World News of Natural Sciences

An International Scientific Journal

Addition of carrageenan fluor on preference level of mackerel nugget

Shinta Siti Fatimah*, Rusky Intan Pratama, Junianto and **Evi Liviawati**

Faculty of Fisheries and Marine Science, Padjadjaran University,
Jl. Raya Bandung Sumedang Km 21, Jatinangor 45363, West Java, Indonesia

*E-mail address: shintasitifatimah85@gmail.com

ABSTRACT

This study aims to determine the preference level of mackerel nuggets supplemented with carrageenan. This research was conducted at the Fisheries Processing Laboratory of the Faculty of Fisheries and Marine Sciences and Central Laboratory of Padjadjaran University, in August - September 2018. The research method used was the experimental method with five treatments of carrageenan flour addition - about 0%, 0.5%, 1%, 1.5%, and 2%, based on mackerel fish surimi weight. The parameters observed were the level of preference which included appearance, aroma, texture and taste of mackerel fish nuggets. The panelists used in this study were 20 semi-trained individuals. The results showed that the addition of carrageenan flour treatment by 0.5% of the surimi weight produced the most preferred mackerel fish nuggets, according to panelist selection.

Keywords: mackerel nuggets, carrageenan flour, elasticity level

1. INTRODUCTION

Fish is a commodity fisheries subsector that is rich in protein, essential amino acids needed by the body, have a biological value of 90% with a little connective tissue so that the fish are easier to digest. According to Howara (2013), the fish is a source of protein that has a weakness; one of the drawbacks of fish is that the fish meat has a high water content and pH close to neutral, therefore that the fish is considerad as a good medium for the growth of spoilage bacteria and other organisms which could cause fish easy to deteriorate. The meat of fish contain unsaturated fatty acids that are in very high levels susceptible to oxidation, such conditions cause rancidity in the fish body.

Processing fish meat into nuggets is one of the alternative utilization of fish products that are intended to extend the shelf life of the product becomes longer. Nugget is a type of food products made from meat, having a relatively long shelf life for the treatment of storage at freezing temperatures.

Raw materials that can be utilized in the processing of these products, one of which being mackerel. Mackerel is a pelagic fish economically valuable and important in Indonesia and even in the world, because it contains high levels of protein and good for growth (Nugroho, 2014). Mackerel has a water content of 76.5%, 21.4% protein, 0.56% fat, 0.61% carbohydrate, and ash content of 0.93 %. Mackerel can be processed into crackers, dumplings, and pempek (Deden and Nurilmala 2015).

Nugget, as a form of processed meat products which has a form of oil-in-water emulsion. Problems which often arise in the manufacture of emulsion is unstable emulsion system dough. This resulted in the outbreak of the emulsion system at the time of processing and storage. Prevention efforts that the emulsion system is not broken and lasts a long time is by adding an emulsifier. Emulsifiers are substances that can maintain the stability of a product, and therefore the processing of mackerel fish nuggets need an additional emulsifier so that the resulting dough has good stability, one emulsifier is carrageenan.

According to Agustin *et al*. (2017), carrageenan is a compound that includes a group of galactose polysaccharide extracted from the seaweed. The polysaccharide used in the food industry is a function of characteristics that can control the water content in the main food ingredients, texture control, and stabilize food. The addition of carrageenan to mackerel fish nuggets or other food materials can affect the texture of the resulting product, thus affecting the panelists also to the level of preference. The purpose of this study was to determine the rate of addition of carrageenan in the manufacture of mackerel fish nuggets on the level of preference (Ardiansyah, 2019; Hakim, 2018).

2. MATERIALS AND METHODS

2. 1. Time and Place of the Research

The study was conducted in August - September 2018 in the Laboratory of Fishery Products Processing Technology of the Faculty of Fisheries and Marine Sciences, Padjadjaran University, and in the Institute for Research and Community Service, Bogor Agricultural University, Indonesia.

2. 2. Tools and Materials

The tools used in the research are knives, cutting boards, food processors, steamer stands, pans, molds, basins, scales, meat grinders, Paris cloths, stoves, styrofoam plates, and blenders. The ingredients used are mackerel fish, carrageenan flour, tapioca flour, panir flour, garlic, onions, salt, pepper and eggs from the nearest local market.

2. 3. Research Methods

The method used in this study was the experimental method with five additional treatments of carrageenan flour including 0%, 0.5%, 1%, 1.5%, and 2% of the surimi weight. The parameters observed were the level of preference for appearance, aroma, texture, and taste of mackerel fish nuggets. The panelists used were semi-trained panelists of 20 people. Favorite

level scales range from 1-9, which are most preferred (9), Preferred (7), normal (5), slightly dislike (3), and dislike (1).

2. 4. Data Analysis

Data obtained from the level of preference were analyzed using Friedman's two-way non-parametric statistics. The statistical formula used based on Sudrajat (1999) is as follows:

$$x^2 = \frac{12}{bk\,(k+1)} + \sum_{i=1}^{t}(Rj)^2 - 3b\,(k+1)$$

where:

X^2 = Friedman test statistics
b   = Repetition
k   = Treatments
RJ^2 = Total Rank of each Treatments.

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

$$FK = \frac{\Sigma\,T}{1-(K^2-1)}x^2{}_c = \frac{x^2}{FK}$$

where:

$Ti = ti3 - ti$
Ti = Amount of similar number for a rating under i-block.

If the value of $Xn2 < Xt2$ (α, k-1), then accept H0 and reject H1, and if $Xn2 > Xt2$ (α, k-1), then H0 is rejected and H1 is accepted. If H1 is accepted, there is an influence between treatments on the appearance, aroma, texture, and taste of mackerel fish nuggets. The next test is followed by a multiple comparison test with the following formula:

$$|Ri - Rj| = \le Z_{\left\{\frac{\alpha}{k\,(k-1)}\right\}} \sqrt{bk\,(k+1)/6}$$

where:

$|Ri - Rj|$ = Total rank
Ri   = Total rank from sample to-i
Rj   = Total rank from sample to-j
α = Experiment
b   = Amount of repetitions
k   = Amount of treatments.

The decision of the panelists on the most preferred product criteria from the appearance, aroma, texture, and taste parameters was carried out by the Bayes method. The Bayes method formula is as follows:

$$\text{Total i value: } \sum_{j=i}^{m} (Kritj)$$

where:

Total Value I = Total Final Value of Alternative 1
Ij value = Value of Alternative 1 in J-Criteria
Citeria-J = To-J Criteria (Weight)
I: 1,2,3,…, N;N = amount of alternative
I: 1,2,3,…, M;M = amount fof criteria.

3. RESULTS AND DISCUSSIONS

3. 1. Level of Preference for the Appearance of Mackerel Fish Nugget

Arnesih (2018) states that appearance is the first characteristic assessed by panelists in consuming a product. The first parameter observed by consumers is appearance or color because it is a parameter that determines the reception of the panelists. The average level of preference for the appearance of mackerel fish nuggets is presented in **Table 1**.

Table 1. Average Value of the Level of Preference for the appearance of Mackerel Nugget from the Treatment of Carrageenan Flour addition

Carrageenan Flour Addition (0%)	Median	Average
0%	7	7.3 a
0.5%	7	7.5 a
1%	7	7.1 a
1.5%	7	7.2 a
2%	7	7.4 a

Description:

The number followed by the same letter in the direction of the column shows no significant difference, according to the multiple comparison test at the 95% confidence level.

Based on the results of multiple comparison tests one can see that all treatments were not significantly different at the 95% confidence level. The results of the two-way Friedman test showed that the addition of carrageenan flour had no effect on the appearance of mackerel fish nuggets which means the panelists had the same level of preference for all the appearance of mackerel fish nuggets.

This is because carrageenan flour, tapioca flour and surimi have white color which causes the appearance of mackerel nuggets to have the same color (white) for all treatments.

The results of this study are in the same line with the results of research by Ririsanti (2017) regarding the addition of carrageenan flour to pempek catfish which also showed that there was no effect of adding carrageenan flour to the appearance of pempek catfish. According to Nurhuda (2017), she stated that the addition of carrageenan flour did not affect the appearance of manyung fish meatballs that were suspected that way because carrageenan flour had a white color.

3. 2. Level of Preference for the Aroma of Mackerel Fish Nugget

The aroma of food products mostly comes from the raw materials used and the spices added when making dough. The delicacy of a food is determined by the aroma factor, in general the aroma is the main attraction in determining the delicious and unpleasant taste of a food (Iffa 2018). The average value of the preference level for the aroma of mackerel nuggets is presented in **Table 2**.

Table 2. Average Value of the Level of Preference for Aroma Mackerel Nugget from the Treatment of Carrageenan Flour addition

Carrageenan flour ddition (0%)	Median	Average
0%	7	6.4 a
0.5%	7	7.7 a
1%	7	7.1 a
1.5%	7	7.0 a
2%	7	6.5 a

Description:

The number followed by the same letter in the direction of the column shows no significant difference, according to the multiple comparison test at the 95% confidence level.

Based on the results of multiple comparison tests one can see that all treatments were not significantly different at the 95% trust level. Meanwhile, according to the Friedman test showed that the addition of carrageenan flour did not affect the aroma of mackerel fish nuggets, which means the panelists had the same level of preference for the aroma of mackerel fish nuggets with the addition of carrageenan.

This is because carrageenan flour has a neutral and odorless aroma, but the addition of herbs used, such as garlic, onions, pepper and flavorings can also affect the aroma of mackerel fish nuggets.

This research is in line with Ririsanti' research (2017) regarding the carrageenan flour addition towards pempek catfish which also showed that there was no effect of adding carrageenan flour to the aroma of it.

3. 3. Level of Preference for the Texture of Mackerel Fish Nugget

Texture is one of the criteria in organoleptic assessment. Texture is a sensation of pressure that can be observed with the mouth and fingers. The measurement of the texture by mouth is done by being bitten, chewed and swallowed, while the measurement of texture with the fingers is done through touching. The texture of 'fish jelly' products in general has a texture that is more supple and easy to chew. The average value of the preference level for the texture of mackerel fish nuggets is presented in **Table 3**.

Table 3. Average Value of Preference Level on the Mackerel Nugget Texture from the Treatment of Adding Carrageenan Flour

Carrageenan Flour Addition (0%)	Median	Average
0%	7	6.5 a
0.5%	9	8.0 b
1%	7	7.4 ab
1.5%	7	6.8 ab
2%	7	7.5 ab

Description:

Numbers followed by the same letter in the direction of the column show no significant difference, according to the multiple comparison test at the 5% level.

Based on the results of multiple comparison tests one can see that the addition of 0% carrageenan flour was significantly different from the 0.5% treatment. The addition of carrageenan flour with a treatment of 1%, 1.5%, and 2% did not have a significant difference in the assessment of the texture of mackerel fish nuggets. As for Friedman test, it shows that the addition of carrageenan flour affects the texture of mackerel fish nuggets, which means the panelists have different levels of preference for the texture of mackerel fish nuggets. This is due to the influence of adding carrageenan flour.

According to Ririsanti (2017), carrageenan can be used as a gelling agent because it contains stronger sulfate esters, which is 25-30%. With high esters, carrageenan can form a gel well. Texture changes are caused by the loss of water or fat content or due to the breakdown of emulsions or gels, hodrolysis of carbohydrate polymers, and coagulation or protein hydrolysis.

3. 4. Level of Preference for the Taste of Mackerel Fish Nugget

Taste is the tongue's response to stimuli given by food. Taste is a factor that is also important in the organoleptic assessment of a product because if other factors are good, but the taste is not, at the end of the day the product will be rejected by consumers. This taste is usually used as a determinant of consumer acceptance of the food products. Taste assessment aims to

determine the panelist's assessment of a product by using the taste buds (Ririsanti 2017). The average value of the preference level for the mackerel fish nuggets is presented in **Table 4**.

Table 4. Average Taste of Mackerel Nugget Based on Carrageenan Flour Treatment

Carrageenan Flour Addition (0%)	Median	Average
0%	7	6.7 a
0.5%	7	7.2 a
1%	7	6.5 a
1.5%	7	6.9 a
2%	7	6.3 a

Description:

Numbers followed by the same letters show no significant difference, according to multiple comparison tests at 95% conpidence level.

Based on the results of multiple comparison tests one can see that all treatments were not significantly different at the 95% trust level. As for the results of the Friedman test, it was pointed out that the addition of carrageenan flour had no effect on the taste of mackerel fish nuggets which means the panelists had the same level of preference for the taste of mackerel fish nuggets with the addition of carrageenan. This is because the formulation of the addition of seasonings is added together, so that there is no taste difference in mackerel fish nuggets.

3. 5. Decision Making Using the Bayes Method

According Risnawati (2018), Bayes method is one technique that can be used to carry out analysis in making the best decisions from a number of alternatives. The goal of Bayes methods is to obtain optimal results by considering various criteria. Their organoleptic characteristics which include appearance, aroma, texture, and taste are the criteria to be considered in the selection of the best mackerel fish nuggets that are based on the acquisition of the highest value of each treatment. The calculation of the weight criteria for mackerel fish nuggets is presented in **Table 5**.

Table 5. Weight Value Criteria for Mackerel Fish Nugget

Criteria	Criteria Quality
Appearance	0.16
Aroma	0.11

Texture	0.18
Taste	**0.56**

Based on the calculation results of the weight criteria it was found that taste is the most important criterion that determines the final decision of the panelist in choosing mackerel fish nuggets with a weighting criteria of 0.56, followed by texture, appearance and aroma with the weight of each criterion, i.e. 0.18, 0.16, and 0.11. Panelists choose the taste criteria as the main consideration in choosing mackerel fish nugget products compared to other criteria, and this is because the taste is a determinant of consumer acceptance of food products. If the criteria for appearance and other criteria are good but the taste criteria are not, then the product will be rejected by the consumer. This result is in accordance with Nurhuda's (2017) study regarding the addition of carrageenan flour to the level of manyung fish meatballs preference which shows that the most important criteria in choosing a product is a taste. The calculation results in determining the best treatment, taking by considered appearance criteria, aroma, texture, and taste of mackerel fish, presented in **Table 6**.

Table 6. Assessment Decision Matrix with Bayes Method.

Treatments	Criteria				Alternative Value	Priority Value
	Appearance	**Aroma**	**Texture**	**Flavor**		
0%	7.30	6.40	6.50	6.70	6.73	0.19
0.5%	7.50	7.70	8.00	7.20	**7.44**	**0.21**
1%	7.10	7.10	7.40	6.50	6.82	0.20
1.5%	7.20	7.00	6.80	6.90	6.94	0.20
2%	7.40	6.50	7.50	6.30	6.71	0.19
Criteria Value	0.16	0.11	0.18	0.56	34.64	1.00

Based on the calculation of the Bayes method, it was found that the addition of 0.5% carrageenan flour treatment on mackerel fish nuggets obtained the highest alternative value of 0.21 followed by the addition of 1.5%, 1%, 0% and 2% carrageenan flour. Overall, it can be concluded that the addition of 0.5% carrageenan flour on mackerel fish nuggets is the most preferred treatment by panelists compared to the other treatments.

4. CONCLUSION

Based on the results of the research it can be concluded that the addition of carrageenan flour by 0.5% of the surimi weight on mackerel fish nuggets is the most preferred treatment.

Refference

[1]   Arnesih. 2018. Flavor Powder Liquid Waste Characteristics Made From Raw Material Mackarel Tuna Filler With Wheat Flour. *Global Scientific Journals* 5 (1): 1-6.

[2]   Agustin, A., A.I. Saputri, and Harianingsih. 2017. Optimization of Carrageenan Making from Seaweed Application for Crispy Biscuits. *Chemical Engineering Innovation,* 2 (2): 42-47.

[3]   Deden, Y.M. and M. Nurilmala. 2015. DNA Barcoding for Authentication of Mackerel Fish Products (Scomberomorus sp). *Journal of Akuatika*, 4 (2): 154-160.

[4]   Howara, D. 2013. Fishery Products Processing Development Strategy In Donggala. *Agrolan Journal,* 17 (3): 75-81.

[5]   L. Marchetti, S.C. Andrés, and A.N. Califano, Low-fat meat sausages with fish oil: Optimization of milk proteins and carrageenan contents using response surface methodology. *Meat Science* Volume 96, Issue 3, March 2014, Pages 1297-1303

[6]   M Pérez-Mateos, M.C. Gómez-Guillén, J.L. Hurtado, M.T. Solas, and P. Montero, The effect of rosemary extract and omega-3 unsaturated fatty acids on the properties of gels made from the flesh of mackerel (*Scomber scombrus*) by high pressure and heat treatments. *Food Chemistry* Volume 79, Issue 1, October 2002, Pages 1-8

[7]   Evelien Dekkers, Sivakumar Raghavan, Hordur G. Kristinsson, and Maurice R. Marshall, Oxidative stability of mahi mahi red muscle dipped in tilapia protein hydrolysates, *Food Chemistry*, 124, 2, (640), (2011).

[8]   Boyd, L.C., Green, D.P., Giesbrecht, F.B., and King, M.F. 1993. Inhibition of oxidative rancidity in frozen cooked fish flakes by *tert*-butylhydroquinone and rosemary extract. *J. Sci. Food Agric.* 61: 87–93.

[9]   Burton, G.W. and Ingold, K.U. 1984. β-carotene: an unusual type of lipid antioxidant. *Science* 224: 569–573.

[10]   Ardiansyah, Junianto, Nia Kurniawati, and Emma Rochima, The Effect of Red Tilapia Bone Gelatin Powder Addition On Preference Level of Panna Cotta. *World Scientific News* 115 (2019) 68-90

[11] Ghifar Hakim, Junianto, Evi Liviawaty, and Zahidah Hasan. Study of Freshness of Mackerel (Rastrelliger kanagurta (Cuvier, 1816)) at Rancaekek Market, Resik Market, and Tanjungsari Market. *World Scientific News* 114 (2018) 1-14

[12] Iffa, R.A. 2018. The Effect Of Carrageenan Flour Addition On Catfish "Otak-Otak" Preference Level. *Gobal Scientific Journals,* 6 (8): 648-656.

[13] Nugroho, A., F. Swastawati and A.D. Anggo. 2014. Effect of Material Fastener And Toasting Against Time Product Quality Street Dragon Fish Mackerel (Scomberomorus sp.). *Journal of Fishery Products Processing and Biotechnology*, 3 (4): 140-149.

[14] Nurhuda, H.S. 2017. The addition of carrageenan Flour Fish Meatballs On The Level passions Manyung. *Journal of Fisheries and Marine Resources,* 8 (1): 157-164.

[15] Ririsanti, N.N. 2017. Addition of Carrageenan Against Level Pempek Passions Catfish. *Journal of Fisheries and Marine Resources,* 8(1): 165-173.

[16] Risnawati, Iis. 2018. Fortification of Soybean Flour on Catfish Nugget Preference Level. *Gobal Scientific Journals,* 6 (8): 892-901