



# **Addition of Mackerel Fish Head Flavor Powder to Cilok's Preference Level**

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## **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## **ABSTRACT**

This research aims to determine the appropriate level of the addition of mackerel fish head flavor powder to obtain the cilok most preferred by panelists. This research was conducted from September to December 2019 at the Fishery Product Processing Laboratory, Faculty of Fisheries and Marine Sciences Universitas Padjadjaran. The method used is experimental with 4 treatment levels of adding mackerel fish head flavor powder that is 0%, 5%, 6%, and 7% of the amount of tapioca flour and wheat flour used. The parameters observed were the level of preference for appearance, aroma, texture, and taste of cilok. Based on the research results it can be concluded that the most preferred cilok was obtained from the treatment of adding mackerel fish head flavor powder as much as 6%.

*Keywords: Cilok; flavor powder; mackerel fish head; preference level.*

## **1. INTRODUCTION**

Mackerel fish is a type of sea water fish from the pelagic fish group that has a distinctive aroma. Mackerel fish is the most important marine

fishery commodity in several countries because it has high commercial value. The spread of this fish covers the entire West Pacific region from North Africa and the Red Sea to the waters of Indonesia, Australia, Fiji to the waters of China

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and Japan. The potential distribution of mackerel fish in Indonesia is almost in all waters of Java and Nusa Tenggara, Sumatera, Kalimantan, Sulawesi, Maluku, and Irian [1]. In 2017 the volume of mackerel fish production in West Java Province reached 4,223,764 kg [2].

The high consumption of people towards mackerel fish meat causes the resulting waste such as bones, heads and viscera of mackerel to increase. Several attempts have been made to utilize mackerel fish waste, such as making gelatin [3] and fish glue [4] derived from mackerel fish bones, block-shaped broth [5], and flavor powder made of mackerel fish heads [6].

The flavor is a combination of taste, smell, and mouth stimulation [7]. Flavor is an important factor in fresh and processed food, especially in fish-based products. This is because the flavor can affect the level of acceptance, preferences, and consumer consumption of a product. The flavor characteristics of a commodity are influenced by volatile and non-volatile flavor compounds [8]. Based on the physical form, flavor is classified into a liquid, emulsion, and solid form.

Making mackerel fish head flavor powder requires supplementary spices and fillers. The use of fillers aims to speed up the drying process, prevent heat damage during heating, increase total solids, increase volume, and coat flavor components [9]. The filler used in this research is maltodextrin.

Mackerel head flavor powder can be used as a giver of distinctive aroma and taste in food. Examples of foods that can be added to this flavored powder are cilok. Cilok is one of the local food products originating from West Java and is a favorite snack for all groups of children and adults. Cilok is made from tapioca flour with additional supplementary spices such as sauce, soy sauce, and peanut sauce. Cilok has a round shape like meatballs but has different basic ingredients [10]. The addition of mackerel head flavor powder on cilok will affect the level of preference. Therefore research needs to be done to get the best cilok formulation with the addition of mackerel head flavor powder based on preference level.

## 2. MATERIALS AND METHODS

### 2.1 Research Tools and Materials

The tools used in the process of making cilok mackerel heads flavor powder namely basins, scales, analytical scales, knives, cutting boards,

measuring cups, spoons, pans, stirrers, stoves, filters, ovens, trays, plastic soleps, blenders, and sieves. The tools used in the organoleptic test are white plastic plates and questionnaire sheets.

The materials used in this research are as follows. The ingredients used in making mackerel head flavor powder consist of 700 gr mackerel fish heads, 15% maltodextrin from the broth produced, garlic, onion, salt, pepper, turmeric, and water as much as 1400 ml. The ingredients used in making cilok for each treatment were 100 g tapioca flour, 50 g wheat flour, garlic, salt, pepper, mackerel fish head flavor powder, and warm water.

The research was conducted in September to December 2019 at the Laboratory of Fisheries Product Processing at the Faculty of Fisheries and Marine Sciences, Universitas Padjadjaran.

### 2.2 Research Methods and Procedures

The research method used was experimental with 4 treatments adding mackerel head flavor powder. The four treatments are as follows:

- Treatment A = Addition of 0% mackerel fish head flavor powder (control)
- Treatment B = Addition of 5% mackerel fish head flavor powder
- Treatment C = Addition of 6% mackerel fish head flavor powder
- Treatment D = Addition of 7% addition of mackerel fish head flavor powder

The addition of mackerel fish head flavor powder is based on the weight of tapioca flour and flour used in making cilok.

The process of making mackerel fish head flavor powder begins with fresh mackerel fish heads washed thoroughly then weighed. Mackerel fish head mixed with water and seasonings. The ratio of mackerel fish head to water is 1: 2. The percentage of the amount of seasoning used is based on the amount of water. Seasoning formulations are presented in Table 1.

**Table 1. Seasoning formulation in the cilok mackerel head flavor powder making**

Seasoning	Percentage per weight of water used for broth extraction
Garlic	2%
Onion	2%
Salt	5%
Pepper	0,1%
Turmeric	1%

*Source: Modification of Ramadhani (2015)*

Then the mackerel fish head, water, and seasonings are put in a pan and then boiled for 60 minutes with a boiling temperature of 85°C-100°C. The broth from the stew is filtered using a sieve to obtain pulp-free liquid (filtrate). Then the broth (filtrate) was added by maltodextrin as much as 15% of the weight of the resulting broth and then stirred for several minutes until homogeneous so that the liquid flavor was obtained. Furthermore, the flavored liquid is dried using an oven at 75°C for 60 minutes by pouring on a baking sheet and then flattened so that a thin thickness is obtained. The dried flavor has been crushed using a blender to form a powder. The flavor powder is sieved using a Tyler 80 mesh sieve to obtain the desired size of flavor powder. Then the flavor powder is packaged using zip lock plastic.

The process of making mackerel flavored head powder cilok consists of mixing ingredients, making cilok dough, molding the dough into small dots, and boiling. The formulation of cilok mackerel fish head flavor powder making refers to [11] with some modification. The formula is presented in Table 2.

### 2.3 Observed Parameters

The parameters observed in this research are the level of appearance, aroma, texture, and taste of cilok with the addition of mackerel fish head flavor powder tested using a hedonic test.

#### 2.3.1 Hedonic test

The hedonic test is a test in which panelists are asked to give a personal response regarding likes or dislikes of a product and its level [12]. This test aims to determine the response of panelists to cilok products with the addition of mackerel head flavor powder based on the characteristics of color, aroma, texture, and taste. This test was conducted by 20 semi-trained panelists. The scale of hedonic test scores ranges from 1-9, namely 1 (very dislike), 3 (dislike), 5 (neutral / ordinary), 7 (like) and 9 (very like) [13].

#### 2.3.2 Data analysis

Data from hedonic test results were analyzed statistically non-parametrically using a two-way analysis of the Friedman test with the Chi-square test [14]. Friedman test was used to determine the effect of the addition of mackerel fish head flavor powder treatments to the cilok preference level. If there are significant differences between treatments, then proceed with multiple comparison tests to determine the differences between treatments. Friedman's test formula is as follows:

$$x^2 = \left[ \frac{12}{bK(K+1)} \sum_{j=1}^k (R_j)^2 \right] - 3b(K+1)$$

Description:

$X^2$  = Friedman Test Statistics

b = Deuteronomy

K = Treatment

R<sub>j</sub> = Total ranking of each treatment

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

$$FK = 1 - \frac{\sum T}{bK(K^2 - 1)}$$

$$X^2_c = \frac{X^2}{FK}$$

Description:

$T = \sum t_i^3 - \sum t_i$

t<sub>i</sub> = The number of same observation values for a rank in the i-block

The significant value of the observation price  $X^2_c$  can be determined by using the Chi-squared critical prices table with db = k-1;  $\alpha = 0.05$ . If the calculated  $X^2_c$  value >  $X^2_c$  table, means the addition of mackerel fish head favor powder to cilok has a significant effect on the level preference then the test is continued by using the

**Table 2. Cilok formulation with the addition of mackerel head flavor powder**

Treatments	Tapioca Flour (g)	Wheat Flour (g)	Salt (g)	Garlic (g)	Pepper (g)	Water (ml)	Mackerel Head Flavor Powder (g)
A	100	50	5	2	0,4	100	0
B	100	50	5	2	0,4	100	7,5
C	100	50	5	2	0,4	100	9
D	100	50	5	2	0,4	100	10,5

multiple comparison test to find out the median values that are not the same or the difference between treatments. The multiple comparison test formula is as follows:

$$|R_i - R_j| \leq Z \left[ 1 \frac{\alpha}{K(K-1)} \right] \sqrt{\frac{bK(K+1)}{6}}$$

Description:

$|R_i - R_j|$  = Difference in the ranking of each treatment

$R_i$  = Average rank of the  $i$  sample

$R_j$  = Average rank of the  $j$  sample

$\alpha$  = Experiment wise error

$b$  = The amount of data or repetition

$K$  = The number of treatments

$Z$  = Value in table Z for multiple comparison

Then to determine the best treatment used interest index with the Bayes method. Bayes method is used to perform analysis in the best decision making with the aim of producing optimal results by considering the criterion weight and median value [15].

### 3. RESULTS AND DISCUSSION

#### 3.1 Hedonic Test

##### 3.1.1 Appearance

Appearance is an important parameter to be assessed by panelists. Although the color may not be able to determine the level of absolute consumer preference, it can affect consumer acceptance [16]. The observations result of cilok's appearance is presented in Fig. 1.

Based on the panelist's assessment of cilok, the average value of the appearance level ranged from 5.8-7, which means that the cilok's appearance ranged from ordinary to preferred by

the panelists. The highest average value of appearance preference level was found in cilok with the addition of 5% mackerel fish head flavor powder which was 7, while the lowest average value of appearance preference level was found in cilok with the addition of 7% mackerel fish head flavor powder which was 5.8. Cilok obtained from the addition of 5% mackerel fish head flavor powder has a slightly brownish yellow color. Cilok's appearance from various treatments can be seen in Fig. 2.

Based on the results of the Friedman statistical test showed that the level addition of mackerel fish head flavor powder did not significantly affect the preference level of cilok's appearance. It means that the cilok's appearance with the concentration addition of 7%, 6%, 5%, and 0% (control) mackerel head flavor powder is equally preferred by the panelists even though the color is a little different. The difference between cilok's color resulting from the addition of 5%, 6%, and 7% mackerel head flavor powder is not too significant so that it is still preferred by panelists even though the cilok's color treatment of 7% is the darkest compared to other treatments.

Based on Fig. 2 it can be seen that the higher concentration of addition mackerel head flavor powder causes the darker color of cilok. The brown color on cilok is thought to be caused by a non-enzymatic browning reaction in the form of the Maillard reaction. Maillard reaction is a reaction that occurs between carbohydrates, especially reducing sugars with free amine groups of protein to form brown melanoidin compounds. This compound gives a brownish color to cilok with the addition of mackerel fish head flavor powder. The reaction occurs during cilok boiling [17].

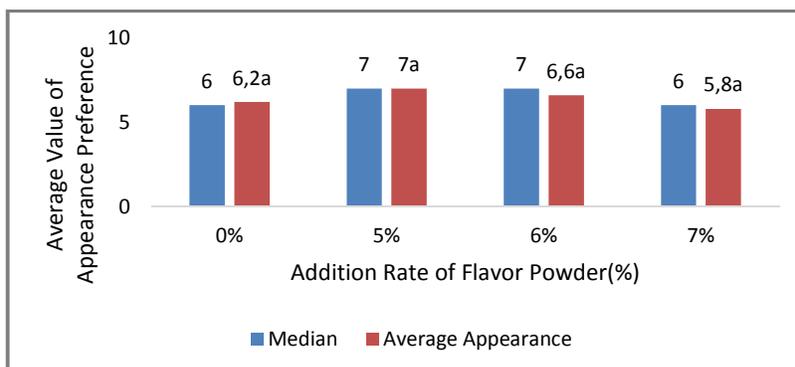
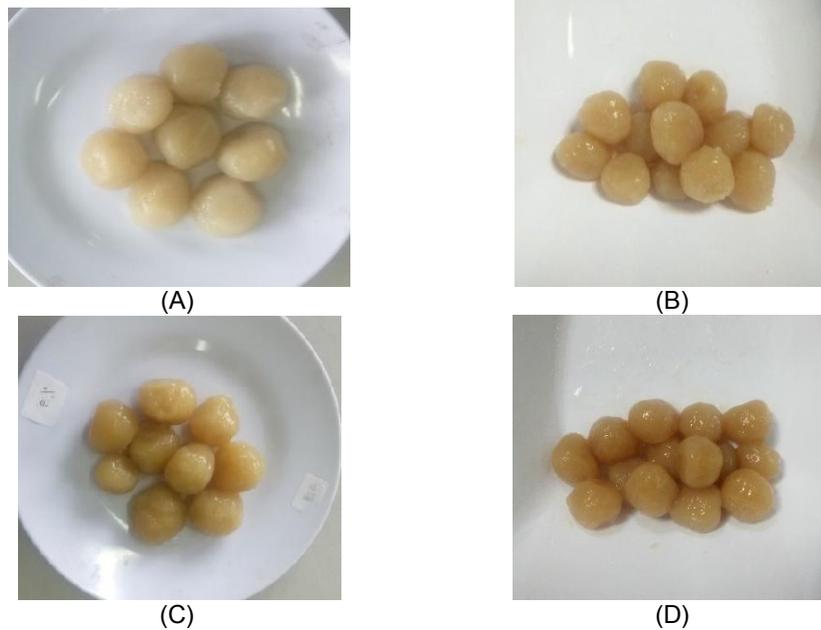


Fig. 1. The preference level of cilok's appearance



**Fig. 2. The appearance of cilok by various treatments of adding mackerel fish head flavor powder. (A) 0% treatment, (B) 5% treatment, (C) 6% treatment and (D) 7% treatment**

### 3.1.2 Aroma

One important factor in determining the acceptance of a food product is the aroma. The aroma received by the nose and brain is a mixture of the four main smells, namely fragrant, rancid, sour, and charred. The aroma can determine the delicacy of food and become its attraction in determining the taste of a food product [18]. The observations result of cilok's aroma is presented in Fig. 3.

Based on the panelists' assessment of Cilok products, the average value of preference level of aroma ranges from 5.7 - 6.8, which means that the aroma of cilok is normal to the preferred level of the panelists. The highest average aroma value was found in cilok from the treatment of adding 7% mackerel fish head flavor powder, namely 6.8, while the lowest average aroma value was found in cilok from the treatment of adding 0% mackerel fish head flavor powder, namely 5.7. Based on the results of the Friedman statistical test, it shows that the treatment of adding mackerel fish head flavor powder does not affect the level of preference for the resulting cilok aroma. This means that the aroma of the cilok 7% treatment is still favored by the panelists as well as the cilok obtained from the addition of 0%, 5%, and 6% mackerel fish head flavor powder treatment. This can be caused by the

distinctive aroma of mackerel fish head flavor powder and not too fishy because the manufacturing process is added with spices.

This is different from the results of research by [19] regarding the use of tuna bone waste in the manufacture of cilok as a source of calcium. The treatment of the addition of tuna bone meal influences the likeness level of the resulting cilok aroma. Increasing the percentage of the addition of tuna bone flour causes the scent of cilok to get stronger so it is less liked by panelists.

### 3.1.3 Texture

The texture is one of the criteria for determining the quality of a food ingredient. The texture of a food ingredient is closely related to the water content in that food. If a food item contains a large amount of water, then the food ingredient has a soft texture, and vice versa [19]. The observations result of cilok's texture is presented in Fig. 4.

Based on Fig. 4 it can be seen that the average value of the highest cilok texture preference level was obtained from the treatment of an additional 6% mackerel head flavor powder which was 7.6. Based on the results of the Friedman statistical test, it shows the treatment of addition mackerel fish head flavor powder has a significant effect on

the preference level for the cilok texture. Furthermore, the results of the multiple comparison test showed that the preference level for cilok texture obtained from the addition of 5% mackerel fish head flavor powder treatment was significantly different from the 6% treatment but not significantly different from the 0% and 7% treatments. The treatment of addition 6% mackerel fish head flavor powder produced the most preferred of cilok texture by panelists because the texture was chewy, not hard, and slightly soft. The higher concentration of the addition of mackerel fish head flavor powder causes the cilok texture is getting chewier, not hard and soft. This is similar to the research conducted by [20] regarding the addition of carrot flour to cilok. The higher concentration of addition carrot flour, the chewier, and more tender the cilok texture will be.

### 3.1.4 Taste

Taste is one of the factors that play an important role in determining a consumer's final decision to accept or reject food [7]. Taste is a response to chemical stimulation that reaches the taste buds, especially the basic types of

sweet, sour, salty, and bitter flavors [21]. The results of observations on the level of cilok taste preference from various treatments of adding mackerel fish head flavor powder are presented in Fig. 5.

Based on the results of the Friedman statistical test, it shows that the treatment level of addition of the mackerel fish head flavor powder has a significant effect on the level of preference for the resulting cilok taste. Furthermore, based on the results of the multiple comparison test, it showed that the addition of 6% mackerel fish head flavor powder resulted in the preferred level of cilok flavor that was the most preferred by the panelists. The 6% treatment was significantly different from the 5% treatment, but not significantly different from the control treatment and 7% treatment. The treatment of adding 6% mackerel head flavor powder resulted in the highest average value of cilok taste preference, namely 7.3. The increasing level of adding mackerel fish head flavor powder will produce cilok which has a stronger and more savory fishy taste. Nevertheless, the treatment of adding 7% mackerel fish head flavor powder produced cilok which was accepted and favored by panelists.

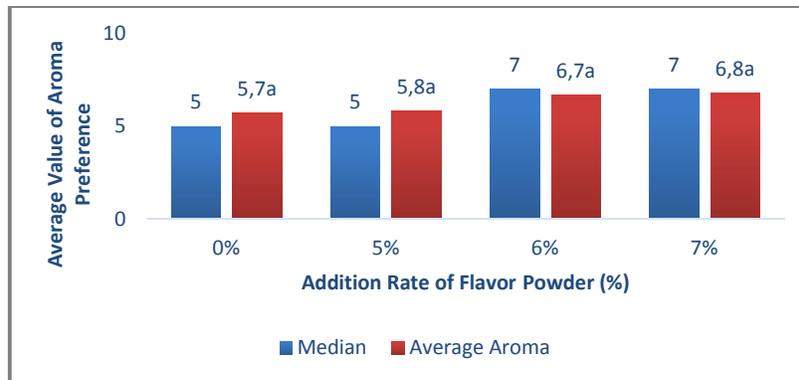


Fig. 3. The preference level of cilok's aroma

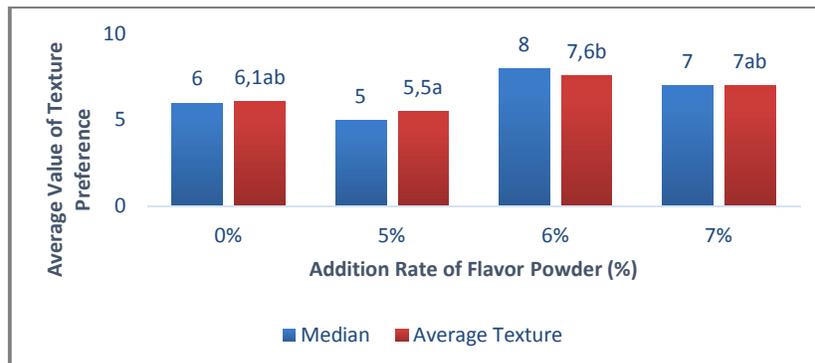


Fig. 4. The preference level of cilok's textur

This is by [22] that the higher the level of adding catfish head meal to cilok production, the more savory the taste. This is because the nature of fish meal is savory. The savory taste is formed by the type of amino acids glutamate and aspartic acid contained in the flavor powder of mackerel fish head [23].

### 3.2 Decision Making by the Bayes Method

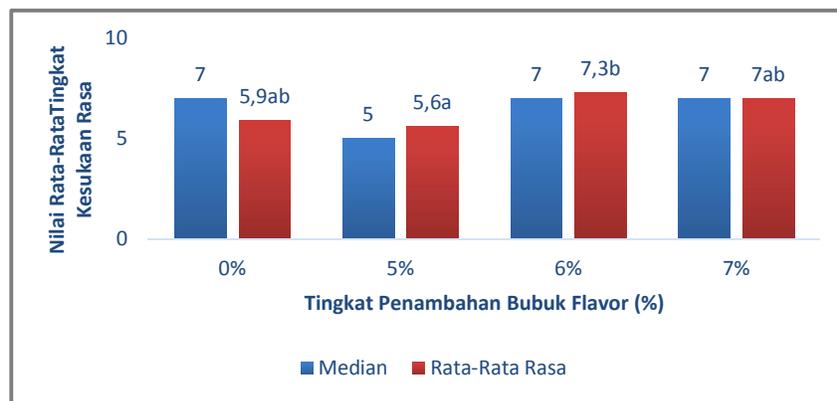
Decision making using the Bayes method is used to analyze the best decision making by considering the weighting of criteria and median values [24]. The weight of the criteria is obtained by performing a pairwise comparison test on the appearance, aroma, texture, and taste parameters of cilok obtained from various treatments of adding mackerel head flavor powder and the calculation results are presented in Table 3.

**Table 3. Weight of criteria for cilok mackerel head flavor powder**

Criteria	Weight of criteria
Appearance	0,09
Aroma	0,16
Texture	0,19
Taste	0,56

Based on the calculation of the weight of criteria, the taste parameter has the highest criterion weights which are 0.56. This shows that the taste parameter is the most important parameter according to panelists in choosing cilok mackerel head flavor powder. The second important parameter is a texture with a weight of criteria 0.19; aroma 0.16 and appearance 0.09. Furthermore, the calculation results of the Bayes method in determining the best treatment by considering the appearance, aroma, texture, and taste criteria are presented in Table 4.

Based on Table 4, it can be seen that the treatment of adding 6% and 7% mackerel fish head flavor powder has a certain similarity to the median value of each criterion. This is due to differences in 6% and 7% treatment based on the parameters of appearance, aroma, texture, and taste is not too significant. The addition of 6% mackerel fish head flavor powder produces cilok with brownish color while 7% treatment produces cilok with darker brownish color than other treatments. The 6% and 7% cilok treatments have a not very different aroma so the median value is the same. Based on the texture parameters, 6% treatment has a median value of 8 which means the treatment is most preferred



**Fig. 5. The preference level of Cilok's taste**

**Table 4. Decision matrix valuation cilok mackerel head flavor powder with Bayes method**

Treatment (%)	Criteria				Alternative value	Priority value
	Appearance	Aroma	Texture	Taste		
0	6	5	6	7	6,40	0,25
5	7	5	5	5	5,17	0,20
6	7	7	8	7	7,19	0,28
7	6	7	7	7	6,91	0,27
Weight of Criteria	0,09	0,16	0,19	0,56	25,67	1

by panelists. However, the 7% treatment was favored by panelists with a median value of 7. Based on the taste parameters, the treatment of 6% and 7% have the same median value of 7 means that each of these treatment produces a cilok with a taste that was not too different and preferred by panelists. The cilok with the addition of 6% mackerel head flavor powder has the highest alternative value and priority value, namely 7.19 and 0.28. Thus the addition of 6% mackerel head flavor powder is the best treatment according to panelist's preference.

#### 4. CONCLUSION

Based on the result of research can be concluded that the most preferred cilok by panelists is obtained from the addition of 6% mackerel head flavor powder.

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#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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