



THE EFFECT OF ADDITIONS KAPPAPHYCUS ALVAREZII FLOUR TO INCREASE FIBER CONTENT OF SHRIMP NUGGET ON PREFERENCE LEVEL

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ABSTRACT

The purpose of this research is to utilize *K. alvarezii* flour in the producing shrimp nuggets and studying the effect of *K. alvarezii* flour addition on panelist preference level of shrimp nugget products. This research was conducted at the Fisheries Technology Laboratory of the Faculty of Fisheries and Marine Sciences and the Ruminant Animal Nutrition Laboratory and Livestock Food Chemistry at the Faculty of Animal Husbandry, Padjadjaran University in November 2018. The research method used was experimental method, with 20 semi-trained panelists and five treatments which consist of *K. alvarezii* flour addition at 0%, 0.15%, 0.20%, 0.25%, and 30% based on the weight of shrimp meat. The parameters observed in the research were hedonic tests with organoleptic characteristics parameters including appearance, aroma, texture, and taste of shrimp nuggets, and folding test. In addition to that, fiber content and moisture content analysis were also carried out on the addition of *K. alvarezii* flour by 0% and 20% samples. The results showed that all treatments of the addition of *K. alvarezii* flour were still preferred by the panelists, however, the 20% addition of *K. alvarezii* flour produced shrimp nuggets with better preference level compared to other treatments, as evidenced by the average value of appearance characteristics 7.67 ; aroma of 7.27; texture 7.40 and taste 8.07 average elasticity of 5 (very elastic). The fiber content produced was 0.26 in the treatment of 0% and 1.20 in the treatment of 20%. and water content of 35.50% in the treatment of 0% and 34.90% in the treatment of 20%.

Keywords: Shrimp nuggets, flour *K. alvarezii*, Hedonic test, preference level, fiber content

1. INTRODUCTION

Vannamei shrimp (*Litopenaeus vannamei*) is one of the important commodities of aquaculture that is developing. The average increase in vannamei shrimp production in Indonesia from 2015 to 2017 was 70% (KKP 2018). Fishery products are *perishable food*. High water content accelerates the breeding process of spoilage microorganisms found in shrimp meat. Post harvest processing is very important because it aims to reduce the water content of shrimp meat. Decreased water content in processed shrimp meat can inhibit the development of microorganisms in shrimp so that its processed products will last longer than shrimp meat in fresh form. Product development is a process for creating new products that are usually associated with the needs of consumers or the market, can be innovative, modificative and imitative products. One of the processed products in the development of fishery products is a nugget with vannamei shrimp raw material.

Vannamei shrimp are chosen because the price is more affordable than tiger shrimp, besides vannamei shrimp are more easily obtained in the market. Physical characteristics that must be possessed vannamei shrimp meat that can be used as raw material for making shrimp nuggets must be in fresh condition, the color of the meat is bright, chewy, and does not smell bad (Dijyantie 2012).

Nugget is a fast food that loved by the people, but nuggets have high fat content and low fiber content (Linda 2017). Therefore, nuggets can be added with food that can increase fiber content. One additional ingredient for baking which has a high fiber content is *Kappaphycus alvarezii*.

K. alvarezii is one source of food that is rich in food fiber. The content of food fiber in *K. alvarezii* is 69.3% (Santoso et al 2003). *K. alvarezii* which is used in making nuggets is in the form of flour. Nugget quality meat if it can form a compact structure and mutually attached to one another, then of the other functions of the flour *K. alvarezii* is hydrocolloid, *K.alvarezii* righ can fix the shrimp nuggets texture. In addition to good texture, there is a taste, aroma, and appearance to determine whether a product is accepted or not, so it is necessary to do a hedonic test to find out how much addition offlour *K. alvarezii* to shrimp nuggets that panelists prefer. The purpose of this research is to determine what is the best concentration of the addition of *K. alvarezii* in increasing fiber content in shrimp nuggets based on preference level.

2. MATERIALS AND METHOD

2.1 Tools and Materials

The tools used for the making of shrimp nugget are food processors, meat grinder digital scales, pans, knives, basins, pans, cutting boards, pans, plastic containers, mortars, scoops, and refrigerators. Equipment for testing the level of preference is the assessment sheet, styrofoam plates

The materials used to make nugget are vannamei shrimp, *K. alvarezii* flour, wheat flour, salt, garlic, eggs, ground pepper, some ice, cooking oil, and bread crumb.

2.2 Research Method

The method used by this research is experimental which consists of 5 treatments and 20 semi-trained panelists as repetition. The hedonic test is a test that aims to determine the level of consumer preference for a product. Testing of the level of preference includes appearance, aroma, taste and texture. Value of consumer preferences that is: 9 (very like); 7 (likes); 5 (neutral/ordinary); 3 (dislike); and 1 (very dislike). The rejection limit for the hedonic test is 3, meaning that if the product being tested gets the same or smaller value (Kahkonen et. al 1998). As for the treatments conducted are percentage *k. alvarezii* as stated below: A (without adding *k. alvarezii* 0%), B (Adding *k. alvarezii* 15%) C (Adding *k. alvarezii* 20%) D (Adding *k. alvarezii* 25%), E (Adding *k. alvarezii* 30%) .

2.3 Observation Parameters

The observed parameters covering the hedonic test to measure the preference level of panelists based on the organoleptic characteristic such as appearance, aroma, texture, and taste from the produced shrimp nuggets. Chemical test (fiber content, and water content) of shrimp nugget is treated with control and most favored using the AOAC 1995 method.

2.4 Data Analysis

The hedonic test data were analyzed using Friedman non-parametric analysis to determine the panelists acceptance preference level of shrimp nuggets. The statistics used are using the formula (Singh 2013) as follows:

$$Xr^2 = \frac{12}{bk(k+1)} \sum_{j=1}^k (Rj)^2 - 3b(k+1)$$

Information:

- Xr^2 = Friedman Test Statistics
- b = Repeat
- k = Treatment
- Rj = Total ranking of each treatment

If the research data shows the same number, the following correction factors are calculated:

$$Fc = 1 - \frac{\sum T}{bk(k^2-1)}$$

$$X^2c = \frac{x^2}{Fc}$$

Information:

- Fc = Correction Factor\
- T = $N(t_i^3 - t)$
- t = The same number frequency

Value X^2c can be known using Chi-square tables with degrees of freedom $db = k - 1$;

I- a. The decision rules for testing hypotheses are as follows:

H_0 = Treatment gives identical or equal results at the level $\alpha = 0,05$

H_1 = Treatment gives different results at the level $\alpha = 0,05$

If value $X^2c < X_{(1-\alpha),(n-1)}$, then H_0 accepted and H_1 rejected. While if the value $X^2c > X^2c < X_{(1-\alpha),(n-1)}$, then H_1 rejected and H_0 accepted. If H_1 accepted, then there are differences among the treatments that should be done multiple comparison test to know the real difference significantly with the following formula:

$$|Ri - Rj| \geq Z \left[\frac{\alpha}{k(k-1)} \right] - \sqrt{\frac{bk(k+1)}{6}}$$

Information:

- Ri = Number of ranking conditions i
- Rj = Number of ranking conditions j

Decision making of panelists review to the product criteria of shrimp nugget which is liked is done by doing pairwise comparison then to determine the best treatment is using the Bayes method. Bayes method is used to compare various criteria and choose one criterion to

be prioritized or more preferred by using numbers to describe the relative importance of an element.

Meanwhile, comparative descriptive analysis is used to analyze the result of yield calculation and chemical test results (fiber value test, and water value test).

3. RESULTS AND DISCUSSION

3.1 Hedonic Test (Preference level)

a. Appearance

Appearance is the first characteristic which is rated by consumers in order to consume a product. Is the product in a good looking or not, because the commodity quality is judged by the appearance such as shape, size, and color. Generally consumer will choose to pick foods with attractive look (Soekarto 1990). The average value of hedonic test to the appearance of shrimp nugget is shown in Table 2.

Table 2. Average Appearance Shrimp Nugget by Adding *K. alvarezii* Flour

The addition of <i>k. alvarezii</i> (%)	Median	Average Appearance
0% (A)	7	7,00 a
15% (B)	7	7,70 a
20% (C)	7	7,80 a
25% (D)	7	7,50 a
30% (E)	7	7,00 a

according to the multiple comparison test at the level of 5 %

Based on the hedonic test results to appearance of shrimp nugget with the average appearance value between 7 and 7.8. The highest appearance shrimp nugget value is 7.8 in treatment C with appearance of whole, neat , bright, and attractive color after being toasted is yellowish bright brown color. Meanwhile the lowest average value of appearance is 7 in treatment E with the appearance of whole, neat, bright, smooth surface and yellowish to brown color after being toasted but a little bit darker, and in treatment A where in this treatment the produc shrimp nugget is whole, neat, bright, and brownish colored after being toasted but looks a little bit pale compared to other treatments. In terms of integrity, all of produced shrimp nugget from every treatment is neat and even. Based on Friedman test, all of the addition of *k. alvarezii* do not give real effect to shrimp nugget.

The number of materials used in formulation as a mix to make shrimp nugget dough such as adding fillers and binders that are capable to dissemble dark colo. Frying can caused shrimp nugget color that is produced from every treatment to be the same that is shrimp

nugget for every treatment to be brownish and no significant difference on the looks of the shrimp nugget. Maillard reaction occurs in the roasting process. According to Winarno (1997), Maillard reaction is non enzymatic browning process between reducing sugar and free amino group from amino acids or protein, so it produces food material color to be brownish. The appearance of shrimp nugget for all treatment is still liked by panelists with median value of 7, however panelists preferred the appearance of shrimp nugget. which had been added with 20% of *k. alvarezii*

b. Aroma

One of the factors that determined the quality of a product is acceptable by consumers is aroma. Food aroma determines the taste of the food itself (Winarno, 1991). Pleasant aroma from food may raise the consumers or panelists’ appetite to taste the food. The average value of hedonic test of shrimp nugget’s. aroma is shown in table 3.

Table 3. Average Aroma of Shrimp Nugget by Adding *K. alvarezii* Flour

The addition of <i>K. alvarezii</i>	Median	Average Texture
0 % (A)	7	7,00 a
15% (B)	7	7,50 a
20% (C)	7	7,70 a
25% (D)	7	7,50 a
30% (E)	7	7,00 a

Information: The average value of aroma followed by the same letter indicating is not significantly different according to the multiple comparison test at the level of 5 %

According to hedonic test results of shrimp nugget aroma the number of average value of aroma is between 7 to 7,7. The highest average value of shrimp nugget’s aroma is 7,7 in treatment C and treatment D (preferred by panelists). The lowest average value of shrimp nugget aroma’s is 7,00 in treatment A with non addition.

The aromas of shrimp nugget every treatment is not significantly different to shrimp nuggets, this is in accordance with the statement from Rochian (2011) that macroalgae flour does not have a specific characteristic aroma, so it will not affect the aroma of shrimp nuggets. The distinctive aroma of shrimp meat comes from volatile compounds resulting from protein breakdown (Karim et al 2014).

Based on Friedman test showed that all treatments were not significantly different in the aroma of shrimp nuggets so that the calculation is not followed by a multiple comparison test

(Multiple Comparison) means that panelists have the same level of preference for the aroma of shrimp nuggets added with *k.alvarezii*. The aroma of shrimp nuggets for all treatments is still liked by panelists with median value of 7, however panelists preferred the appearance of shrimp nugget. which had been added with 20% of *k. alvarezii*

c. Texture

Texture is sensing related to touch. Texture is one of the factors that influence the consumers to choose foodstuffs. (Winarno 1991). The average value of hedonic test to shrimp nugget texture is shown in Table 4.

Table 4. Average Texture of Shrimp Nugget by Addition of *K. alvarezii* Flour

The Addition of <i>k. alvarezii</i> (%)	Median	Average Aroma
0%(A)	7	6,50 a
15% (B)	7	7,80 ab
20% (C)	7	7,90 b
25% (D)	7	7,90 b
30% (E)	7	7,10 ab

Information: The average value of texture followed by the same letter indicating is not significantly different according to the multiple comparison test at the level of 5 %

Assessment to the nuggets shrimp texture is done by observing at the level of compactness, tenderness and density of nuggets shrimp. Based on the hedonic test results on the texture of shrimp nuggets have an average value of the texture ranging from 6.5 to 7.9 meaning that the texture of all treatments on shrimp nugget including neutral to panelists favored. The average value of texture shrimp nugget tends to increase with increasing concentration of flour *K. alvarezii*, but decreases again in the treatment of adding *K. alvarezii* 30% (E). The highest average value of texture shrimp nugget is 7.9 in the treatment of 20% and 25% which has a chewy, dense, and compact texture so that it is most preferred by panelists, while the lowest average value is 6.5 at 0% treatment has a texture that is rather springy and solid.

The addition of flour *K. alvarezii* to shrimp nugget gave a significant difference to the texture of shrimp nuggets, namely in the treatment of 20% (C) and 25% (D). These results are the same as those obtained by Rochian (2011) regarding the addition of macroalgae flour the blood clam dumplings that showed significantly different results on texture criteria. This is because macroalgae can increase the elasticity. According to Fardiaz (1989) in Rochian (2011) the addition of *K. alvarezii* on a large scale is thought to cause gel formation too hard.

As happened in shrimp nuggets with a treatment of 30% (E) has a smaller value compared to the treatment of adding flour *K. alvarezii* with a smaller amount.

In addition of *K. alvarezii*, the fillers namely wheat flour also plays a role in gel formation. Fillers are ingredients added in the process of making processed meat products which have the ability to bind a certain amount of water and have gelling properties (Zulfachri 2017).

Based on the Friedman test, the addition of flour *K. alvarezii* to shrimp nuggets significantly affected the panelist acceptance level for the texture parameters of shrimp nuggets. There are several treatments that are significantly different to the texture of shrimp nuggets at 0% (treatment A) significantly different from 20% (treatment C) and 25% (treatment D).

More and more flour grating *K. alvarezii* on shrimp nuggets, the resulting nugget products will be more chewy and dense, this is because *K. alvarezii* produces sap of kappa type carrageenan that can form gels properly. According to Rochian (2011) the addition of flour is *K. alvarezii* large-scale thought to cause the formation of gel too hard. As happened in shrimp nugget with the addition of 30% (treatment E) has a smaller value compared to the treatment of adding flour *K. alvarezii* with a smaller amount.

d. Taste

Taste is an assessed parameter that use the sense of taster or tongue. Taste is an important factor to determine whether the product is accepted or not by the consumers. Consumer preference towards a product's taste is supported by the interest of the color and aroma from the product. The smell that caught by olfactory nose cell and the color seen by the eye are able to stimulate the taste nerves (Winarno 1997). The average value of shrimp nugget taste is shown in Table 5.

Table 5. Average Taste of Shrimp Nugget by Addition of *K. alvarezii*

The Addition of <i>K. alvarezii</i> Flour (%)	Median	Average Taste
0% (A)	7	6,9 a
15% (B)	8	8,0 ab
20% (C)	9	8,3 b
25% (D)	7	7,3 ab
30% (E)	7	7,1 ab

Information: The average value of taste followed by the same letter indicating is not significantly different according to the multiple comparison test at the level of 5 %

According to the hedonic test, shrimp nugget taste has the average value between 6.9 and 8.3 (most preferred shrimp nugget taste). The highest average value of shrimp nugget taste is 8.3 with the median value of 9 in treatment C where according to panelists have the most tasty nugget shrimp taste, and delicious. The lowest average value of shrimp nugget taste is 6.9 with median number of 7 in treatment A which is still likeable by the panelist with tasty taste and fresh shrimp taste.

Based on Hedonic test results, the taste of nuggets have an average value of taste ranging from 6.7 to 8.3. The average value of flavor shrimp nuggets highest median value of 8.3 to 9 in increments of 20% flour treatment K. alvarezii (treatment C), which means highly favored panelists with taste nuggets shrimp more delicious, savory and taste of the shrimp tasted. The lowest average value of shrimp nuggets is 6.9 with a median value of 7 at 0% (treatment A), which means that the panelists still like the taste of nuggets and shrimp taste more pronounced. The value of flavor parameters nugget shrimp increases with increasing percentage of flour K. alvarezii, but decreases with the addition of 25% (treatment D) and 30% (treatment E). The addition of flour K. alvarezii influences the taste of nuggets shrimp, namely because the addition of flour K. alvarezii that is too much will reduce the taste of nuggets.

Some components that play a role in determining the taste of food are food aromas, food seasonings and food ingredients, tenderness or suppleness of food, crispness of food, level of maturity and temperature of food (Meilgaard et al 1999). Nugget taste influenced by flour K. alvarezii and the raw material used is shrimp. Flour K. alvarezii contains glutamic acid which can stimulate several types of nerves in the human tongue. Glutamic acid gives food a taste. Glutamic acid contained in K. alvarezii 3-20 is%, this causes flour to K. alvarezii cause a savory taste in food making it suitable for processing into a variety of food products (Winarno 1996).

According to Hadiwiyoto (1993) The special taste of shrimp is produced from volatile and non-volatile compounds. Volatile compounds that play a role are carbon and alcohol (free fatty acids), sulfur, bromphenol and hydrocarbons, while non-volatile compounds are nitrogen compounds (free amino acids, nucleotide peptides and organic bases). The taste of shrimp nugget which is preferred over other treatments is the addition of 20% flour K. alvarezii (treatment C) with an average value of 8.3. Overall based on flavor parameters, it is preferred according to panelists because it produces shrimp nugget with more dominant shrimp flavor so that it is significantly different compared to shrimp nugget that are added too much flour K. alvarezii. All treatments are still favored the panelists with a median value

of 7, 8 and 9 as well as acceptable because its average value over the rejection limit value is ≤ 3 .

3.2 Fold Test

According to Muljanah et. al (1986) in Aruan (2009) *nuggets* that are preferred by consumers generally have a level of elasticity with criteria sufficiently springy to springy. Average elasticity in shrimp nuggets that have been added with flour is *K. alvarezii* presented in Table 5

Table 5. Criterion Weight *Nugget* Shrimp

The Addition of <i>K. alvarezii</i> (%)	Average	Rating	Hardness Level
0 % (A)	4.45	AA	Very Chewy
15 % (B)	4.6	AA	Very Chewy
20 % (C)	5.00	AA	Very Chewy
25 % (D)	5.00	AA	Very Chewy
30 % (E)	5.00	AA	Very Chewy



The result of calculating shrimp nuggets added with flour *K. alvarezii* has an average value with a

No	Chemical Test Parameters The	Treatment of Flour <i>K. alvarezii</i> To Shrimp Nugget	
		0%	20%
1	Fiber Content (%)	0.26	1.20
2	Water Content (%)	35.5	34.9

range between to 5. Value highest average of 5 is produced by nuggets with the addition of flour *K. alvarezii* 20%, and 25% with very springy criteria and AA ratings. Shrimp nuggets with 0% treatment produce an average value of 4.45, nuggets shrimp with 15% treatment produce an average value of 4.6, and 30% treatment produce an average value of 4.75 with springy criteria. An increase in the average value is in accordance with the increasing amount of flour concentration *K. alvarezii* added, this also increases the strength of the gel formed.

Based on Rohian's research results (2014) the addition of flour *K. alvarezii* holding to blood shellfish sioamay has been proven to increase the thickness of blood clam dumplings seen from the increase in water capacity and gel strength, but the average value of adding flour *K. alvarezii* has decreased at 30% treatment, this is because the addition of flour *K. alvarezii* too much will cause the texture of the shrimp to become chewy and tend to be hard

3.3 Chemical Test

Chemical tests of Shrimp nugget are carried out on the control treatment and most preferred treatment as a comparison. The chemical test which is conducted is protein level test, fat level test and water level test. The results of chemical test are shown in Table 8.

Table 8. Chemical Test Results Shrimp Nugget

Fiber Content

The test results of fiber content obtained an average value of 0.26% for 0% treatment and 1.20% for 20% treatment. The fiber content increases with the addition

offlour *K. alvarezii*. According to Maharani (2009) in Larissa (2017) flour *K. alvarezii* can increase fiber levels in food. The shrimp nugget fiber content of 20% treatment was 1.20%. One serving of shrimp nuggets if weighing 100 g, can help provide fiber intake of 1200 mg / 100g, while according to Rahmah et. al (2017) calcium in adulthood is 25000 mg to 30000 mg / day, so as to meet the calcium requirement the shrimp nuggets with the addition offlour *K. alvarezii* as much as 2083.33 mg to 2.500 mg per day

Water Content

Based on observations shrimp nugget water content with 0% treatment (control) has a water content of 35.50% while the addition of flour treatment *K. alvarezii* 20% has a water content of 34, 90%, this shows that the water content of shrimp nuggets with 0% treatment (control) is greater than 20% shrimp nugget treatment. The decrease in water content in nuggets shrimp caused by the addition offlour *K. alvarezii* has water binding properties (Listiyani 2014) Based on the National Standardization Agency (01-775-2013) the maximum water content in fish nuggets is 60%. Based on these data the water content of the shrimp nuggets produced still meets the water level requirements of the nugget, so that it can be said that the shrimp nugget with the addition offlour *K. alvarezii* by 20% still meets the quality requirements nugget based on the BSN.

3.4 The Decision-Making Using the Bayes Method

Based on the calculation results of the appearance, aroma, texture and flavor of the *nugget*, the highest number of criteria weight was obtained at the flavor parameter of 0, 56 means that the taste parameter is the most important assessment or as the main consideration according to panelists in choosing shrimp *nugget*. The second most important parameter is the texture then appearance and aroma in a row with criteria weight values of 0.19, 0.16 and 0.10. has the highest criteria weight value, so if the taste of shrimp nuggets is not liked by panelists then the product will not be accepted or will be rejected by the panelists although other assessments are good. Method Bayes is one of the techniques that can be used to analyze the best decision-making of a number of alternatives with the aim of producing optimal results. Optimal decision making will be achieved when considering various criteria (Marimin 2004). The results of calculations in determining the best treatment using the Bayes method by considering the criteria for appearance, aroma, texture and taste of shrimp nuggets are presented in Table 6.

Table 6. Value of Criteria for Shrimp Nugget

Criteria	Weight Criteria
Appearance	0.16
Aroma	0.10
Texture	0.19
Taste	0.56

According to the calculation to criteria of appearance, aroma, texture, and taste of shrimp nugget, the results shows that taste is the most important parameter to be assessed according to panelists by the value of 0.58. Taste is the main consideration according to panelists to choose shrimp nugget by addition of *K. alvarezii*, so shrimp nugget was not likeable by the panelists then the products will not be accepted or will be rejected by panelists although the other assessment is well scored. The calculation results will determine the best treatment with considering the criteria of appearance, aroma, texture, and taste of shrimp nugget shown in table 7

Table 7. Decision Matrix of Shrimp Nugget with Bayes Method

The Addition of <i>K. alvarezii</i> (%)	Criteria				Alternatif Value	Priority Value
	Appearance	Aroma	Texture	Taste		
0%	7	7	7	7	7,00	0,19
15%	7	7	7,7	8	7,56	0,21
20%	7	7	7	9	8,12	0,22
25%	7	7	7	7	7,00	0,19
30%	7	7	7	7	7,00	0,19
Value Criteria Weight	0,16	0,10	0,19	0,56	36,86	1,00

According to calculation using Bayes Method, the result shows that treatment C is the most preferred product by panelists with alternative score in the amount of 8.12 and priority value of 0.22 which is the highest value amongst other treatment. Even so, shrimp nugget with the addition of 30 % *K. alvarezii* is still acceptable and likeable by panelists.

CONCLUSION

Based on the research results of adding flour *K. alvarezii* to increasing levels of fiber shrimp nugget based on preference level, all treatments adding flour *K. alvarezii* to shrimp nuggets were favored by panelists, but the treatment of adding *K. alvarezii* by 20% of shrimp weight was preferred than any other treatment on shrimp nuggets. The shrimp nuggets 20%

have the elasticity with a value of 5 or very chewy. The fiber content is 1.2% while the water content is 34.9%, then there are organoleptic characteristics with a median appearance of 7.8 (preferred), aroma 7.7 (preferred), texture 7.9 (preferred) and taste 8.3 (preferred).

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