Original Research Article

The Effect of Heating Duration on the Preference Level of Pindang Presto Indian Mackerel

ABSTRACT

Indian Mackerel is one of the potential small pelagic fish and has a dense meat quality so that it can be made as a pindang product. Presto roasting is one of the processing performances resulting from the modification by applying high-temperature heating with a pressurized device whose process can reduce or eliminate fishy smell by maintaining the nutritional content and melting fish bones so that they can be consumed without causing pain, the length of the heating process can reduce quality disturbances. Organoleptic characteristics of the product affect consumer acceptance. This study aims to determine the effect of heating time on the nutritional content of pressure cookers and consumer power. This research was carried out from January 2022 to March 2022 and took place at the Laboratory of Fishery Products Processing, Faculty of Fisheries and Marine Sciences, Padjadjaran University, and the Laboratory of the Faculty of Food Technology, Pasundan University. The method used is a non-parametric statistical method that consists of 3 treatments, namely the experimental heating time of 60 minutes, 90 minutes, and 120 minutes and 20 semi-experimental panelists as replicates. The tests consisted of Friedman's test and Bayes' test which were discussed descriptively and proximate and calcium tests were carried out for the best treatment. The results showed that the most preferred Indian Mackerel pindang presto was an overall aromatic, texture, and taste, with 120 minutes of heating time. Organoleptic characteristics of Indian Mackerel with a heating time of 120 minutes have an effect on the appearance of brown fish meat, the scent of fish is not fishy, the texture of the meat becomes softer and the spines and bones of the fish become soft so it can be consumed, and the taste is more savory. The results of the proximate test and calcium tests showed that the nutritional content of Indian Mackerel pindang presto was the most preferred, with the water content of 57.39%, ash content of 4.39%, a fat content of 14.56%, protein content of 21.94%, carbohydrate content 1.72% and calcium levels 18.73 mg/100g.

Keywords: Indian Mackerel, Nutrition, Organoleptic, Heating, Presto

1. INTRODUCTION

Fish is one of the foods that are very beneficial for humans because it has various substances needed for the human body, such as protein, fat, carbohydrates, vitamins, and minerals [1]. Fish also has particular benefits, in that are contains omega-3 fatty acids whose essential fatty acid composition is polyunsaturated [2]. Fish prices are also relatively more economical than other sources of protein production [3]. Fish has components that are often not utilized, one of which is fish bones.

Fishbone is a waste product from the fish processing industry which contains calcium which is quite enough among other fish body parts because the main elements of fish bones are calcium, phosphorus, and carbonate [4]. Fish bones contain large amounts of calcium in the form of calcium phosphate. The complex of calcium phosphate in bones can be well

absorbed by the body around 60-70% [5]. Indian Mackerel is a fish that can be used the waste and is one of the commodities that are often consumed.

Indian Mackerel is one of the potential small pelagic fish and has important economic value in Indonesia [6]. Indian Mackerel is arrested for consumption, because it has dense meat quality and high nutritional value compared to other pelagic fish, and has a profitable selling value [7]. Indian Mackerel has dense meat that can be used as a pindang product, especially since the production of Indian Mackerel in Indonesia is abundant and easy to obtain [8]. Indian Mackerel is a source of nutrients that is important for the body, namely minerals and vitamins [9]. Indian Mackerel has a mineral, especially in the bones, which is calcium.

Calcium is an important substance for the body because it has an active role in the formation of bones and teeth, calcium also plays a role in measuring biological processes in the body [10]. According to Ramayulis et al. (2011) [11], calcium consumed by people in Indonesia is only 254 mg/day from the 800 mg/day recommended by the RDA (Nutrition Adequacy Ratio) in 2004. Calcium deficiency in the adult group causes osteoporosis, which causes bones to become brittle and break easily [12]. Calcium in Indian mackerel bones has higher levels than the meat, but Indian Mackerel has a sharp fishy smell because of the trimethylamine levels in the fish's body.

Trimethylamine (TMA) is a compound that gives fish a characteristic fishy smell [13]. Trimethylamine (TMA) is the result of the reduction of Trimethylamine oxide (TMAO) utilized by microorganisms for oxygen atoms under aerobic conditions, increasing TMA [14]. Trimethylamine oxide (TMAO) in marine fish tends to be higher than in freshwater fish. Indian Mackerel is one of the marine resources, so TMAO levels in Indian Mackerel tend to be higher. The fishy smell of Indian Mackerel caused by the content of trimethylamine (TMA) requires processing that can reduce or even eliminate it.

Indian Mackerel processing at the household level is usually processed simply by frying, but the temperature of processing by frying can reach 160ºC. Processing in this way is estimated to damage the nutrients in a fish, one of which is a decrease in minerals ranging from 5-40%, especially calcium, iodine, zinc, selenium, and iron [15]. Processing in other ways is needed to minimize this occurrence, one of which is diversification of processing, namely presto transfer.

Presto roasting is a form of diversification of processing modified by adopting a canning process, namely by heating at high temperatures [16]. Presto roasting is processed by seasoning and through high-temperature heating with a pressurized device [17]. The pressing process with salt and spices and high-temperature pressure aims to reduce or eliminate the fishy smells while maintaining the nutritional content of fish and softening fish bones to be consumed without causing pain. However, the heating process takes a long time and makes the poor result of organoleptic characteristics of the product and affects consumer acceptance. Therefore, it is necessary to research because diversification of Indian Mackerel fish products by pressing pressure during a particular heating time can affect the nutritional content and consumer acceptance. Processing with a presto can reduce waste to be beneficial nutrition for the body if it is well received.

2. MATERIAL AND METHODS

2.1 Time and Place

This research started in February 2022. The processing of pindang presto and hedonic tests were carried out at the Fishery Product Processing Laboratory, Faculty of Fisheries and Marine Sciences, Padjadjaran University.

2.2 Tools and Materials

The tools used in the processing of Indian Mackerel pindang presto are pressure cookers (1-1.5 atm), knives, scales, basins of various sizes, gas stoves, plastic containers, cameras, blenders, and trays.

The ingredients used in the processing of pindang presto are 3.5 kg of male Indian Mackerel from Jatinangor Market, aqua dest water, ingredients/condiments (shallots, garlic, ginger, turmeric, galangal, coriander, candlenut, water, lime leaves, coriander leaves). salam, salt, chili, tamarind, and flavoring).

2.3 Research Methods

The research method is used the experimental method with 3 treatments at a pressure of 1.5 atm as follows :

Treatment A: 60 minutes of heating time,
Treatment B: 90 minutes of heating time and
Treatment C: 120 minutes of heating time.

Organoleptic testing was carried out by hedonic test (preferred level test) and the results of the treatment that were most favored by the panelists were then tested for proximate and calcium tests. The results of the proximate and calcium tests were then discussed in a comparative descriptive manner with other literature.

2.4 Research Stages

The stages of research carried out in the processing of Indian Mackerel pindang presto are weeding the fish, cleaning until there is no dirt and blood on the fish, then smearing with spices prepared as pindang spices on the outside and inside of the fish body, the fish is arranged in a pressure cooker and put in distilled water as a heating medium, and the pressure cooker was tightly closed to be cooked according to the treatment given, namely 60 minutes, 90 minutes, and 120 minutes.

2.5 Observation Parameters

The parameters observed in this research were the organoleptic test, proximate test, and calcium test. The organoleptic test uses a hedonic test (level of preference) which included appearance, aromatic, texture, and taste tests [18]. The proximate and calcium test were after the panelists found the most preferred product to determine the nutritional content of the product.

2.5.1 Hedonic Test

The hedonic test aims to determine the response from the panelists to the Indian Mackerel presto product based on organoleptic characteristics including appearance, aroma, texture, and taste. According to Haris and Agustiawan (2018) [19], the test method uses a preference score on a scale of 1 to 9, namely:

1 = very dislike
3 = dislike
5 = neutral/ normal
7 = like
9 = very like

The requirement for the organoleptic test value of soft thorn fish is with a rejection limit of 5 then the product is declared acceptable by the panelists (Soekarto 1985) [20], meaning that if the product is tested obtains a value less than five then the product is declared unacceptable.

2.5.2 Proximate Test

The proximate test was taken to determine the nutrition value of the fish. The proximate tests include moisture content using the drying method (Gravimetry), ash content using the dry ashing method, protein using the Kjeldahl Macro Nitrogen method, fat using the extraction method, and carbohydrates using the by difference calculation method.

2.5.3 Calsium Test

The calcium test was taken to determine the level of calcium contained in the Indian Mackerel pindang presto. The principle of testing calcium levels is the result of calcium oxalate and oxalic acid titrated with KMnO4.

2.6 Data Analysis

The data for organoleptic testing uses non-parametric analysis, which is a two-way variant between the Friedman test and the Multiple Comparison test. The results of the hedonic test assessment are followed by the Bayes test to determine the selection of criteria based on the importance and the highest score of a product [21]. The results of the statistical analysis were taken from the best samples and analyzed for proximate and calcium then the results were compared with the minimum ≤ 5 for presto fish/presto milkfish [20].

3. RESULTS AND DISCUSSION

3.1 Hedonic Test Indian Mackerel Pindang Presto

3.1.1 Appearance

Appearance is a parameter that is important in organoleptic. Panelists assess the parameter and if the impression of the parameter is good, the panelists will see other organoleptic parameters (aromatic, texture, and taste). Appearance also affects consumer acceptance, although it does not determine the absolute level of consumer preference [22]. Based on the analysis of the Friedman test with a 95% confidence level, the median value of the appearance parameter for the 60 minutes, 90 minutes, and 120 minutes of heating time is 7, which means that the Indian Mackerel pindang presto product is favored by the panelists. The average appearance value for each treatment tends to be favored with a value of 6.4 to 6.8 because the appearance of the surface of the fish is intact, flat and the color tends to be brilliant and does not have a significant difference overall.

The Statistical test showed that the heating time did not significantly affect the appearance of Indian Mackerel pindang presto. Overall treatment was acceptable on the appearance

parameters. That means that the heating time of the Indian Mackerel pindang presto with 60 minutes, 90 minutes, and 120 minutes is still favored by the panelists.

The appearance of the Indian Mackerel pindang presto has a brownish yellow color. The yellow color is obtained from giving turmeric to the pindang spice which has curcumin compounds that function as natural dyes, while the brown color is obtained from high temperatures and the length of the heating process due to the reaction between proteins, peptides, and amino acids with the results of fat decomposition [23].

3.1.2 Aromatic

Aromatic is an important response of the sense of smell. Aromatic plays an important role in food production thereby increasing the attractiveness of food products [24].

Based on the results of the statistical tests, it was shown that the heating time significantly affected the aromatic of the Indian Mackerel pindang presto. Overall all treatments are acceptable on the aroma characteristics with a value of 5. That means the heating time for Indian Mackerel pindang presto on 60 minutes, 90 minutes is favored by the panelists and can be consumed and 120 minutes in treatment (7, 9) is most liked by the panelists.

3.1.3 Texture

The texture is one of the characteristics of food ingredients and their processed products that are also considered by consumers and panelists [25]. Changing the texture of a material can make a different aromatic and taste because the texture will affect the speed of stimulation of the olfactory cells and salivary glands [22].

Based on the results of statistical tests, Friedman and Multiple Comparison tests, the overall Indian Mackerel pindang presto (heat treatment 60 minutes, 90 minutes, and 120 minutes) was favored on the texture characteristics. The average value of 120 minutes of treatment has the highest value which shows the characteristics of the pindang presto texture at 120 minutes of heating is the most preferred characteristic. The heating time on the Indian Mackerel pindang presto with texture characteristics within 120 minutes means that the heating time is the most preferred by the panelists.

The longer heating process on the Indian Mackerel pindang presto makes the bones and spines of the fish softer. This can be seen from the pindang presto which was treated for 60 minutes, 90 minutes and 120 minutes where the fish treated for 60 minutes had bones and spines that were still hard, the fish treated for 90 minutes was quite soft and the fish treated for 120 minutes had soft bones and spines. This proves that the Indian Mackerel pindang presto can be eaten directly along with the bones and spines, which is 120 minutes of treatment.

According to Saparinto (2007) [26], the texture of the presto pindang meat on the quality criteria of fish presto with the texture category is compact, dense, quite dry, not watery, and rough. The texture of the meat in the 120-minute treatment had a compact and soft texture, then the 90-minute treatment had a compact texture and was not too soft, while in the 60-minute treatment the meat had a texture that was not compact and still rough. The treatment of 60 minutes, 90 minutes, and 120 minutes was still favored by the panelists, as seen from the median values of 5, 7, and 8 with a limit of ≤ 5, the product was preferred [20].

3.1.4 Taste

The taste of a product greatly affects the level of consumer acceptance. although the other parameters are good, the taste is not, and the product will be rejected [20]. Taste is assessed through the sense of taste and is a unity between the sensory properties of aromatic, taste, and texture [27].

Based on the results of statistical tests showed that the heating time significantly affected the taste of Indian Mackerel pindang resto. The whole Indian Mackerel pindang presto products (treatment 60 minutes, 90 minutes, and 120 minutes) is acceptable on the taste characteristics. The heating time of the mackerel presto with a characteristic taste of 120 minutes has the highest value, which means that the heating time of 120 minutes is the most preferred taste characteristic by the panelists.

The criteria for the taste of Indian Mackerel pindang presto by the results of the hedonic test analyzed using Friedman showed that different heating treatments gave a significant difference in the taste of Indian Mackerel pindang presto. The average value shows that the longer the heating process of Indian Mackerel pindang presto, the panelists' preference for the taste of fish presto increases. According to Saparinto (2007) [26], the quality criteria for fish presto products with a taste category are the specific savory fish presto with soft spines, not too salty, and evenly salty.

3.2 Analysis with Bayes Method

The best decision was made by the Bayes method. The Bayes method calculates the median result and the weight of the criteria for each criterion in the hedonic test and determines the alternative and priority value of each of these criteria. The calculation of the weight of the criteria and the priority value in determining the best treatment by considering the appearance, aroma, texture, and taste of Indian Mackerel fish are presented in Table 1.

Based on the calculation using the Bayes method, it was found that the Indian Mackerel pindang presto with 120 minutes of heating treatment had alternative values and the highest priority values were 8.24 and 40.8%, respectively. Indian Mackerel pindang presto with a heating time of 120 minutes is the best treatment most favored by the panelists.

Table 1. The Decision Matrix of Pindang Presto Indian Mackerel Fish Assessment Decision Matrices with the Bayes Method

	Perlakuan				Alternatif Value	Priority Value
Time	Apparance	Aromatic	Taste	Texture		
60 minute	7	5	5	5	5,15	0,255
90 minute	7	6	7	7	6,80	0,337
120 minute	7	7	9	8	**8,24**	**0,408**
Weight	0,08	0,20	**0,51**	0,21	20,19	1,00

3.3 Proximate Test Indian Mackerel Pindang Presto

3.3.1 Water Content

The principle of water content analysis is the process of evaporation of water from the material by heating. Heating at high temperatures reduces the water content in a material [28].

Based on the results of the water content test, the water content of Indian Mackerel pindang presto was 57.39%, while the water content of raw Indian Mackerel was 76.4%. The decrease in water content in Indian Mackerel pindang presto is influenced by a long heating process with high temperatures. This is following Susilo et al. (2014) [29], that there was a decrease in the water content of the resulting presto product due to the long heating and high temperatures that took place so that the fish's body released a certain amount of water.

3.3.2 Ash Content

Ash is an organic residue obtained by ashing organic components in food [30]. The principle of ash content analysis is the process of burning organic compounds to obtain an organic residue called ash [28]. Measurement of ash content is determined by gravimetry.

Based on the results of the ash content test, it was found that the ash content of Indian Mackerel fish had an ash content of 4.39%, while fresh Indian Mackerel had an ash content of 1.49%. There was a change in the value of the ash content along with the decrease in the water content of the fish pressure because the ash content was a residual inorganic substance from mineral elements and other organic materials [31].

Food ingredients consist of 96% inorganic substances and water, and the rest are mineral elements, so the higher the ash content, the higher the mineral content [32]. The results obtained from the increase in the value of the ash content that occurs in the product mean there is a possibility of a decrease in the value of the mineral content contained in the product.

3.3.3 Protein Content

Protein is a food substance for the body because it functions as fuel and is also a building block and regulator for the body [33]. The principle of analysis of protein content from total nitrogen is the process of liberating nitrogen from protein in the sample using sulfuric acid by heating [28]. Determination of protein content of total nitrogen using the Kjeldahl micro method.

Indian Mackerel pindang presto has a protein content of 21.94% while the protein content of fresh Indian Mackerel is 18.5%. The increase in protein value that occurred in Indian Mackerel pindang presto was caused by a long heating process with high temperature and pressure. According to Susilo (2014) [29], the addition of salt and high temperatures cause the fish protein to become concentrated. This agrees with Tapotubun et al. (2008) [31], the value of the protein content of fish press has increased due to the use of salt and high temperatures, due to the release of water from fish meat which causes the protein to be more concentrated than fresh fish, the value of protein content of presto products has increased.

3.3.4 Fat Content

The principle of fat content analysis is extraction, which is the separation of fat from the sample by circulating the hexane solvent into the sample. Therefore, the other compounds cannot be dissolved in the solvent. The method used in the fat analysis is the Soxhlet extraction method.

Based on the results of the fat content test, Indian Mackerel fish has a fat content of 14.56%, while raw Indian Mackerel is 0.59%. The increase in the fat content value in the pressure cooker occurs because the pressure in the pressure cooker dissolves organic and inorganic

elements through hot steam which is in line with the release of carbon chains that form free fatty acids [34]. The increased free fatty acids were linoleic and linolenic due to the overall accumulation of free fatty acids.

The heating process causes the fat content to increase as the heating time increases. This is different from the results of research by Susilo et al. (2014) [29], that the longer the heating process can reduce the fat content of presto petek fish, but this is following the research of Kurniasih et al. (2017) [30], namely the longer the heating, the higher the fat content of presto milkfish. The high-pressure heating process causes fat hydrolysis [35]. The level of damage that occurs due to hydrolysis varies greatly depending on the temperature used and the length of processing time, the higher the temperature used, the greater the fat damage [29](Susilo et al. 2014), but the measurement of fat content is also influenced by the water content of a food ingredient [35]. According to Soeparno (2009) [36], fat content is negatively correlated with the water content contained, the lower the fat content, the higher the water content, and vice versa.

3.3.5 Karbohidrat Content

Based on the results of the test on carbohydrate levels using the by difference method, the carbohydrate content in Indian Mackerel pindang presto was 1.72%, while the carbohydrate content of fresh Indian Mackerel was 2.9%. There was a decrease in carbohydrate levels due to the length of heating on the mackerel Pindang presto. This is in accordance with the research of Kurniasih et al. (2017) [30], where the longer the presto cooking process, the lower the carbohydrate content.

3.4 Calsium Test Indian Mackerel Pindang Presto

Based on the results of the test for calcium levels, the value of calcium contained in the meat and bones of Indian Mackerel fish was 18.73 mg/100 g, while the results of the test for calcium levels in the whole milkfish obtained a value of 1422 mg/100 g **[37]**. According to Almatsier (2002) **[38]**, the recommended nutritional adequacy rate is 500-800 mg/day. These results indicate that the mackerel's pindang presto cannot meet the calcium requirement per day when consuming 100 g of Indian mackerel pindang presto, so to meet the calcium needs it is necessary to balance it with calcium-containing foods or drinks such as milk.

Calcium content in Indian Mackerel pindang presto decreased overall, with calcium content in raw Indian Mackerel which was 20 mg/100 g and after processing pindang presto the overall calcium level was 18.73 mg/100 g **[39]**. Decreased calcium content can occur because during cooking the fish's body releases a certain amount of water which allows other nutrients to be released including the mineral content, namely calcium in fish **[40]**. Calcium levels are also related to the protein content contained in the product, the more decomposed the protein content, the higher the calcium content, and vice versa, the more concentrated the protein content, the lower the calcium level **[41]**.

4. CONCLUSION

Based on research on the effect of heating time on the level of preference for Indian Mackerel, it can be said as follows :

1) Indian Mackerel pindang presto as a whole on the criteria of appearance, aromatic, texture, and taste favored by good panelists in all treatments, by 60 minutes, 90 minutes,

and 120 minutes. The 120-minute treatment is the treatment with the highest value on the overall criteria. The 120-minute treatment is the most preferred compared to the others.

2) Weight The criteria for Indian Mackerel pindang presto include 8% appearance, 20% aromatic, 21% texture, and 51% taste. The priority value of Indian Mackerel pindang presto in the 60-minute treatment is 25.5%, the 90-minute treatment is 33.7% and the 120-minute treatment is 40.8%. The Indian Mackerel presto with a heating time of 120 minutes produces fish presto the most preferred bloating by the panelists.

3) The results of the proximate test and the calcium test of pindang presto Indian Mackerel were the most preferred by the panelists (120 minutes) with the water content 57.39%, ash content 4.39%, fat content 14.56%, protein content 21.94%, the carbohydrate content of 1.72% and calcium content of 18.73 mg/100g.

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