Original article

Penambahan tepung karaginan terhadap tingkat kesukaan pada produk bakso ikan mayung (Arius thalassinus)

The Addition of carrageenan flour on the fondness level of sea catfish (Arius thalassinus) *meatballs*

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Abstract

The purpose of this study was to find out the addition amount rate of carrageenan powder to the amount of sea catfish meat to produce the most preferred fish balls. The design used was a completely randomized design (CRD) with six treatments in adding carrageenan on the number of sea catfish meat (b / b) and 20 panelists as repetition. The six treatments were 0.0%, 0.5%, 1.0%, 1.5%, 2.0%, and 2.5%. The parameters measured were the level of fondness based on the organoleptic characteristics which included appearance, aroma, texture and taste. The analysis used was nonparametric Friedman analysis, which followed by a multiple comparison test if there were differences on the treatments. The decision making was best done by using Bayes methods. The results showed that the addition rate of carrageenan powder at 1% of the sea catfish meat weight produced most preferred fish balls of other treatments.

Keywords *: Meatballs, sea catfish, carrageenan, texture, fondness level*

Introduction

Meat balls is one of quite popular and much liked processed fishery products, besides the styles for presenting the meatballs are also quite varied, not only boiled but also fried, baked or processed into other food additives.

Sea catfish (*Arius thalassinus*) have thick and white fleshes which are good for fish ball raw materials. The fish contain quite high unsaturated fat. Although the fat is very good for health, the fat is also very easily oxidized that will result in rancidity and color change to brown (Ariyani et al. 2012).

The catches of the fish are quite abundant. The data obtained from the KKP shows that the sea catfish catches in 2011 reached 90. 980 tons and kept increasing in last 10 years. The fish is quite familiar for salted bread but not for other processed products; therefore it requires alternative treatments to increase the relatively low economic value of the fish.

Carrageenan is a natural emulsifier extracted from the red seaweed *Kappaphycus alvarezii*. In addition to keeping the oil emulsion in water on meatballs, carrageenan can also improve the texture of the meatballs to be more chewy (Chandra et al., 2014). According to Sitanggang (2015), carrageenan is capable of forming gel, resulting more chewy texture as the addition of it. According to Sidi (2014) the gelling by carrageenan is a phenomenon by merging or cross-linking polymer chains to form a three-strong and rigid dimensional mesh. The addition of carrageenan in huge amount can result hard gel, so the texture of the fish balls resulted will be bouncy and less favored by panelists. This study is conducted to determine the precise amount in adding the carrageenan to produce most preferred sea catfish balls.

The purpose of this study is to find out the addition amount rate of carrageenan powder to the amount of sea catfish meat to produce the most preferred meatball. The advantage of this research is to increase the economic value of sea catfish through diversification of products, namely sea catfish balls. It is also expected to be a reference for the society in making high quality fish balls which are free from harmful chemical substance for not only increasing the consumption of fish meat, but also improving the quality of life.

Materials and Methods

This study was conducted at the Laboratory of Fishery Products Processing Faculty of Fisheries and Marine Science, Padjadjaran University and at the Laboratory of Nutrition Ruminant Livestock and Food Chemistry Faculty of Animal Husbandry, Padjadjaran University, Jatinangor in May to June, 2016.

Tools used were food processor, blender, scales, basins, pots, stove, strainer, spoon, knives and cutting boards. Materials used were sea catfish meat, tapioca flour, salt, onion, garlic, pepper, flavoring, ice water and carrageenan flour.

The design used was a completely randomized design (CRD) with six treatments in adding carrageenan on the number of manyung fish meat (b / b) and 20 panelists as repetition. The six treatments were namely 0.0%, 0.5%, 1.0%, 1.5%, 2.0%, and 2.5%.

Organoleptic (Soekarto Febiyando 1985 in 2011) is a test that uses human senses which is applied to obtain data on the level of consumer

fondness of the fish balls produced. The test covers appearance, aroma, texture, taste and some other possible factors. The appearance rate includes brilliance and color of the fish balls. This assessment is done by looking at the condition of the fish balls appearance surface. The aroma assessment is done by directly smelling the fish balls. The good fish balls will have distinctive fish smell without any additional odor. According to Soekarto (1985) in Febiyando (2011), the delicacy of a product is determined by its aroma. The texture assessment is done by pressing the surface of the meatballs by level of consistency, elasticity and density. The taste assessment is done by tasting the fish balls and the flavor.

Hedonic test is a test aimed to determine the level of consumer preference of a product. The test on the level of fondness includes appearance, aroma, taste and texture. The value of consumer fondness, namely: 9 (love); 7 (like); 5 (neutral / plain); 3 (dislike); and 1 (strongly dislike). The refusal limit for the hedonic test is 3, which means that if the tested products acquire equal value or less than 3 meaning that the products are stated to be unacceptable by the panelists (Soekarto, 1985 in Febiayando, 2011).

Data Analysis

Determining the most important criteria in hedonic test can be done by using AHP (Analytical Hierarchy Process). The test result on the hedonic test is analyzed by using non parametric Friedman analysis (Sudrajat, 1999, in Ramadhani, 2015), the formula is:

$$X^2 = \frac{12}{NK(K+1)} \sum_{i=1}^{t} (Rj)^2 - 3N(K+1)$$

Note:

N = Repetition

K = Treatment

Rj = total rank of each treatment

If there are the same numbers, the calculation factor correction (FK) is: $FK = 1 - \frac{\sum T}{NK(K^2-1)}$

$$H_c = \frac{X^2}{FK}$$

Decision rule to test the hypothesis:

Reject H_0 if $X^2 > X^2_{\alpha,t-1}$

Accept H_0 if $X^2 \leq X^2_{\alpha,t-1}$

If there is a difference in treatments, the calculation will be followed by a multiple comparison test with the formula:

$$|R_i - R_j| \leq Z\left(\frac{\alpha}{K(K-1)}\right)\sqrt{\frac{NK(K+1)}{6}}$$

Note:

| Ri - Rj | = Difference in number of each treatment ranking

Ri = average ratings of the sample to-i

Rj = average ratings of the sample to-i

N = number of replications

k = number of treatment

Then, it is proceeded with the Bayes method in the decision making for the best of the several alternatives or treatments by considering the weight of the criteria and the median.

Results and Discussion

Appearance

According to Soekarto (1985) in Febiyando (2011) appearance is the first rated characteristic by consumers in selecting a product; if the impression of the appearance is fine or preferably, the consumers will see the other characteristics. The appearances of all sea catfish balls produced had grayish-white color, with not perfectly round shape yet less smooth surface but still acceptable to the panelists. Friedman's two-way test results showed that all treatments were not significantly different at 5% level, meaning that panelists had nearly the same level of fondness on the appearance of the sea catfish balls with carrrageenan. The results were in line with the results of research conducted by Febiando (2014) concerning on the addition of carrageenan in red tilapia fish balls which also showed that the results were not significantly different at the appearance criteria. The addition of carrageenan powder did not affect the appearance of sea catfish balls allegedly because of the white color of the carrageenan powder; with not more than 2.5% (Table 1) the addition of carrageenan in this study did not affect the sea catfish balls appearance.

Tabel 1. The average of sea catfish balls appearance based on the addition of carrageenan powder treatment

Treatment of carrageenan powder (%)	Median	Average
0,0	7	6,4
0,5	5	5,5
1,0	7	6,1
1,5	7	6,7
2,0	6	5,9
2,5	5	5,6

Note: Value X^2 and H_c< table X at the level of 5%, the test on significancy was not significantly different (H_0 accepted H_1 rejected)

According to Dewi (2007), the appearance of good fish balls should be smooth round shape, homogeneous size, clean, bright and not dull. In general, the sea catfish balls produced had met these criteria, but the shape was not round, the texture was not smooth and the size was not homogeneous. These were probably due to the shaping of fish balls was made manually by hand. However, the appearance of the fish balls was deemed acceptable by the panelists. Figure of sea catfish balls appearance is presented in Figure 1 below.


sea catfish balls treatment control


sea catfish balls treatment 0,5% carrageenan


sea catfish balls treatment 1,0% carrageenan


sea catfish balls treatment 1,5% carrageenan


sea catfish balls treatment 2,0% carrageenan


sea catfish balls treatment 2,5% carrageenan

Figure 1. Sea catfish balls appearancce

Aroma

Generally, aroma is the main attraction in determining the quality of a product. All of the sea catfish balls produced had distinctive aroma of fish and spices added to the processing of the fish balls without any other aroma. Friedman's two way test results showed that all treatments were not significantly different at 5% level, meaning that panelists had nearly the same level of fondness to the aroma of the fish balls which was added with carrageenan powder (Table 2).

Table 2. The Average of sea catfish balls aroma based on the addition carrageenan powder treatment

Treatment of carrageenan powder (%)	Median	Average
0,0	7	6,3
0,5	5	5,6
1,0	7	6,1
1,5	7	6,5
2,0	7	6,3
2,5	7	6,1

Note: Value X^2 and H_c< X table at the level of 5%, the significancy test was not significantly different (H_0 accepted H_1 rejected)

These results concurred with the results of Febiando's work (2014) concerning the addition of carrageenan to red tilapia fish balls which also showed that there was no significantly different result in aroma criteria. The addition of carrageenan powder did not affect the aroma of sea catfish balls alledgelly because carrageenan tended to have a neutral aroma, besides the small scale addition of the carrageenan did not affect the aroma of sea catfish balls produced.

According to Dewi (2007) good fish balls have dominant distinctive smell of boiled fresh fish related to the type of fish used and the quite sharp smell of spices, with no fishy, rancid, sour, iron or foul smell. In general, the sea catfish ball produced in this study had met these criteria, the fish balls had distinctive aroma of fish and spices added at the processing of the fish balls without any other aroma.

Texture

According Soekarto (1985) in Febiyando (2011), sometimes the texture is more important than the aroma, flavor and color because it affects the image of the food, especially the fish-jelly products such as fish balls in which the elasticity becomes the crucial parameter.

The sea catfish balls at the control treatment had a less chewy texture, with the higher addition rate of the carrageenan, the more chewy the fish ball could be, but the addition of carrageenan treatment of 1.5%; 2.0% and 2.5%, the fish balls texture tended to be hard and stiff. Friedman two-way test results showed that the treatment on the addition of 1.0% carrageenan powder had the highest average value of the texture of sea catfish balls but not significantly different with the addition of powder with the treatment of 0.5% carrageenan and significantly different from the control, treatment of carrageenan powder addition by 1 , 5%; 2.0% and 2.5% (Table 3). These results were consistent with the work of Dijayantie (2012) about the addition of carrageenan on shrimp nuggets which also showed the highest average was in treatment of carrageenan addition of 1%.

Table 3. The average texture of sea catfish balls by adding of carrageenan powder treatment

Treatment of carrageenan powder (%)	Median	Average
0,0	7	6,2 a
0,5	7	6,8 b
1,0	7	7,1 b
1,5	6	6,0 a
2,0	5	5,3 a
2,5	5	4,8 a

Note: Numbers followed by the same letter show results that are not significantly diferent according to the multiple comparison test at 5%.

According to Sitanggang (2015), carrageenan is capable of forming a gel, which causing more chewy texture as the addition of carrageenan, it is thought to cause the increasing average value fondness on the texture at the treatment of 0%, 0.5% to 1.0%. According Fardiaz (1989) in Sidi (2014) gelling by carrageenan is a merging phenomenon or cross-linking polymer chains that forms a strong and rigid three-dimensional mesh, so the addition of carrageenan in too high rate suspected of causing the formation of too hard gel which as the results the texture of the fish balls produced were bouncy. That matter, which was thought to cause the average value in the treatment of 1.5% 2.0% and 2.5% was smaller than the addition of carrageenan treatment of 1.0%.

Treatment	Criteria				Alternative Value	Priority Value
	Appearance	Aroma	Texture	Taste		
A	7	7	6	7	6,85	19,80
B	5	5	7	7	6,29	18,17
C	7	7	7	7	**7,00**	**20,23**
D	7	7	6	7	6,85	19,80
E	6	7	5	7	6,61	19,11
F	5	7	5	7	6,52	18,83
Credit	**0,09**	**0,26**	**0,15**	**0,50**		

According to Dewi (2007) texture fish balls is good to be consistently elastic, without spines or bones, not clay or bouncy, mushy, runny and brittle. In the control treatment the fish balls have a less chewy texture, the higher amount on adding the carrageenan, the more chewy the fish balls will be, but the addition of carrageenan treatment of 1.5%; 2.0% and 2.5% textures of the fish balls tend to be hard and rigid so that less favored by the panelists.

Taste

Taste is the most important parameter for consumers to decide to accept or reject a product. Although other parameters considered quite good, but if it tastes bad or disliked the product will be rejected (Soekarto 1985 in Febiyando 2011).

Tabel 4. The average taste of sea catfish balls by adding of carrageenan powder treatment

Treatment of carrageenan powder (%)	Median	Average
0,0	7	6,3
0,5	7	6,5
1,0	7	5,9
1,5	7	6,9
2,0	7	7,3
2,5	7	6,2

Note: Value X^2 and H_c< table X at the level of 5%, the significancy test is not significantly different (H_0 accepted H_1 rejected)

All sea catfish balls produced had the typical fish taste, and flavor of the spices are quite prominent and there are no extraneous flavors. Friedman's two-way test results showed that all treatments were not

significantly different at 5% level, meaning that panelists had nearly the same level of fondness to the aroma of sea catfish with the addition of carrageenan powder. These results were consistent with work of Dijayantie (2012) about the addition of carrageenan on shrimp nuggets which also shows the results were not significantly different in taste criteria. The addition of carrageenan powder did not affect the taste of the fish balls. This could be caused by the neutral or tasteless flavor of the powder which did not affect the taste of fish balls produced.

According to Dewi (2007) good fish balls have dominant fish flavor of the related to the type of fish used and quite prominent but not overwhelming spice flavors, no strange annoying taste and not too salty. The sea catfish balls on this study mostly had met these criteria, had distinctive fish flavor and quite prominent spice flavor without any extraneous flavors.

Decision-making by Bayes Method

The result of the calculation based on the method PHA obtained are presented in Table 4.

Table 4. Calculation Results pairwise comparison criterion by 20 panelists.

Based on the calculation of the appearance, aroma, texture and taste parameters, the highest value of the number and credit is on the taste criterion with the total of 11.81 for the number and 0.50 for the credit criterion. This suggests that taste is the most important criteria for sea catfish balls products. After finding out that the taste is the most important parameter, the calculation is followed by calculation the taste of each treatment. The taste calculation results of each treatment are presented in Table 5.

Criteria	Appearance	Aroma	Texture	Taste	Number	Criteria Credit
Appearance	1	0,50	0,56	0,19	2,25	0,09
Aroma	2,00	1	2,82	0,38	6,20	0,26
Texture	1,79	0,35	1	0,34	3,48	0,15
Taste	5,23	2,60	2,98	1	**11,81**	**0,50**
Total					23,74	1

Table 5. Determining the product using Bayes method with median value

Based on the above calculation can be seen that sea catfish balls by treatment of addition of 1.0% carrageenan powder is the most preferred treatment with alternative value of 7.00 and the priority value of 20.23.

Conclusion

Based on the results of the study, the writer concluded that the sea catfish balls with the treatment of addition of 1% carrageenan powder of the meat weight is the most preferred treatment of other treatments.

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