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Effect of Steaming Temperature on Nutrient Content and Organoleptic of Shredded Mackerel Tuna Fish

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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

Organoleptic and nutrient content of shredded mackerel tuna fish products can be affected by the steaming temperature. This study aims to determine the effect of steaming temperature on the nutritional and organoleptic content of shredded swordfish and to obtain the optimum temperature from the tested treatment. The study was conducted from December 2022 to June 2023. Fish shredded processing and organoleptic tests were carried out at the Fisheries Product Processing Laboratory, Faculty of Fisheries and Marine Sciences, and chemical tests were carried out at the Central Laboratory, Padjadjaran University, Jatinangor. The method used in the study was an experimental method with 3 treatments of steaming temperature variations and 20 semi-trained panelists as a repeat with steaming temperature levels 50°C, 55°C, and 60°C. Data processing using Friedman non-parametric analysis. The parameters observed are fish shredded yield, organoleptic hedonic test characteristics which include appearance, aroma, texture, and taste of shredded fish, as well as chemical tests which include protein content, fat content, moisture

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content, ash content, and carbohydrate content. The results showed that the effect of steaming temperature of 60°C is the optimum treatment and the most preferred treatment has an average value of appearance, aroma, texture, and taste of 7 (preferred) with proximate test results of the protein content of 29.42%, ash content of 6.38%, moisture content of 7.04%, fat content of 27.91%, and carbohydrate content of 29.26%.

Keywords: Mackerel tuna fish; organoleptic; proximate; shredded; steaming.

1. INTRODUCTION

The fisheries sector is very important for people's lives and is the main of the national economy. This is based on the fact that Indonesia is the largest maritime and *archipelagic state* that has the potential availability of large fishery resources [1]. Based on data from the Ministry of Marine Affairs and Fisheries [2], Indonesia's fisheries production reached 23.86 tons. One of Indonesia's fishery production is mackerel tuna fish which is a type of small tuna group marine fish. The use of mackerel tuna fish which is processed for consumption is still limited with pindang and canned mackerel tuna fish products [3].

Food consumption has become an important need for the community, so it is necessary to supervise and control, especially in food processing [4]. Food processing is the conversion of the original form into an edible form. According to Mamuaja [5], communities and small industries engaged in processing fishery products do not understand the characteristics of materials and changes that occur and determine how to process them to maintain food quality. Understanding of good food processing techniques needs to be learned, including understanding of the raw materials used including fish so that the quality of these raw materials is still maintained. One of them is processing which can minimize the level of loss or decrease in nutritional content contained in fish after processing, namely making shredded fish.

According to BSN [6] in SNI 01-0737-2013 it is stated that shredded is a processed dry food product with a distinctive shape, made from meat, boiled, slashed, seasoned, and fried. Shredded meat is generally made from beef and chicken, but fish meat can also be used. The quality of shredded processed products is influenced by the ingredients used, how they are processed, and the nutritional value they contain [7]. The cooking process before consumption can affect changes in ingredients such as physical and chemical content [8].

Steaming is one of the most important cooking processes in the early stages of making shredded fish because the steaming process can produce the level of doneness and quality as desired so that the quality of fish meat is still maintained from the beginning to the end. Cooking methods that use hot and high temperatures greatly affect the structure of food and the nutritional value of the fish [9]. The longer a food is processed and the higher the temperature used, the nutritional content will be proportional to the rate of decrease in nutrient content [10].

Thus, knowledge of how much change occurs in the characteristics of shredded fish due to the processing process needs to be known so that it can determine a good and appropriate processing method so that the final product results are by the provisions of quality standards by the Ministry of Industry of the Republic of Indonesia and SNI shredded 01-0737-1995. The better the quality and special attention to the food produced, the higher the interest in people's purchasing power toward food safety and health awareness [11]. Therefore, it is necessary to research the importance of steaming and analyze the effect of steaming temperature on the nutritional and organoleptic content of shredded mackerel tuna fish.

2. METHODOLOGY

2.1 Time and Place of Research

This research was carried out from December 2022 to June 2023 at the Fisheries Product Processing Laboratory (PHP), Faculty of Fisheries and Marine Sciences, Padjadjaran University, and proximate testing was carried out at the Central Laboratory of Padjadjaran University.

2.2 Research Tools and Materials

Tools for making shredded fish include digital scales (accuracy 0.01), knives, basins, boilers (steamers), iron thermometers, *stopwatches*, cutting boards, bowls, plates, pans, spatulas, spoons, forks, spice blenders, slicers/presses, and gas stoves.

The ingredients used in making shredded fish are divided into two, namely the main ingredient and additional ingredients. The main ingredients use fresh mackerel tuna fish from traditional markets weighing 5-6 kg, while additional ingredients are coconut milk, spices/spices (onion, garlic, coriander, galangal, salt, sugar, bay leaf, lemongrass leaf, ginger), and cooking oil.

2.3 Research Methods

The method used in this research is an experimental method. This study was conducted with 3 different treatment steaming temperatures in making shredded mackerel tuna fish with each temperature difference of 5 ° C and each steaming time for 20 minutes. The temperature variations used include:

A. Steaming temperature 50 ^{o}C
B. Steaming temperature 55 ^{o}C
C. Steaming temperature 60 ^{o}C

2.4 Manufacturing Procedure Shredded Mackerel Tuna Fish

Mackerel tuna fish is weeded by removing the contents of the stomach and head, then washed thoroughly with running water and drained. Mackerel tuna meat weighed as much meat as needed in the test for each treatment of about 700 g. Mackerel tuna meat is steamed using a 2-level boiler and then given an *aluminum foil* base so that it cooks quickly because it is covered in hot temperatures and does not stick. The temperature used in steaming is 50^{o}C, 55^{o}C, and 60 ^{o}C with each duration of 20 minutes and then transferred to a basin container. The steaming process is carried out over low heat while observing the thermometer so that the temperature does not change. Fish meat is shredded into fine fibers using a fork. Additional ingredients are prepared, namely spices such as shallots as much as 150 grams, garlic as much as 50 grams, coriander as much as 2 tablespoons, and ginger as much as 1 segment after that the spices are mashed, then galangal and lemongrass are crushed. 5 tbsp cooking oil is heated to reach a temperature of 120 ^{o}C as measured by an iron thermometer. Fine spices are sauteed until cooked brown for approximately 15 minutes, then add bay leaves as much as 3 sheets, lemongrass as much as 3 stems, and galangal as much as 25 grams. 250 ml coconut milk, 3 tbsp sugar, and 1 tbsp salt are poured into the frying pan, then cooked for 10 minutes until all the spices are combined. 700 g of fish meat is put into a frying pan, then stirred using a spatula until the spices and fish meat are well mixed for approximately 30 minutes. Shredded cooked fish is removed and drained. Then pressed using a press, then shredded and separated using a spoon so as not to clump. The seasoning formulation can be seen in Table 1.

2.5 Observed Parameters

The parameters observed in this study were steaming temperature variations, then yield calculations and analysis were carried out on shredded meat produced on carbohydrate content, protein content, fat content, moisture content, ash content, and hedonic tests (aroma, taste, appearance, texture).

2.5.1 Physical characteristics

Physical analysis is carried out to calculate the yield value of mackerel tuna fish meat. Yield is a calculation method for making a product in the form of a percentage comparison between the weight of the final product with the initial weight of the main raw material [12]. The formula used to calculate the meat of mackerel tuna fish is as follows

$$\text{Fish meat yields} = \frac{\text{Weight of the shredded meat produced}}{\text{Initial weight fish meat}} \times 100\%$$

2.5.2 Hedonic test

Hedonic testing in this study uses a favorability test, namely the hedonic test. The hedonic test used in this research was conducted by 20 semi-trained panelists. Hedonic testing is carried out by tasting directly and giving personal impressions or responses to fish shredded products provided through sensory devices to determine the level of liking or disliking of the sample to be tested, then panelists are asked directly about opinions by filling out organoleptic

Table 1. Shredded mackerel tuna fish formulation

Ingredients	Treatments		
	A (50°C)	B (55°C)	C (60°C)
Mackerel tuna fish (kg)	700	700	700
Bay leaf (sheet)	3	3	3
Lemongrass (stem)	3	3	3
Garlic (g)	50	50	50
Shallots (g)	150	150	150
Coriander (g)	8	8	8
Ginger (internode)	1	1	1
Coconut milk (ml)	250	250	250
Galangal (g)	25	25	25
Salt (g)	9	9	9
Sugar (g)	30	30	30

test. The parameters observed in the hedonic test are appearance, aroma, taste, and texture in shredded swordfish with variations in steaming temperature of three treatments. This method uses a number scale ranging from 1 to 9 with 5 levels of liking, namely: (1) strongly dislike, (3) dislike, (3) neutral/ordinary, (7) like. (9) very like.

2.5.3 Chemical characteristics

The chemical analysis carried out was by testing the proximate content of the shredded quality of mackerel tuna fish which included ash content, moisture content, fat content, carbohydrate content, and protein content using the AOAC method [13]. The proximate test was carried out after the results of the hedonic test there was fish shredded which was most preferred by the panelists according to the calculation of the data analysis.

2.6 Data Analysis

The data obtained are the results of the calculation of organoleptic hedonic tests on questionnaire assessments using two-way non-parametric statistical methods *of Friedman* analysis with *Chi-Squared* tests. Determining the best results that can be used in this study is the *Bayes* test. The processes produced by the *Bayes* test are a basis for use in determining the most preferred product.

3. RESULTS AND DISCUSSION

3.1 Yield

Yield is the most important ratio parameter to determine the economic value and effectiveness of the final product to the initial raw materials used. The greater the yield, the higher the yield value of a material. The yield value can be seen in Table 2.

Based on Table 1, the results of the calculation of the shredded yield of mackerel tuna fish produced, the highest yield value of the three treatments given was obtained at a steaming temperature treatment of 55°C of 52.43% and the lowest at a steaming temperature treatment of 50°C of 47.40%. The yield value of shredded mackerel tuna fish is greatly influenced by its moisture content, which is influenced by the binding power of water by protein in fish meat. This is thought to be related to a decrease in the ability to hold water in the connective tissue of fish meat so that the space between the nets becomes wrinkled and reduced which causes water in the meat to come out as a liquid [14]. Different levels of fish freshness can also affect

Table 2. Mackerel tuna fish shredded yield results

Treatment	Results		
	Raw Material Weight (g)	Shredded Weight (g)	Yields
A (50°C)	1158	549	47,40%
B (55°C)	1005	527	52,43%
C (60°C)	1130	538	47,61%

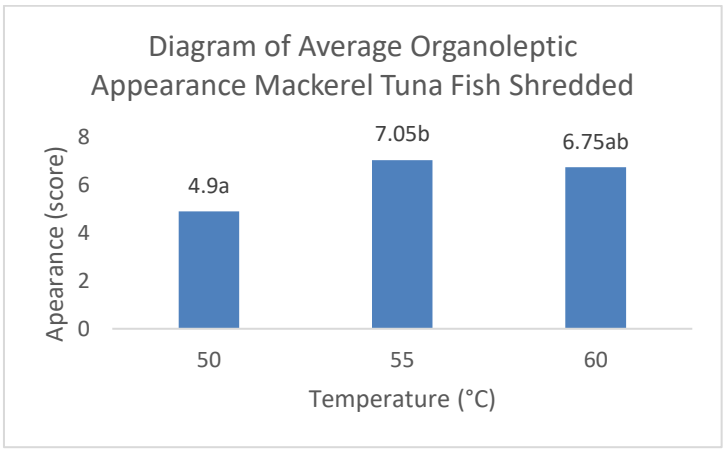

Fig. 1. The average appearance of mackerel tuna fish shredded

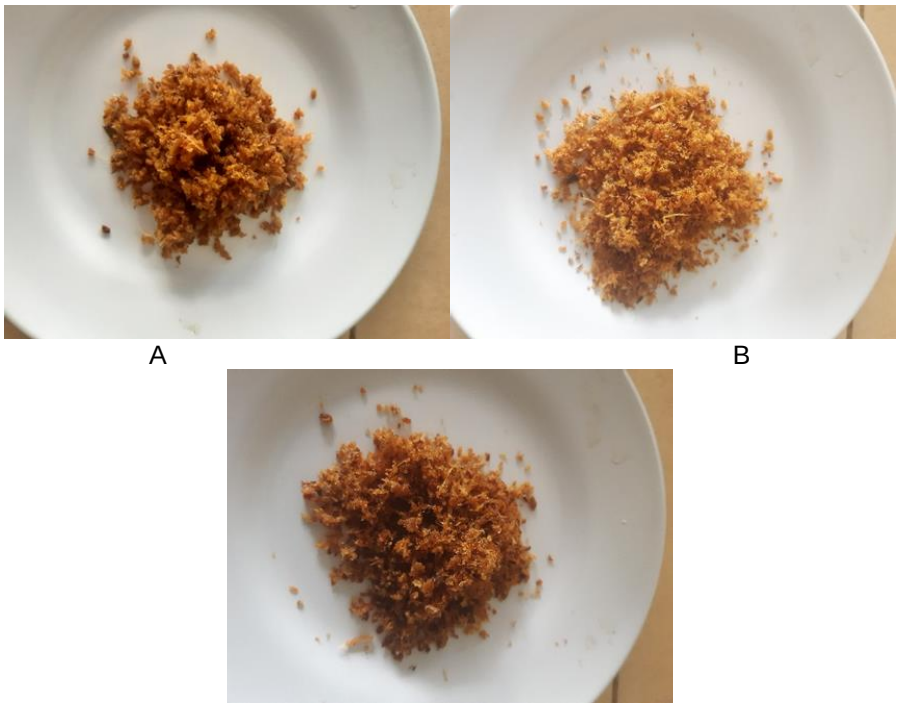

Fig. 2. Shredded Fish Appearance Based on Steaming Temperature Variation Treatment (A) 50°C, (B) 55°C, dan (C) 60°C

the yield increase results. This is in accordance with Pamungkas [15], the texture of meat has each phase is different, the softer the texture of the meat the more water in it.

3.2 Organoleptic Parameters

3.2.1 Appearances

Appearance is the first assessment seen by panelists that determines the panelists' acceptance before finally spreading to other factors such as aroma, texture, taste, and nutritional value. The bright appearance of food gives more appeal to consumers because it is an indicator of the perfection of the food processing process [16]. The value of the shredded appearance of mackerel tuna fish can be seen in Fig. 1.

Based on Fig. 1, the 55°C steaming temperature treatment produces the highest appearance

value which has an average value of 7.05 with a median value of 7 and the lowest in the 50°C steaming temperature treatment which has an average value of 4.90 with a median value of 5. Panelists preferred the appearance of the shredded color of mackerel tuna fish, namely at a steaming temperature treatment of 55°C can be seen in Fig. 2. It is suspected that the steaming process uses a temperature of 55 ° C the most ideal temperature among the three compared to other shredded steaming processes, resulting in a uniform and compact shape making the most attractive color results and in accordance with the shredded color at the end of frying. The lower the steaming temperature, the color change to less brown because the meat is not fully cooked and the color of the meat is still pale white. The higher the steaming temperature, the darker the color change, and the brightness decreases. According to Kaliky [17], the cooking process with the use of medium standard steaming temperature will produce a better shredded fish color after the frying process.

All reactions that cause changes in the appearance of fish shredded are produced due to the influence of the processing process. The steaming process with relatively high temperatures can cause a reaction to change the color of the meat. In accordance with Harimurti's statement [18], the tendency to experience a decrease in the color appearance score is thought to be from the use of heat with a high degree of steaming temperature difference. According to Yunita [19], the steaming process causes the globin protein part to be denatured so that the pigment of cooked meat will cause a brown-gray discoloration. The intensity of color in processed foods is determined by pigment changes that occur during the cooking process and these changes depend on the type, duration, and cooking temperature [20]. Although a food ingredient that is considered nutritious, tastes good, and has a very good texture, it will not be eaten if in terms of appearance it is not interested in the eye. According to Mulyadi [21], color is the property of food products that most influence consumer interest, so visually the color factor appears first.

3.2.2 Aroma

Aroma is one of the factors that can determine the deliciousness of food ingredients and has a lot to do with the sense of smell so that consumers can choose these food products by smelling the aroma [22]. The scents received by the nose and brain are mostly four main scents: fragrant, rancid, sour, and charred [23]. The value of the shredded aroma of mackerel tuna fish can be seen in Fig. 3.

Based on Fig. 3, the steaming temperature treatment of 50°C produces the highest aroma value which has the highest average value of 7.50 with a median value of 8 and the lowest aroma value at the steaming temperature treatment at 60°C treatment has an average value of 5.90 with a median value of 5. The results of the research that has been done, the panelists' impression of the shredded aroma of mackerel tuna fish that the aroma of all treatments smelled still smelled of mackerel tuna fish but there was no fishy smell. According to

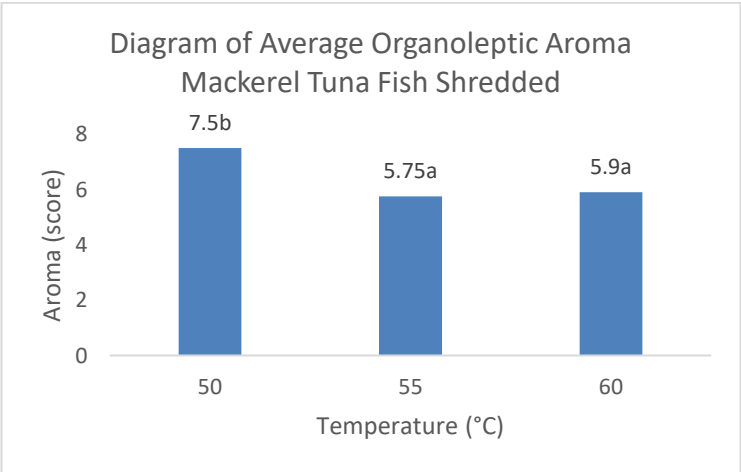

Fig. 3. The average aroma of mackerel tuna fish shredded

Witttriansyah [24], stating the standard aroma of shredded fish for consumers is that it still smells distinctive from the fish ingredients themselves, but does not smell fishy. The aroma in fish meat is due to the content of unsaturated fatty acids. The heating process in fish meat causes many fatty acids to undergo a liquefaction process so that the rancid odor of fatty acids becomes reduced [19].

Panelists preferred the 50°C steaming temperature treatment. It is suspected that the lower the temperature during the steaming process, there are still many fish meat that is not fully cooked so it is suitable when the second heating process occurs, namely the frying process which makes it not eliminate the characteristic smell of fish excessively. According to Denis et al. [25], the higher the temperature in the steaming process, the more the distinctive aroma of the fish decreases. In sulthoniyah research [26], getting the highest aroma results in steaming temperature treatment of 50 ° C which shows that low temperatures can give a distinctive shredded aroma of snakehead fish with spices still felt because it is influenced by the level of doneness of the steamed meat. Aroma components can affect the organoleptic characteristics of a food so that in turn it also plays a role in the level of acceptance and consumption of the final product.

3.2.3 Textures

Texture is one of the parameters in sensory testing that can be felt by the skin and the sense of taste. The texture factor is done touch by hand, tenderness and easy to chew which includes an assessment of wetness, dry, hard, smooth, rough, crispy, and oily [27]. Texture influences the valuation of a product and is the main criterion in estimating food quality because food can be tasted when consumers eat it [28]. The value of the shredded texture of mackerel tuna fish can be seen in Fig. 4.

Based on Fig. 4, the 60°C steaming temperature treatment produces the highest texture value which has an average value of 7.05 with a median value of 7 and the lowest texture value at the 50°C steaming temperature treatment has an average value of 5.45 with a median value of 6.5. The results of the research that has been done, the panelists' impression of all treatments on the average texture of shredded mackerel tuna fish is fibrous and dry conditions so that it can still be accepted by the panelists. Shredded texture generally has a fine and dry fibrous texture to be a consumer assessment [29]. Panelists prefer the 60°C steaming temperature treatment because the texture results are the most fine, soft, and dry so that the panelists' tongues can feel the texture that is easy to swallow. According to Rihayat [30], shredded cooking using a steaming temperature of 60 ° C produces fish meat that is already cooked so that it is easily shredded and looks fibrous, so the frying process produces smoother and softer shredded.

The more protein, fat, and carbohydrate content in fish meat, therefore cooking fish meat must use the right heating temperature, especially in steaming so that the protein is well accommodated. The integrity of the meat texture can be maintained through the steaming process, where this process will produce shredded results that have a fibrous texture. According to Jacoeb [31], the steaming process can cause the moisture contained in fish meat to evaporate and cause fish meat to solidify affecting the texture tissue. Sulthoniyah's research [26], states that if the use of steaming temperature at 65°C the texture of fish meat has been damaged so that it does not produce fibrous shredded after the frying process. Reinforced by Pratiwi's statement [32], the tenderness and doneness of fish meat when steamed greatly affect the shredded texture to produce smooth and soft shredded fiber.

3.2.4 Taste

Taste is a very important factor in determining the panelists' final decision to accept or reject a food [33]. Taste is an assessment parameter using chemical stimuli to the taste buds or tongue which is classified into four main tasters, namely sweet, salty, sour, bitter, and additional responses when modified [16]. The value of the shredded taste of mackerel tuna fish can be seen in Fig. 5.

Based on Fig. 5, the 60°C steaming temperature treatment produces the highest taste value which has an average value of 7.60 with a median value of 7 and the lowest taste value at the 55°C steaming temperature treatment has an average value of 5.70 with a median value of 5. The results of research that have been done, the panelists' impression of the shredded taste of mackerel tuna fish that from all treatments has a sweet and savory taste. According to Uyunun [34], consumer assessments of shredded meat usually have a good and savory taste even

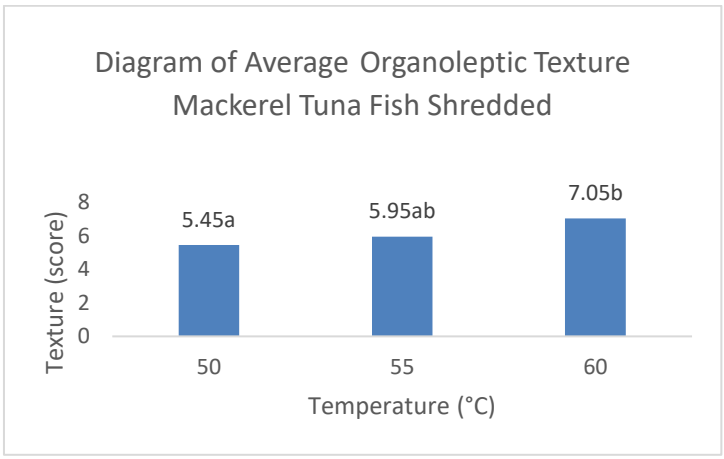

Fig. 4. The average texture of mackerel tuna fish shredded

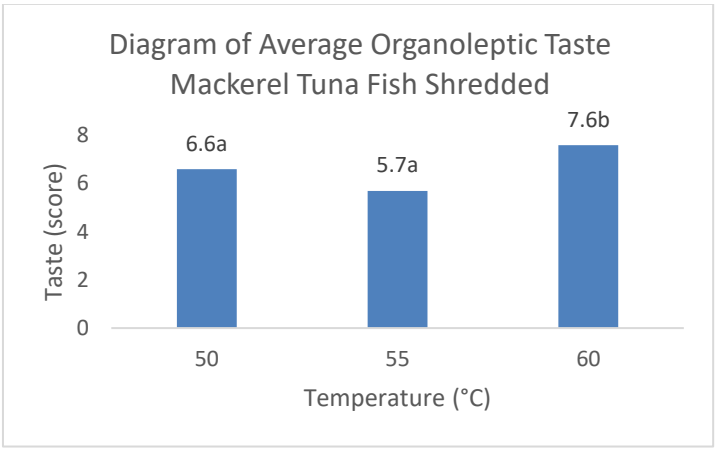

Fig. 5. The Average Taste of Mackerel Tuna Fish Shredded

though there are additional spices carried out such as brown sugar that cause sweetness. Panelists preferred the 60°C steaming temperature treatment resulting in a very tasteful, savory, sweet, and complex shredded fish. This is in the process of steaming protein in fish meat, hydrolysis occurs which converts protein into amino acids. One of the amino acids formed is glutamic acid, which is known to provide a savory taste. Therefore, one of the reasons why steaming protein in fish meat is considered effective in producing a distinctive taste. According to Pido [35], the steaming process that takes place results in protein hydrolyzing into amino acids whose one component, glutamic acid, produces a distinctive savory taste in fish meat.

The influence of heating temperature carried out can result in a decrease in the constituent of taste. According to Hadinoto [36], the presence of heating temperature treatment can cause changes in protein structure in amino acids so that it can reduce taste. The taste can also be affected by the addition of spices (salt, garlic, onion, coriander, sugar, and coconut milk) during the cooking process. Processed food products do not only consist of one taste but a combination of flavors so that a complete taste arises.

3.3 Proximate Test

Proximate tests analyzed include ash content, moisture content, fat content, protein content, and carbohydrate content. The proximate test carried out on shredded fish that was most preferred by the panelists was based on the results of the shredded level assessment, namely at a steaming temperature treatment of 60°C. The results of the proximate test can be seen in Table 3.

Table 3. Mackerel tuna fish shredded proximate test results

Chemical Content	60°C Treatment
Protein (%)	29,42
Ash (%)	6,38
Moisture (%)	7,04
Fat (%)	27,91
Carbohydrate (%)	29,26

3.3.1 Moisture content

Water is an important component in food because it can affect the reception of appearance, texture, and taste [37]. The moisture content contained in food has different amounts even though it is from animal or vegetable food. Moisture content can be used as an important analysis and parameter in determining the quality of food processing because it can affect chemical changes and shelf life [38].

Based on the test results, the shredded moisture content of fish at 60°C steaming temperature treatment has a value of 7.04%. The result of this value is still within the normal limits set by Indonesian industrial standards according to SNI 3707-2013 [6] the moisture content of shredded fish is a maximum of 7%. This result, influenced by the use of steaming temperature, the higher the decrease in moisture content in the meat evaporates, making the texture of the meat cooked and easy to shred. After the frying process, some of the moisture contained in the fish meat will experience evaporation. The use of temperature and heating time must be considered often because it will affect the moisture content. Supported by statements from Sulthoniyah [26] and Rihayat [30], that the higher the use of steaming temperatures of 60°C and 65°C results in low moisture content. Shredded making is also a required stage frying method. According to Gaga [39], as a result of the frying process, the water that is still present in the meat is evaporated by the temperature heat in the pan and oil (intermediate media) so that the moisture content becomes reduced again.

3.3.2 Ash content

Ash is an inorganic substance left behind from the rest of the combustion of an organic matter. Ash is generally in the form of minerals such as potassium, calcium, magnesium, and sodium [40]. The ash content in an ingredient product can be described as a large amount of minerals and as a parameter for assessing the nutritional content of the material product [41].

Based on the test results, the shredded ash content of fish at 60°C steaming temperature treatment has a value of 6.38%. The result of this value is still within the limits set by Indonesian industry standards according to SNI 3707-2013 [6] the shredded ash content of fish is a maximum of 7%. These results, influenced by increasing temperature in the steaming process, will experience a decrease in water content so that more residues are left. Therefore, changes in ash content in steamed fish are also related to the decrease in water content that occurs after steaming. The processing of shredded fish goes through a steaming process that can affect the ash content of fish meat due to heating. This is in accordance with Wiwiek [42], the decrease in ash content when high water content in meat is experienced during the steaming process for a long time causes some of the minerals in the meat to be carried away by the water vapor that comes out. Ash content is also influenced by the characteristics of fish, one of which has many scales and bone constituents because it provides many minerals [43].

3.3.3 Fat content

Fat is one of the food substances and the main component as a source of energy found in foods other than carbohydrates and proteins. Fat content is owned by almost all foodstuffs even with different content [44]. According to Widyaningsih [45], the nutritional content of fat can improve appearance, physical structure, add nutritional value and bring flavor components to foodstuffs.

Based on the test results, the shredded fat content of fish at 60°C steaming temperature treatment has a value of 27.91%. The result of this value is still within the normal limits set by Indonesian industry standards according to SNI 3707-2013 [6] the fat content of shredded fish is a maximum of 30%. These results, are influenced by the use of a temperature of no more than 65 ° C so as not to cause damage and a very large decrease in fat. While during the frying process, fat levels do not experience a drastic increase which causes fat levels to be in accordance with shredded standards. The decrease in fat content in cob meat is influenced by the cooking process that uses heat, namely the stage of making shredded fish which begins the steaming process. According to Salmatia

[46], the steaming process can cause shrinkage of fat content in fish meat due to loss of tissue fluid and accelerate the movement of fat molecules into large distances to facilitate fat removal. According to Rihayat [30], the use of steaming temperatures exceeding 65°C can reduce the value of the fat content of ingredients due to the frying process which can increase the shrinkage of fat content.

3.3.4 Protein content

Protein is the main nutritional content that is important for the body and functions as a source of energy, maintenance, formation of essential bonds, regulating water balance, formation of antibodies, and transport of nutrients [47]. Protein is also one of the components with the largest amount after water content. Proteins have a component structure consisting of long chains of amino acids bonded to each other by peptide bonds [48]. Protein is found in many fishery products whose protein content is easily absorbed and digested so it is good for consumption as a meeting of protein nutritional needs [49].

Based on the test results, the shredded protein content of fish at 60°C steaming temperature treatment has a value of 29.42%. The results of this value have met the limits set by Indonesian industry standards according to SNI 3707-2013 [6] fish shredded protein content of at least 15%. These results are influenced by the use of steaming temperatures that do not exceed steaming temperatures of more than 70-75 ° C and above because when below that temperature the protein experiences perfect coagulation in the tightness of the meat so that during the frying process, protein levels do not decrease by a large amount or no protein damage occurs and produce perfect protein levels. The occurrence of a fairly high decrease in protein levels in shredded cob fish due to the processing process (cooking) using repeated high temperatures such as steaming and frying. According to Fitrawan [50], steaming can reduce protein levels in fish meat which can cause protein denaturation so that coagulation occurs which forms a simpler structure, decreases solubility (redundant), and the amount decreases. heating temperature can affect myofibrillar tightness (at 60°C it is completely coagulated) so cooking with high temperatures will result in meat drying and myofibrillar hardness coagulating. According to Hidayat [51], the occurrence of early stage protein denaturation is at the use of 50 ° C which is categorized as a protein that has not been damaged and only undergoes changes in the structure of secondary, tertiary, and quaternary, while at the use of temperatures between 70-75°C can experience denaturation of most proteins.

3.3.5 Carbohydrate content

Carbohydrates are the main source of energy and have an important role in the body of living things. Carbohydrates have a function to prevent excessive protein breakdown, mineral loss, and help metabolize fat and protein [52]. Carbohydrate content *by difference* can be determined from the results of a 100% reduction with water content, ash content, fat content, and protein content so that carbohydrate levels depend on the reduction factor.

Based on the test results, the shredded carbohydrate content of fish at 60°C steaming temperature treatment has a value of 29.26%. The result of this value is still within the normal limits set by Indonesian industry standards according to SNI 3707-2013 [6] the carbohydrate content of shredded fish is a maximum of 30%. These results are influenced by the cooking process which goes through two stages of repeated heating, namely the use of steaming and frying temperatures, carbohydrate levels are influenced by the results of other proximate content such as water, ash, fat, and protein. The high and low carbohydrate content of shredded fish products depends on the proportion of other nutrients. According to Mergypta [53], the increase or decrease in carbohydrates is caused by other nutritional factors such as water content, ash content, fat content, and protein content. The lower the proximate content such as water, ash, fat, and protein produced, the carbohydrate content also decreases. The higher the proximate content produced from the cooking process, the carbohydrate content also increases.

4. CONCLUSION

Based on the results of the study, it can be concluded that all treatments with steaming temperature variations were accepted by panelists while the 60°C treatment was the preferred treatment, based on the level of organoleptic characteristics with the median value of appearance, aroma, texture, and taste getting a value of 7 (preferred) with proximate

test results of protein content 29.42%, ash content 6.38%, water content 7.04%, fat content 27.91%, and carbohydrate content of 29.26%.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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