate, (d) 7.5% addition of nilem fish protein concentrate

3.1 Level of Preference for the Color of Cakwe

Color is the first sensory that consumers can see directly [9]. Consumers can judge a product quickly and easily by looking at color parameters. The color of a product can increase consumer attractiveness to the product.

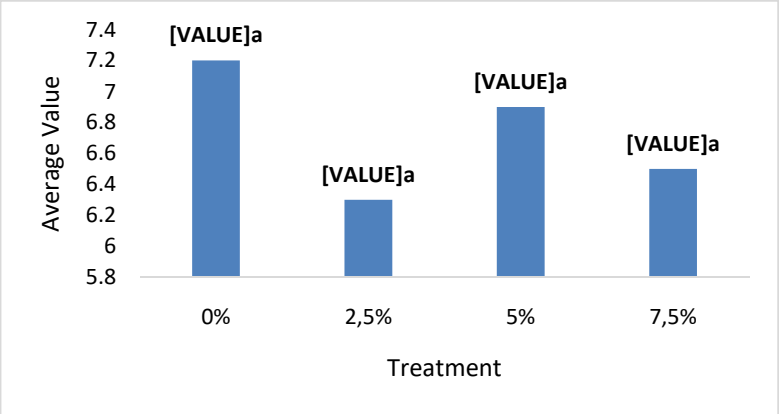

Fig. 2. The average value for the color of cakwe

Based on the Friedman statistical test results, it showed that the addition of nilem fish protein concentrate to cakwe did not significantly affect the level of preference for the color of cakwe, which means that in the most considerable treatment or treatment of adding 7.5% nilem fish protein concentrate, the color of cakwe was still favored by panelists. Based on the assessment of the color of cakwe with the addition of nilem fish protein concentrate, the median value was 7 for all treatments (preferred). Treatment A (0% or without nilem fish protein concentrate addition treatment) had the highest average of 7.2 with bright golden brown color criteria. Then, treatment C, which has a slightly dark golden brown color and a few brownish spots, treatment D has a slightly dark golden brown color and lots of brownish spots and treatment B has a slightly dark golden brown color and very few brownish spots.

From the observations, it can be seen that the addition of nilem fish protein concentrate to cakwe can change its color from pale golden brown to darker. The decrease in color brightness or the darker shade of the cakwe was caused by more significant content of the nilem fish protein concentrate added in each treatment. The nilem FPC added to cakwe contains high protein content so that when the heating process is done, the protein is denatured. During the frying process, there occurs Maillard reaction [10] because of the presence of an amino group free from protein that binds to the hydroxyl group of reducing sugars, causing the product to turn brown [11]. A decrease in brightness levels occurs because high protein levels can increase the risk of a Maillard reaction.

3.2 Level of Preference for the Aroma of Cakwe

The aroma is one of the critical parameters to test because it can give an impression/assessment of the food product quickly and also affect the taste of the food product [12].

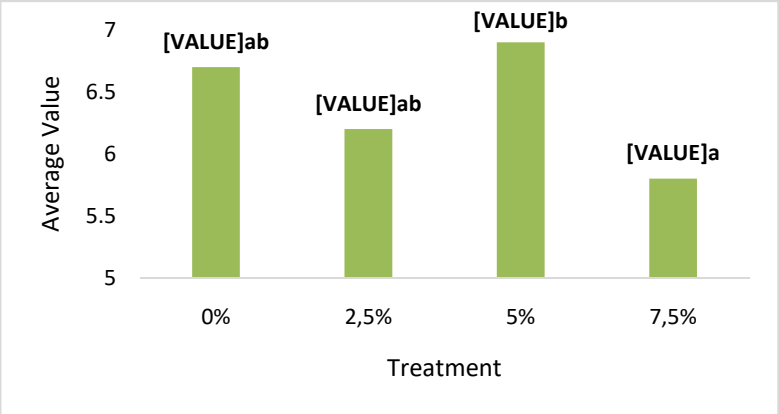

Fig. 3. The average value for the aroma of cakwe

Based on the Friedman statistical test results, it can be seen that the addition of nilem fish protein concentrate in cakwe has a significant effect on the level of preference for the aroma of cakwe. Based on assessment of the aroma of cakwe with the addition of nilem FPC flour, the median value was 7 for all treatments (preferred). Furthermore, based on the multiple comparison test results, treatment C (addition of 5% nilem FPC) produced the highest (most preferred) aroma level average of 6.9 with a distinctive aroma of cakwe, namely savory aroma and a slight fish-specific aroma. In the addition of 2.5% FPC, there was also a slight fish aroma, but the panelists still liked it. The lowest average aroma value is found in the 7.5% treatment, which is 5.8. This happened because there was a specific aroma of fish that caused the panelists to dislike 7.5% treatment cakwe.

The addition of nilem fish protein concentrate (FPC) affected the average value of the taste level of cakwe. This is in line with the research results of [12] that cork FPC's addition has a significant effect on donuts' aroma value. The donuts produced with the addition of snakehead fish protein concentrate have a neutral aroma where a fishy smell in the snakehead fish protein concentrates that does not sting. There is also a distinctive aroma of donuts. One of the factors that can determine a product's aroma comes from the content of the freshwater fish used. If the fish contents are given adequate treatment, unwanted aromas can be minimized [13].

3.3 Level of Preference for the Texture of Cakwe

The texture is one of the parameters for assessing the acceptance of a food product. The texture is an essential characteristic of food products that can affect consumer acceptance. The texture is usually related to sensing or organoleptic testing on solid materials that can be felt by the sense of touch and taste.

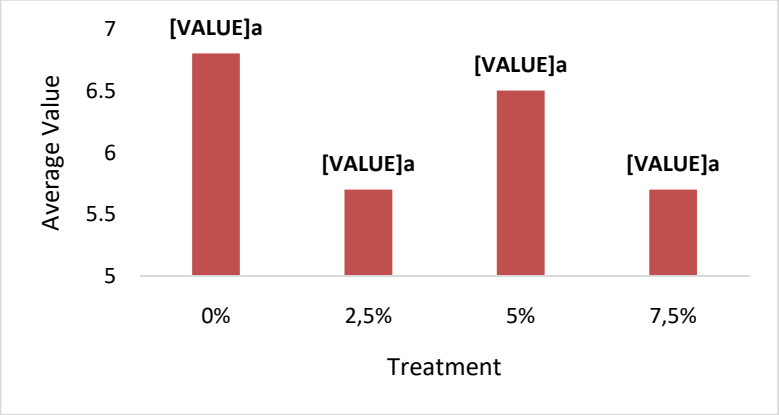

Fig. 4. The average value for the texture of cakwe

The Friedman statistical test results showed that the addition of fish protein concentrate (FPC) to cakwe had no significant effect on the level of preference for the texture of cakwe. Based on the panelists' assessment of the cakwe texture, the median value ranged from 5 to 7. Furthermore, based on the multiple comparison test results, treatment A (addition of 0% nilem FPC) produced the highest level of texture preference (most preferred). Treatment A was the most preferred treatment for panelists because it produced cakwe with a crunchy texture on the surface and soft and hollow on the inside. In treatment C, the resulting cakwe texture was also crunchy on the surface and soft and hollow inside but was slightly denser than treatment A. Meanwhile, treatment D had a texture of cakwe which was less soft and dense so that panelists less preferred it.

The number of FPC additions influences the resulting cakwe texture. The greater the number of FPC additions, the resulting cakwe becomes less fluffy so that the texture becomes less soft and tends to be dense. This is because the number of FPCs added to the dough affects the lack of other compositions in the bread dough, one of which is the moisture content in the bread produced [14]. Fish protein concentrate is water absorbent [15]. Many things affect the texture of food ingredients, including the ratio of protein content, fat, processing temperature, water content, and water activity.

Meanwhile, the increasing number of additions of nilem fish protein concentrate into cakwe can make the texture of the cakwe denser. The higher will be the protein content in the product, the higher will be the hardness level. This is because the higher will be the protein content, the lower will be the water content so that the cakwe becomes denser. The presence of water in a food product will affect the softness or hardness of a product. Wheat flour contains gluten, flexible and elastic and can make the cakwe texture soft, but its ability is limited due to increased protein content in a product [16].

However, the addition of nilem fish protein concentrate at 0% to 7.5% treatment into cakwe was still acceptable to the panelists because the average value in each treatment was still above the value of 3 or above the rejection limit.

3.4 Level of Preference for the Taste of Cakwe

The taste of food is a factor that determines consumer acceptance. If a product tastes bad even though other parameters' assessment is better, it will still be rejected by consumers [17].

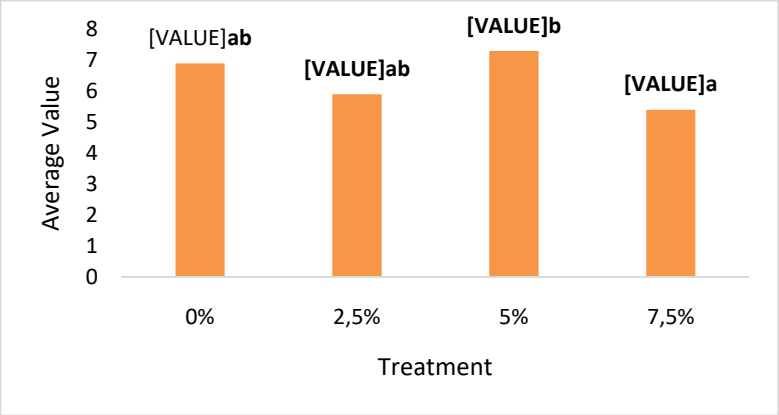

Fig. 5. The average value for the taste of cakwe

The Friedman statistical test results showed that the addition of nilem fish protein concentrate (FPC) to cakwe had a significant effect on the liking level of cakwe. Furthermore, based on the multiple comparison test results, the addition of a 5% nilem FPC resulted in the highest (most preferred) taste preference level. The addition of 5% nilem fish protein concentrate was the most preferred treatment because the 5% treatment produced cakwe with a savory taste, a specific taste of cakwe and very little taste of nilem fish protein concentrate. This is in line with [14] concerning fortification of tilapia protein concentrate on sweet bread; the highest taste value was produced at 5% treatment. This is because the effect of the tilapia FPC fortification given is not too high. Similar to cakwe, the addition of 5% nilem FPC is not too high, so the resulting taste of cakwe is not much different from cakwe without the addition of nilem FPCs.

In the treatment, the addition of a 7.5% nilem FPC showed a decrease in the panelists' preference because it produced cakwe with a specific taste of cakwe, and there was a slight taste of nilem fish protein concentrate. However, the taste of cakwe with the addition of nilem fish protein concentrate at 0% to 7.5% treatment was still acceptable to the panelists.

The taste test involves more of the sense of taste, namely the tongue. Taste can determine a person's assessment of a food product and determine the satisfaction value of people who consume it [12]. Most fish protein concentrates have a typical taste and not a specific fish taste, while the type C fish protein concentrate still leaves a fish odor and taste [18]. The taste of nilem fish in making cakwe is not too strong because the taste of fish from the fish protein concentrate in cakwe is covered with other raw materials from making cakwe, one of which is wheat flour. The taste produced from cakwe is dominant with a savory taste resulting from broth used in making cakwe.

3.5 Bayes Test

The decision making on the relative weight value and criteria for color, aroma, texture and taste of cakwe with the addition of nilem fish protein concentrate was carried out with a pairwise comparison. The pairwise comparison test data from 20 semi-trained panelists on the preference level of cakwe with the addition of nilem fish protein concentrate can be seen in Table 2.

Table 2. Criteria value of cakwe with the addition of nilem fish protein concentrate

Criteria	Value of Criteria
Color	0.17
Aroma	0.15
Texture	0.17
Taste	0.50

Based on the calculation, the value criteria for color, aroma, texture and taste of cakwe can be seen in Table 2. Based on the calculation results, the highest criterion weight value is found in the flavor parameter that is 0.50, while the lowest criterion weight is the aroma that is 0.15. This shows that the taste parameter is the most crucial parameter according to panelists in choosing cakwe products with the addition of nilem fish protein concentrate. Furthermore, the assessment decision matrix with the Bayes method can be seen in Table 3.

Table 3. Assessment decision matrix via Bayes method

Treatment	Criteria				Alternative Value
	Color	Aroma	Texture	Taste	
0%	7.20	6.70	6.80	6.90	6.90
2.5%	6.30	6.20	5.70	5.90	5.98
5%	6.90	6.90	6.50	7.30	**7.03**
7.5%	6.50	5.80	5.70	5.40	5.70
Total	0.17	0.15	0.17	**0.50**	25.62

Based on calculations using the Bayes method, the results showed that cakwe with the addition of nilem fish protein concentrate in all treatments were still acceptable or preferred by the panelists. The highest alternative value (7.03) was found in the treatment of adding 5% nilem fish protein concentrate with a weight value of taste criteria (0.50). Data from the Bayes method shows that taste is the most crucial criterion in the panelists' final decision regarding the level of panelist preference in this research.

3.6 Recapitulation of Observation

The overall results of observations of the cakwe with the addition of nilem fish protein concentrate are presented in Table 4.

Table 4. Recapitulation of observation results of cakwe

Observations	The Average Treatment of Addition of Nilem Fish Protein Concentrate			
	0%	2.5%	5%	7.5%
Hedonic Test				
Color	7.2a	6.3a	6.9a	6.5a
Aroma	7.5ab	7.1ab	7.3b	6.9a
Texture	6.8a	5.7a	6.5a	5.7a
Taste	6.9ab	5.9ab	7.3b	5.4a
Bayes Method				
Alternative Value	6.90	5.98	7.03	5.70

Based on the results of the hedonic test observations, it can be seen that the average value of the addition of nilem fish protein concentrate (FPC) on the color, aroma, texture and taste of cakwe is ranging from 5.4 to 7.5. Meanwhile, based on the Bayes method, the highest alternative value is found in the addition of 5% nilem FPC, which is 7.03, which means that the treatment is the most preferred treatment by panelists. In comparison, the lowest alternative value is found in the addition of 2.5% nilem FPC treatment, which is equal to 5.98.

4. CONCLUSION

The most preferred product by panelists was the cakwe with the addition of a 5% nilem fish protein concentrate with an average hedonic value of color 6.9, aroma 7.3, texture 6.5 and taste 7.3.

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