The Effect of Turmeric (Curcuma domestica) Addition on The Consumer Acceptance Level of Milkfish Crackers

Nabila Aulia1, Sapto Andriyono2,3, Eka Saputra2
1Study Program of Fisheries Product Technology, Faculty of Fisheries and Marine, Universitas Airlangga, Surabaya 60115 Indonesia
2Department of Marine, Faculty of Fisheries and Marine, Universitas Airlangga, Surabaya 60115 Indonesia
3Corresponding author: sapto.andriyono@fjpk.unair.ac.id

Abstract. Milkfish (Chanos chanos) crackers are Indonesian snacks made from fish, which are quite popular among communities. Indonesia has many spices that can be used as food additives, such as turmeric for natural coloring. Turmeric (Curcuma domestica) has an aromatic odor and contains curcuminoids which are beneficial for the body. This study was aimed to determine the consumer acceptance of milkfish crackers added with different amount of turmeric concentration. This research was conducted by using Completely Randomized Design (CRD) with one factor which is the different amount of turmeric added consisting of 4 concentration with 3 replications. The results showed that there was a significant difference between treatments (P<0.05), the results of nutritional value showed the best treatment for milkfish crackers with the addition 0.05 g turmeric with an average value of water content (2.64%), ash content (1.75%), protein content (10.54%), fat content (7.51%), and carbohydrate content (77.53%). The result of the organoleptic test showed the best treatment for the milkfish crackers with the addition 0.5 g of turmeric with an average value of color (8.6), aroma (8.4), taste (8.53), and texture (8.8).

1. Introduction

Indonesia is potential for large capture fisheries and aquaculture products. Milkfish (Chanos chanos), is a superior fishery commodity to be able to fulfill nutritional needs that have a delicious and savory taste. The price of milkfish is also quite affordable for various levels of community. The protein content of milkfish ranges from 20-24%, unsaturated fatty acids 31-32%, amino acids glutamate 1.39%, and contains micro and macro minerals such as Ca, Mg, K, Cu, Fe, Mg, and Mn [1]. Milkfish is generally consumed in processed forms such as thornless milkfish (Batari), but for the use of milkfish as the main ingredient in making fish crackers is rare found.

Fish cracker (Amplang) is an traditional snack from East Kalimantan which has a distinctive fish taste and aroma, and is in demand by people of all ages. This food is made from fish, which has a crunchy texture and a savory taste. The main ingredient in making this crackers is mackerel fish mixed with other ingredients such as tapioca flour, eggs, and others [2]. This product is so common in market, using mackerel as the main ingredient, so the product diversification is needed. One thing that can be done is using milkfish as the main ingredient and using spices contains natural dyes to make it look attractive.
Indonesia has spices that have various kinds of properties and benefits. Indonesian people have long used spices as an addition to cooking spices, for example ginger, turmeric, and etc. One of the spices that is often used is turmeric. Turmeric has an aromatic odor and dyes are commonly called curcuminoids which give the rhizome a yellow-orange color [3]. Because it contains curcuminoids, it can be used as a natural coloring agent in food. This can be a product diversification in fish crackers, by using additional turmeric as a natural dye.

The manufacture of fish crackers generally uses garlic as a seasoning, but the use of turmeric as an additional spice in crackers has not been widely used. The problems that exist today include the absence of the right concentration in the use of turmeric in fish crackers products. The use of turmeric in fish crackers is expected to be an alternative as an additional flavoring as well as a natural coloring agent. The purpose of this study was to determine the effect of adding different turmeric to the level of preference for milkfish crackers.

2. Materials and Methods

2.1 Production of Fish Crackers

Production of fish crackers begins with separating fish meat from other body parts. The other ingredients such as tapioca flour, turmeric powder, and fine ingredients (eggs, sugar, salt, garlic powder, and baking soda) were well prepared. The fish meat was mashed using a food processor. Crack the eggs into a bowl and beat until fluffy for 5 minutes. After it expands, add the fish meat and fine ingredients, then stir until evenly distributed. Add the flour little by little, and mix until the dough is smooth. The dough that has been kneaded is shaped lengthwise and cut to the same size. Put the cut dough in a frying pan filled with oil. Turn on the fire, wait until the dough floats. After all the dough floats, reduce the heat and fry the crackers for 15 minutes until the texture of the crackers is crispy. The ripe crackers were filtered and stored in a container and tightly closed. The formulation of the modified milkfish crackers-making material can be seen in table 1.

| Ingredients          | Ingredients Weight |
|----------------------|--------------------|
|                      | P0     | P1     | P2     | P3     |
| Turmeric (g)         | 0      | 0.5    | 1      | 1.5    |
| Tapioca Flour (g)    | 100    | 100    | 100    | 100    |
| Milkfish Meat (g)    | 100    | 100    | 100    | 100    |
| Egg (g)              | 50     | 50     | 50     | 50     |
| Sugar (g)            | 12     | 12     | 12     | 12     |
| Salt (g)             | 4      | 4      | 4      | 4      |
| Garlic Powder (g)    | 8      | 8      | 8      | 8      |
| Baking Powder (g)    | 0.5    | 0.5    | 0.5    | 0.5    |

2.2 Test Procedure

2.2.1 Water Content.
Evaporating dish was dried in an oven for 15 minutes at 105°C and then cooled in a desiccator for 30 minutes. Then the dried evaporating dish (A) and the sample (B) were weighed respectively. Then the sample on the dish was dried in an oven for 8 hours at 105°C (C) and then cooled in a desiccator for 30 minutes. The cooled samples were weighed 2 to 3 times to get constant weight by using the equation (1):

\[
\text{% Water Content} = \left( \frac{(C-A)}{B} \right) \times 100
\]

2.2.2. Ash Content.
The evaporating dish was dried in an oven at 105°C for 1 hour, after that, it was cooled in a desiccator and then weighed (W1). A total of 3 grams of the sample were weighed (W2) then put into the crucible cup and
Put into a furnace, burned at a temperature of 525°C for 3 hours. Then cooled in a desiccator for 1 hour and weighed (W3).

\[
\% \text{ Ash content} = \frac{W3 - W1}{W2} \times 100
\]  

(2)

2.2.3. Fat Content.
The evaporating dish was heated in an oven at 105°C for 1 hour, then cooled in a desiccator and then the aluminum cup was weighed (Wa). Weigh 2 g of sample (Wb) and put it in lead then cover with cotton. The lead containing the sample was put into Soxtec, then turned on the tool and heated to a temperature of 135°C and water was flowed. Lead is placed in a rinsing position. After the temperature reaches 135°C (temperature has normalized), input the aluminum cup containing 70 ml of petroleum benzene into the soxtec, then press the start button to start with the boiling position, carried out for 20 minutes, then in the rinsing position for 40 minutes, then recovery 10 minutes with the position of the Soxtec faucet opened. The aluminum cup is then placed in the oven at 135°C for 2 hours, then cooled in a desiccator and weighed (Wc).

Fat content (%) = \[\frac{Wc - Wa}{Wb} \times 100\]  

(3)

2.2.4. Protein Content.
First, weigh 1 g of the sample and then put it into the digestion tubes straight where the catalyst (1.5 g K2SO4 and 7.5 mg MgSO 4) is added and 6 ml of H2SO4 (P) is added. The sample was destroyed at 415°C for 1 hour until the liquid became clear (greenish). Then the sample was cooled and 30 ml of distilled water was added slowly. The sample was transferred to distillation and a 125 ml Erlenmeyer was prepared which already contained 25 ml of H3BO3 solution, 7 ml of methylene red and 10 ml of bromine cresol green. The tip of the condenser must be submerged under a 4% H3BO3 solution. Then 30 ml of 40% NaOH solution was added into the Erlenmeyer and distilled for 3-5 minutes. The condenser tube was rinsed with water and accommodated in the same Erlenmeyer. Then titrate with 0.1 N HCl until a pink color change occurs.

\[
% \text{ Protein} = \frac{\text{Titrant vol.(ml) - blank vol.(ml)} \times \text{normality} \times 14.007 \times 100}{\text{sample weight (mg)}}
\]  

(4)

% Protein = % N \times \text{Conversion Factor (6.25)}  

(5)

Where 14.007 is relative atom mass of Nitrogen.

2.2.5. Carbohydrate Content.
Carbohydrates content can be calculated by the difference between 100% and the following percentages:

% Carbohydrate content = 100% - (protein + fat + water + ash)%

2.2.6. Fiber Content.
The fiber content test was carried out by referring to research from Bawias and Sumarni (2019). The sample was weighed as much as 1 gram, then put into a 250 mL beaker and added 50 mL of 0.3 N H2SO4 and then heated at 70°C for 1 hour. Then 25 ml of 1.5 N NaOH was added and heated for 30 minutes at 70°C. Then the solution was filtered using a Buchner funnel. During filtration, the precipitate was washed successively with sufficient hot water, 50 ml of 0.3 N H2SO4, and 25 ml of acetone. Then the filter paper containing the residue was put into a dish and dried in the oven for 1 hour at a temperature of 105°C. Then cooled and weighed.

\[
\text{Fiber content} = \frac{b-a}{x} \times 100 \%
\]  

(6)

Description: b = filter paper weight + sample after heated 
\[a = \text{filter paper weight}\] 
\[x = \text{sample weight}\]
2.2.7. Organoleptic Test.
The organoleptic test was carried out with a hedonic test (likes) with a hedonic scale range of 9 scales covering color, aroma, taste, and texture. Organoleptic testing was carried out by scoring method with 30 untrained panelists. The Milkfish crackers will be served cooked and ready to be consumed. Panelists will be given 4 types of crackers with one control treatment and three with different turmeric addition treatment, each of which has been coded. The following is a table of rating scales for the appearance, aroma, taste, and texture.

2.2.8. Data Analysis.
The research data obtained will be analyzed using ANOVA (Analysis of Variance) 1 factor to determine whether or not there are differences in the results of the test treatment. If the treatment shows significant results, the calculation is continued with the Duncan’s Multiple Range Test (DMRT) further test at 95% accuracy.

3. Results and Discussion
Milkfish crackers used in this study was made from tapioca flour, mashed milkfish meat, sugar, salt, baking soda, and eggs. The additional material added to the milkfish cracker is turmeric in the form of turmeric powder. The use of turmeric in this study because it can be used as a natural dye that has useful content. Turmeric contains curcuminoid dyes, essential oils, and protein. Milkfish on the market have been found to have an unpleasant smell such as the smell of soil, this is a problem if you want to use it as a raw material for fish crackers. Fish crackers generally has a bright color that tends to be pale, therefore researchers want to make new changes to the appearance of fish cracker to attract the attention of consumer. Therefore, the addition of turmeric into the milkfish crackers is expected to increase consumer acceptance and become the newest variety of fish cracker products using milkfish meat.

3.1. Organoleptic Analysis
Organoleptic test was conducted to determine the level of consumer acceptance of a product. The parameters used in this test use four parameters, namely appearance, smell (aroma), taste, and texture which are carried out in accordance with SNI 7762:2013. This test was carried out by 30 untrained panelists. The data from the organoleptic test results will be continued with the Kruskal-Wallis test aimed to determine the rank of each treatment, then if there are differences in the results of the treatment (p <0.05) then perform the Mann-Whitney test.

| Parameters | Organoleptic Score |
|------------|-------------------|
|            | P0                | P1                | P2                | P3                |
| Appearance | 7.87 ± 1.358ab    | 8.60 ± 1.137a     | 8.47 ± 1.042bc    | 8.05 ± 0.814c     |
| Aroma      | 8.40 ± 1.192a     | 8.40 ± 0.932a     | 8.27 ± 0.980a     | 8.47 ± 1.042a     |
| Taste      | 8.67 ± 0.758a     | 8.53 ± 0.860ab    | 8.13 ± 1.008b     | 7.07 ± 1.337c     |
| Texture    | 8.27 ± 0.980a     | 8.80 ± 0.610a     | 8.27 ± 0.980a     | 8.40 ± 1.070a     |

Notes : a, b = Similar superscript letter notation means that there is no significant difference at the Mann-Whitney test level which has a value of 5%

Water content is the most important factor in foodstuffs. Water content in ingredients can affect a food product in terms of texture, durability, and taste. The lower the water content in the eating cracker product, the better the quality of the cracker. The results of statistical analysis of water content showed a significant effect from the addition of turmeric. This reduction in water content in milkfish cracker products is due to
turmeric which is used in powder form. The control treatment got the highest water content value because there was no addition of turmeric. The results obtained water content decreased which was in line with the increase in other content such as protein, ash, and fat, this was because during the drying process the bound water molecules would be released by the protein. Tapioca flour will bind water during the gelatinization process, the greater the percentage of tapioca flour in a food product, the greater the water content contained. The higher the turmeric dose given to each treatment, the lower the water content will be.

The results of chemical analysis of ash content showed different results for each treatment. Ash is a mineral or a mixture of inorganic materials present in a food ingredient. According to [5], ash is a residue or inorganic material from combustion residues at high temperatures. Based on the results of chemical analysis in, it shows that the ash content is different in each treatment. The results of statistical analysis showed that there was a significant effect of the addition of turmeric, the data showed the results of the ash content ranging from 1.69-1.85%, with the lowest ash content obtained by P0 (1.69%) and the highest results obtained by P3 (1.85%). This is in accordance with SNI 7762:2013 Fish Crackers that the maximum ash content of cracker products is 5%. The ash content obtained by milkfish cracker products can be influenced by the mineral content in turmeric. The higher the additional dose of turmeric, the greater the value of the ash content. According to [4] turmeric contains ash content of 6.0% in 100 grams of food, so the addition of turmeric will increase the value of ash content in milkfish cracker.

The results of the chemical characteristics test of protein content in milkfish cracker showed different results in each treatment. Based on the results of the analysis in, it shows that the protein content in each treatment along with the addition of turmeric, the greater the protein content. The results of the protein content ranged from 10.54-11.11%, with the results of the treatment having the lowest protein content, namely P1 of 10.54%, and the highest protein content of P3 11.11%. The protein content in this cracker is in accordance with SNI 7762:2013 concerning fish crackers in which the minimum protein content is 7%. The increase in protein content was in line with the addition of turmeric which was given. According to [7], turmeric has a protein content of 8%.

The results of the test of chemical characteristics of fat content affect the addition of turmeric, it is shown in that the more turmeric is added, the fat content increases. Based on the results of the analysis in, it shows that the fat content ranges from 6.24-12.69%, with the highest fat content being P2 (11.06%) and the lowest fat content being P3 (6.14%). The fat content in this crackers increased with the increase in the content of turmeric but then decreased with the administration of turmeric. The increase in turmeric levels can be due to the volatile oil content contained in turmeric. The essential oil content in turmeric is between 2.5-2.7% which is a group of bioactive compounds which are also included in the oil group [8]. Due to the use of turmeric in this milkfish cracker in powder form, it is possible that a decrease in fat content may occur. The decrease in fat content in this treatment can occur because it is caused by reduced water content in the product, the fat component is basically bound in water [9]. The fat content value produced is in the range of 6.24-12.69% which is included in a good range in meeting the requirements of SNI 7762:2013 for fat content in milkfish cracker products, where the allowable fat content value is a maximum of 35%.

In addition to the test results of water content, ash content, protein content, and also fat content in a food, carbohydrate content is an important content for the body. Carbohydrate content determines the characteristics of foodstuffs because the results of carbohydrate content depend on reducing factors such as water content, ash content, protein content, and fat content. Carbohydrate content is the most important factor in a food ingredient which depends on the results of the reducing factor, the higher the value of the reducing factor, the lower the value of the carbohydrate content produced [10]. Based on Table 1, the results of the analysis of protein levels in the content of milkfish cracker showed a decrease but in one of the treatments it increased. The carbohydrate content has a value ranging from 71.90-78.12% with the highest value obtained by P3 of 78.12% and the lowest carbohydrate content obtained by P2 of 71.90%. The results
of the proximate analysis showed that the addition of turmeric to milkfish cracker decreased. This decreasing condition is due to the content of turmeric which is able to degrade the glucose content in milkfish [11].

3.2. Chemical Characteristics

In addition to the results of chemical analysis, this study carried out organoleptic tests conducted by 30 untrained panelists. Hedonic scale organoleptic test results using four parameters of preference test, namely color, smell, taste, and texture.

The results of the hedonic test on color showed that the average value of the panelists' preference for the color of milkfish cracker with the addition of turmeric was between 7.87-8.60%. The highest level of preference was found in milkfish cracker with the addition of 1.5 grams of turmeric in P3 treatment with a value of 8.60%, and the lowest level of preference was obtained by P1 with a value of 7.87%. The level of color preference increased along with the addition of turmeric to the milkfish cracker. This is because the addition of turmeric to milkfish cracker causes a bright brown color when compared to the control. The emergence of this bright color is caused by the content of dye in turmeric which gives the yellow-orange color to cracker products. According to [3] turmeric contains a yellow-orange dye located in the rhizome.

The aroma factor in food is one of the most important factors in the delicacy of a food. The aroma factor in food is the main attraction in determining the delicious taste of a food product [12]. The results of the hedonic test showed that the average value of the panelists' preference for the aroma of milkfish cracker with the addition of turmeric ranged from 8.40-8.47% with the highest value obtained by P3 with 8.47% and the lowest value obtained by P1 with a value of 8.40%. The aroma value of milkfish cracker with the addition of turmeric increased with the addition of turmeric in each treatment. The more turmeric content is added, the higher the aroma of turmeric in the milkfish cracker. This is due to the essential oil content which is the distinctive aroma of turmeric. Turmeric has a sweet aroma and an aromatic smell, so it can give a distinctive aroma to a food ingredient. The essential oil content in turmeric is also often used in meat or fish dishes, because it can eliminate the rancid smell.

The taste factor in a food product is the most important factor after aroma. This factor is important because it determines the value of people's preferences because even though the nutritional value of a food is high, the taste is not acceptable to consumers, so the target to improve people's nutrition will not be achieved and result in the product being unattractive or not selling well in the market [6]. Taste is assessed using the sense of taste or tongue. The results of the hedonic test on the taste parameters showed values ranging from 7.07-8.53%, with the highest value obtained by P1 with a value of 8.53 and the lowest value obtained by P3 with 7.07%. In table 8, it can be seen that the higher the addition of turmeric to the milkfish cracker, the lower the value of consumer preferences. Because the specific taste of fish in amplang P3 is mixed with a distinctive turmeric taste, it causes the taste of milkfish cracker to be different from fish crackers in general.

The most important factor in the hedonic assessment of fish cracker products is the texture factor, which can be seen from the crispness of the fish cracker product. The results of the hedonic test on the texture parameter show values ranging from 8.27 to 8.80%, with the highest value obtained at P1 with a value of 8.80% and the lowest value at P2 with 8.27%. Table 9 shows that the higher the addition of turmeric to the amplang, the lower the value of consumer preference. This is presumably because the more turmeric is added to the milkfish cracker, the harder the product is because the dough does not expand during the frying process optimally. This is because the fiber content in turmeric is 6.7 grams in 100 grams of material. Fiber content can affect the texture of a food ingredient, this is in accordance with [13], an increase in the value of fiber in a product makes the resulting product harder.
4. Conclusion

Based on the results of research on milkfish crackers products with the addition of turmeric, it can be concluded that the addition of turmeric according to the ANOVA test had a significant effect (P<0.05) on the quality of the chemical characteristic values (moisture, ash, protein, fat, and carbohydrate content) and the organoleptic value of milkfish cracker products. Treatment with the addition of 0.5 grams of turmeric in milkfish crackers is the best treatment that has the highest average preference value which is favored by panelists with appearance values (8.60), odor (8.40), taste (8.53), and texture (8.80). This treatment also increased the average value of protein content (10.54%), ash content (1.78%), and carbohydrate content (77.53%), and reduced water content (2.64%) and fat content (7.51%).

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