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Evaluation of Sensory Quality and Nutritional Value of Fish Cakes (*Perkedel*) Made by Tuna Fish (*Euthynnus affinis*) and Milk Fish (*Chanos chanos*)

Erven Era Prastica, Endang Dewi Masithah*, and Kustiawan Tri Pursetyo

Department of Marine Science, Faculty of Fisheries and Marine, Universitas Airlangga, Surabaya, East Java, Indonesia

*Corresponding author's Email: endang-d-m@fpk.unair.ac.id; ORCID: 0000-0001-9932-1039

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ABSTRACT

Fish Cakes (*Perkedel*) is Indonesian fried patties, most commonly made from mashed potatoes mix with beef or chicken. This research was conducted to determine the sensory quality and the best nutritional value of the cakes which are composed of tuna fish and milkfish. The study used an experimental method with the main parameters of sensory quality (organoleptic test) and nutritional value (proximate analysis) in seven different cake treatments. The results showed that the composition of tuna fish and milkfish of fish cakes had a very significant effect on the color and aroma aspects, while the texture and taste aspects were not significantly different among the treatments. The findings indicated that the composition of tuna fish and milkfish only affected color and aroma. The best formulation of the fish cake was on *Perkedel* 7 (P7) which has a sufficiently good organoleptic color, aroma, texture, and taste with higher nutrient content, compared with other treatments. The nutritional content of P7 was Recommended Dietary Allowance (RDA) protein of 28.77%, RDA fat of 0.68%, and RDA carbohydrate of 7.41%. Moreover, it also produced energy of 162 kcal/100g. In conclusion, fish cake with great sensory quality and nutritional values was obtained with 45 g of tuna fish and 15 g of milkfish. The P7 formulation is a combination of 45 g of tuna fish and 15 g of milkfish. The RDA obtained from fish cakes in the best treatment *Perkedel* 7 (P7) was 28.77% for RDA protein, 0.68% for fat, and 7.41% for carbohydrates. The investigated fish cakes provide energy of 162 kcal/100 g at an affordable price.

Keywords: Milk fish, Organoleptic test, Proximate analysis, RDA nutrition, Tuna fish

INTRODUCTION

Fish Cakes (*perkedel*) are a typical food product that is quite favored by people in some countries (Archana et al., 2016). Many cakes products experience diversification with the addition of chicken, beef, shrimp (Adesola Olayinka et al., 2009), other types of fish meat, and some processed animal protein. Moreover, the vegetable protein used is not only sourced from potatoes but sometimes also processed mushrooms and anchovies ingredients (Hwang et al., 2013). In addition, cakes are also consumed as popular daily food (Archana et al., 2016; Rahma et al., 2019).

For middle and lower-middle groups, this matter definitely cannot be reached, therefore the solution is to use fish meat to make delicious and nutritious cakes at more affordable and economical prices (Islam et al., 2018; Mottaleb et al., 2018). Currently, the use of surimi is an alternative to making burgers, ham, and other food products. It is because the price of surimi is cheaper than shrimp and beef and it has an appropriate nutritional value (Bashir et al., 2017).

Some fish species that can be used as fish cakes are tuna fish and milkfish because they are found easily in Indonesia. The reason why tuna fish and milkfish become selected ingredients for making fish cakes is because of the relatively high production volume. Tuna fish had a production volume of 230.580 tons in 2011 while milkfish had 631.125 tons in 2014. Tuna fish and milkfish have high protein and low-fat content. Most of the ingredients are essential and non-essential amino acids (Vasava et al., 2018), omega 3 (Rani et al., 2016), and unsaturated fats (Bayaga and Deveza, 2005). Milkfish has the highest protein content of 22.7% and the lowest fat content of 2% (Magondu et al., 2016) while the high protein and low-fat content of tuna fish are around 25% and 1.25%, respectively (Rani et al., 2016).

Milkfish is a kind of fish that mostly live in tropical freshwaters (Darmawan et al., 2019). Milkfish has a distinctive color, smell, taste, and texture (Villagonzalo, 2008; Hakim et al., 2019). Therefore, the composition of tuna fish and milkfish can produce fish cakes which have good sensory quality.

The experiments are carried out to increase the quality of fish cakes produced, either sensory quality or nutritional value. Thus, this research was performed to obtain the best sensory quality and nutritional value from the cakes which are composed of tuna fish and milkfish.

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MATERIALS AND METHODS

The experimental design was a combination of a completely randomized research design, by a single factor experiment in the form of different formulations of tuna fish and milkfish composition. Tuna fish and milkfish would be combined to obtain the best quality and nutritional values (Robinson et al., 2009). The performed method included seven treatments and four repetitions with the calculation of *t* (n-1)> 15 (Kusuriningrum, 2008).

The independent variables used were tuna fish and milkfish, while the dependent variable was the sensory quality (color, aroma, texture, and taste) and physicochemical characteristics (water content, ash content, carbohydrate content, fat content, and protein content) of fish cakes. Moreover, control variables in this study were material size, making process, seasoning concentration, setting and cooking temperature, and heating time.

The first test was carried out using quantitative and qualitative parameters. The main test parameters were organoleptic, water content, ash content, protein content, fat content, and carbohydrate content. The supporting test parameters were the yield of raw materials and products, as well as analysis of Total Volatile Base (TVB) and histamine. Tests of organoleptic data from research results were processed using Kruskal-Wallis analysis. The Kruskal-Wallis analysis was used to determine the treatment rating for various product samples (Elamir, 2015).

Tuna fish and milkfish are common types of fish that can be obtained from traditional markets, among them in Surabaya City markets. Subsequently, batter is made by adding a high amount of water and low viscosity to Japanese breadcrumbs (Owens, 2001).

Table 1 presents the formulation of ingredients for making cakes with seven treatments using ingredients and dough in the same amount and composition. Tuna fish and milkfish are used as the meat that is separated from the thorns and skin through the steaming process. The fish meat that has been separated from the thorns and skin then made a composition of tuna fish: milkfish with ratios of 1:0, 0:1, 1:1, 1:2, 2:1, 1:3, and 3:1 as in Table 1. Then, the composition of fish meat is crushed manually so the meat will not be too crumbled (Fuchs et al., 2013)

Table 1. Ingredients formulation for Making Cakes (*Perkedel*)

Ingredients (g)	P1	P2	P3	P4	P5	P6	P7
Coconut (g)	20	20	20	20	20	20	20
Salt (g)	3	3	3	3	3	3	3
Sugar (g)	7	7	7	7	7	7	7
Pepper (g)	2	2	2	2	2	2	2
Shallot (g)	4	4	4	4	4	4	4
Garlic (g)	4	4	4	4	4	4	4
Tuna Fish (g)	60 (1)	0 (0)	30 (1)	20 (1)	40 (2)	15 (1)	45 (3)
Milkfish (g)	0 (0)	60 (1)	30 (1)	40 (2)	20 (1)	45 (3)	15 (1)

RESULTS

All treatments produce various organoleptic. One treatment and another will be compared according to the standard score that has been made. The other observations are also carried out on products that have the highest and lowest scores.

The results of the analysis of various colors and aromas in Table 2 showed that there were very significant different interactions ($p < 0.01$) between the concentration treatment of tuna fish and milkfish with the color of fish cakes. The color on P2 had the highest organoleptic score, while the color on P1 had the lowest organoleptic score. For various aroma formulas, P1 had the highest score, but P1 was not significantly different from P7. It was probably due to the content of tuna fish that was almost 100%.

The results of the variance analysis showed that there were no significant differences between the concentration treatment of tuna fish and milkfish on the texture and taste of fish cakes produced ($p > 0.05$). Organoleptic texture scores given by panelists ranged from 3.6 to 3.9 or slightly dense and fibrous. Formulations with the best texture were in P1 and P7. Meanwhile, the organoleptic test score for taste ranged from 3.0 to 3.4 (quite ideal). The best treatment for flavor formulations was on P7.

Results of proximate, recommended dietary allowance, and energy

Proximate analysis is performed to determine the nutritional content of fish cake products. Proximate analysis that is examined includes water, ash, protein, fat, and carbohydrate content. Fish cakes are prepared with several basic ingredients and each of which has a different nutritional contribution. Coconut contains 1% protein, 0.9% fats, and 14% carbohydrates in 20 grams. Pepper contains 11.5% proteins, 6.8% fats, and 64.4% carbohydrates in 2 g. Shallot contains 1.5% protein, 0.3% fat, and 0.2% carbohydrates in 3 grams. Garlic contains 4.5% proteins, 0.2% fats, and 23.1% carbohydrates in 2 grams. Eggs contain 12.8% proteins, 11.5% fats, and 0.7% carbohydrates in 3 grams (Rehault-Godbert et al., 2019).

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After accumulating with a proximate analysis, all the ingredients that are mixed with a comparison of multi-variants tuna fish and milkfish produce different contents which are presented in Table 3. The results of the proximate analysis in 100 grams produce different contents. The highest water content was observed in treatment 5, and the lowest water content was in treatment 2. The highest protein content occurred in treatment 7, and the lowest protein content was in treatment 4. The highest fat content was reported in treatment 6, and the lowest fat content was in treatment 7. The highest carbohydrate content occurred at treatment 4, and the lowest carbohydrate content was estimated in treatment 1.

Proximate analysis in each formulation was carried out to determine the nutritional content of each on the results of fish cakes. By this proximate analysis, the RDA of different nutritional values was eventually obtained. Based on Table 4, the best treatment was at P7 for it had the highest protein RDA value and the lowest fat RDA value. The calorific value produced by fish cakes in the P7 formulation was every 100 grams contains 162 kcal. This value was obtained because every 1 gr of carbohydrate contained 4000 calories, while 1 gram of fat contained 9000 calories, and 1 gr of protein had 4 calories (Lagergren et al., 2013).

Table 2. Organoleptic test results on treatments

Organoleptic Test	Color	Aroma	Texture	Taste
Treatment 1	3.81	3.77	3.87	3.31
Treatment 2	4.71	3.43	3.66	3.17
Treatment 3	4.38	3.43	3.66	3.18
Treatment 4	4.48	3.31	3.66	3.16
Treatment 5	4.27	3.49	3.66	3.08
Treatment 6	4.57	3.52	3.63	3.18
Treatment 7	4.22	3.53	3.78	3.34

Table 3. Proximate analysis results (%)

Proximate values	Water content	Ash content	Protein content	Fat content	Carbohydrate content
Treatment 1	55.39	10.81	15.59	3.34	14.87
Treatment 2	54.37	7.48	13.95	3.13	21.07
Treatment 3	54.89	9.58	14.24	1.15	20.14
Treatment 4	54.88	5.24	8.55	2.10	29.23
Treatment 5	55.60	4.09	15.17	2.30	22.84
Treatment 6	55.47	4.98	14.88	3.38	21.29
Treatment 7	55.17	4.92	17.26	0.42	22.23

Table 4. Recommended dietary allowance value of fish cakes (*Perkedel*)

Recommended dietary allowance	Protein content*	Fat content*	Carbohydrate content*
Treatment 1	25.98	5.39	4.96
Treatment 2	23.25	5.05	7.02
Treatment 3	23.37	1.85	6.71
Treatment 4	14.25	3.39	9.74
Treatment 5	25.28	3.71	7.61
Treatment 6	24.80	5.45	7.10
Treatment 7	28.77	0.68	7.41

*: Refers to the percent of dry matter

DISCUSSION

Organoleptic testing performed is not just to get the impression of likes or dislikes of samples, but to determine whether the product is accepted by the panelist. The organoleptic test is a test performed based on the sensing process (Yi et al., 2016). The purpose of the organoleptic test is to find the differences between samples (one another), so as to obtain the best product results (Ana et al., 2017; Widyastuti et al., 2019). It is also performed to evaluate food, especially organoleptic properties of pastry products including aroma, taste, and texture.

The results of the data analysis showed that there were significant differences between treatments on color and aroma parameters, while texture and taste parameters were not significantly different. The best color of the inside of fish cakes was observed in treatment P2since the fish composition in the fish cakes of P2 formulation was 100% milkfish so that the white structure was formed. Moreover, milkfish has a color attribute distribution of 44.90 (Villagonzalo, 2008). In a study conducted by Chen and Chow-Jen (2001), it was found that milkfish had a low myoglobin content so that when the warming or denaturation of globin was carried out, the color of the product would be even brighter.

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The aroma parameter most favored by panelists is the P1 Treatment since P1 had 100% tuna fish (60 g). The score from the organoleptic test results for flavors was ranged from 3 to 3.4 (quite ideal). The formulation with the highest taste preference score is in the P7 treatment. It is probably due to a balanced mix of flavors.

Based on the proximate results in Table 3, the average water content produced by fish cakes in seven treatments was within the range of 54.37-55.60%. These levels can still be accepted by Indonesian National Standard (SNI) on products that have similar characteristics to fish cakes, namely nuggets. Meanwhile, the average protein content produced by fish cakes in seven formulations ranged from 8.55-17.26%. The lowest protein content is found in P4 formulation so that P4 is not included in the nutrient content of SNI 01-6683-2002 which states that the protein content must be at least 12%. Furthermore, P4 also does not meet the requirements for carbohydrate levels because it exceeds 25%.

Protein is needed by the body for the growth, development, maintenance, and repair of damaged body tissue. Water content and fat content in fish are quite fluctuating (Pal et al., 2018). The fat found in fish cakes is mostly a type of unsaturated fat that is good for health (Bayaga and Deveza, 2005). The carbohydrate content in fish cakes mainly comes from tapioca flour and bread flour with its carbohydrate content per 100 grams holds more than 75% or around 26 grams (Montes et al., 2015).

CONCLUSION

The best fish cakes with the highest sensory quality and nutritional value were observed in the P7 treatment. It had higher protein content than other treatments and a low-fat content (in accordance with SNI 01-6683-2002). The P7 treatment was a combination of 45 g of tuna fish and 15 g of milkfish. The Recommended Dietary Allowance (RDA) obtained from fish cakes was at its best in P7 treatment with 28.77% RDA protein, 0.68% fat, and 7.41% carbohydrates. The investigated fish cakes provide energy of 162 kcal / 100 g. For future studies, treatment with a high combination of 45 g of tuna fish and 15 g of milkfish is suggested.

DECLARATIONS

Authors' contributions

All authors approved the final draft of the manuscript for publication. Ethical issues (including plagiarism, consent to publish, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancy) have been checked by the authors.

Competing interests

All authors declared no conflict of interests.

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