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The Preference Level of Nila Nugget - *Oreochromis niloticus* (Linnaeus, 1758) with Addition Texturized Soy Protein

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ABSTRACT

This research aims to determine the percentage of adding Texturized Soy Protein (TSP) to the quality of the preferred nila nuggets. This research was carried out at the Fisheries Product Processing Laboratory, Faculty of Fisheries and Marine Sciences, Food Chemistry Laboratory, Faculty of Agricultural Industrial Technology, Padjadjaran University and Food Chemistry Laboratory, Pasundan University in March to May 2019. The approach employed in this research was an experimental method with TSP addition treatment of 0 %, 20%, 30%, 40% and 50% TSP on Nila nuggets. Observations were made on the level of preference. These included the characteristics of appearance, aroma, taste, and texture, and were performed by semi-trained panelists. Other tests included Nila nugget folding and texture tests, moisture content, ash content, protein content and fat content. The results showed that panels preferred a treatment of the addition of 30% TSP. This, accordingly, had an average value of appearance of 9.0, aroma of 7.0, texture of 9.0 and taste of 9.0. Proximate test results showed increased water content of 0.04%, 0.25% ash content, 0.03% fat content and 0.55% protein content. Moreover, results indicated that the addition of 30% TSP can reduce the hardness value by 1933.99 g Force and add springiness value of 1.45 g Force.

Keywords: The preference level, Nuggets, Nila, Texturized Soy Protein, TSP, *Oreochromis niloticus*

1. INTRODUCTION

Nila (*Oreochromis niloticus*) is one of the leading export commodities whose number of requests is increasing. Increased demand for fish is not comparable to the problems that often arise in the fisheries sector in maintaining quality. Because it is necessary to process and diversify fishery products to increase fish consumption.



Figure 1. Nila Fish - *Oreochromis niloticus* (Linnaeus, 1758)

Fish Nugget is a type of food product made from fish meat and has a relatively long shelf life and is liked by the community. However, nuggets circulating in the market can only be enjoyed by certain groups, especially the middle and upper class. This is due to the relatively expensive price of nuggets. Therefore, it is important to diversify products as an alternative nugget that can meet the nutritional content and is affordable by the middle class. In making nuggets, raw materials and fillers determine the characteristics of the nuggets produced. Fish meat has a protein with a fiber structure that is shorter when compared to chicken or beef. Processing fish meat into nuggets requires fillers with strong adhesion so that the texture of the resulting fish nuggets has a compact texture. Types of fillers added to improve the stability of the emulsion, reduce shrinkage due to cooking, give effect to the appearance in terms of color, increase the elasticity of the product of fish nuggets, form a dense texture and draw water from the dough. One of the fillers added in making fish nuggets is TSP.

Texturized Soy Protein (TSP) is a food additive that is used to obtain added value for food, including alternative protein sources, giving flavor, color / appearance so as to increase consumer preferences, improve processed food elasticity and make textures the product is more compact and elastic. TSP is a class of Texturized Vegetable Protein (TVP) made from soybeans that are removed from fat as a raw material. Regarding the substitution of soy protein isolates in red bean analog meat prove that the digestibility of proteins from soy protein is 91% or can be interpreted easily digested by the body. The addition of TSP has long been used in various developed countries such as America and Canada as an analog of patties, hot dogs, pepperoni,

bacon bits, sausage nuggets, meatballs, and others, while Japan, China and South Korea are used as meat snacks for vegetarians.

Until now, in Indonesia there is not much known processing of fishery products using TSP as food additives for fish nuggets that can affect textures, taste, color/appearance for the products produced, so that it also affects the level of preference of the panelists. Based on this, this research aims to determine the level of preference for nila nuggets with the addition of TSP and the effect of adding TSP to nila nuggets.

2. MATERIALS AND METHOD

2. 1. Material and Tools

The materials used in this research include (fresh) nila with a size of 250-300 g and a length of 25-28 cm, TSP, Wheat Flour, Tapioca Flour, Salt, Ice, Garlic, Onions, Chicken eggs, Panir flour, Cooking oil, Pepper powder and chemicals needed in proximate analysis (HCl, hexane solvent, H₂SO₄, CuSO₄, K₂SO₄, distilled water, 30% NaOH, H₃BO₃ and Tashirol indicator).

Tools used: spoons, knives, cutting boards, food processors, steaming cages, frying pans, scales, molds, basins, meat grinders, blenders/mortars, calico cloths, cookers, styrofoam containers, and coolboxes. TA-XT Express Texture Analyzer, as well as a set of laboratory tools for proximate analysis.

2. 2. Research Methods

The research used an experimental method. This research uses 5 TSP addition treatments based on surimi weights are as follows:

Treatment A: Without the addition of TSP (control)

Treatment B: Addition of TSP 20%

Treatment C: Addition of TSP 30%

Treatment D: Addition of TSP 40%

Treatment E: Addition of TSP 50%

The formula used in this research is as follows:

Table 1. Formulation of Making Fish Nugget with TSP Addition.

Materials	TSP Addition Treatment (%)				
	(0%)	(20%)	(30%)	(40%)	(50%)
Surimi nila (g)	100	100	100	100	100
Tapioca flour (g)	10	10	10	10	10
Wheat flour (g)	10	10	10	10	10
Salt (g)	2,5	2,5	2,5	2,5	2,5

Pepper (g)	0,5	0,5	0,5	0,5	0,5
Ice (g)	10	10	10	10	10
TSP (g)	0	20	30	40	50
Garlic (g)	2	2	2	2	2
Onion (g)	10	10	10	10	10

Source: modified

The process of making fish nuggets according was modified as follows:

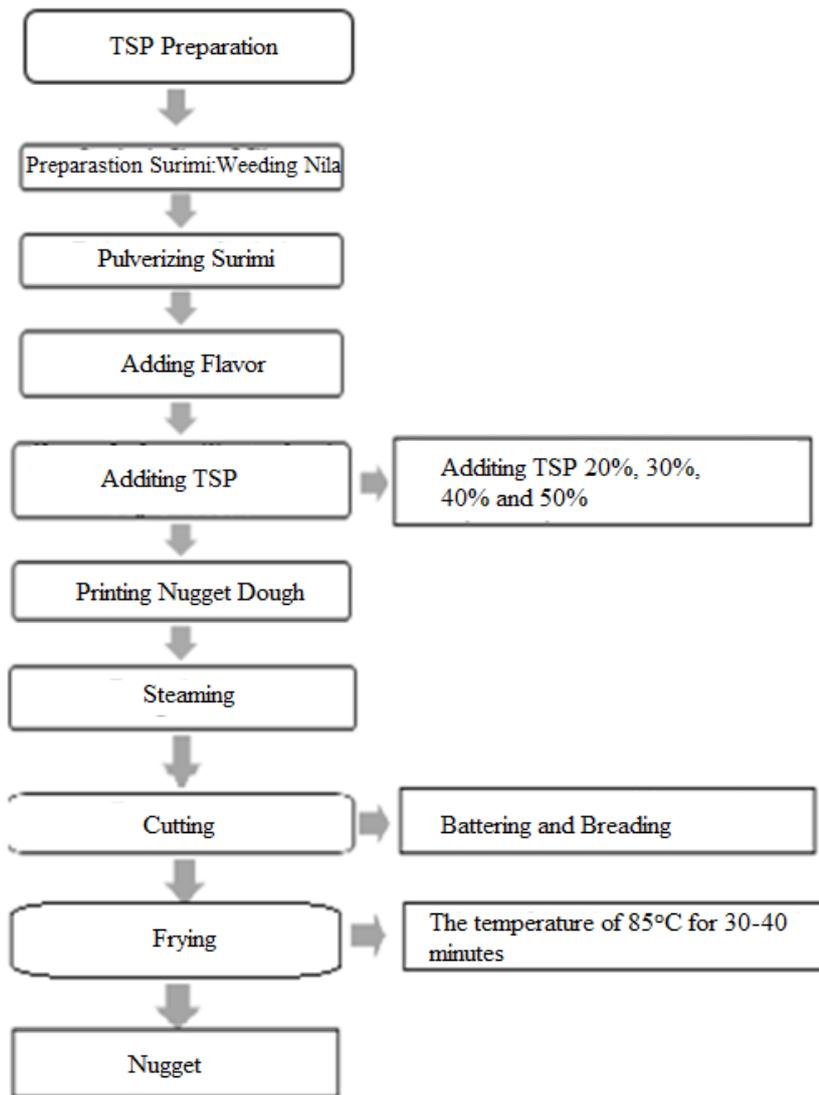


Figure 2. The process of making fish nuggets according was modified

Formulations for producing meat analogue nugget were shown in Table 1. The TSP was varied from 0%, 20%, 30%, 40% and 70% as the substitution of batter in the formulation. The procedure for making nila nugget with addition TSP begin from preparation dried TSP was weighed and boiled in the water (the ratio of TSP to water equal to 1:3) for 7 min. After boiling, TSP was squeezed to remove the water and then chopped to reduce the size using a grinder for 1 min. After preparing the TSP, surimi is made starting with separating the meat from the skin and bones of the fish. Then meat milling and soaking and meat washing are done 3 times using water and salt. The last stage of making nila nugget measuring 2.5 cm × 2.5 cm × 1.5 cm by following the procedure in Figure 2.

2. 3. Parameters Observed

The observed parameters are characteristics organoleptic, by using a hedonic test for appearance, aroma, texture, and taste. The test was carried out by 15 semi-trained panelists. Panelists are asked to fill the preference level test questionnaire according to personal opinion. The numerical scale consists of five types, namely; 1 (very dislike), 3 (dislike), 5 (neutral / normal), 7 (like), and 9 (really like). Folding Test, proximate analysis (moisture content, ash, fat and protein), and texture analysis using the Textured Profile Analyzer as supporting parameters.

2. 4. Data Analysis

The results of general test measurement data were analyzed descriptively comparatively. The comparative descriptive method is the result of the research and its analysis described in scientific writing in the form of a narrative, then the results of the analysis that has been carried out are taken as a conclusion. Descriptive research is generally carried out to systematically describe the facts and characteristics of objects or subjects that are precisely examined.

Data obtained from organoleptic observations were analyzed using a two-way analysis of the Friedman test using the Chi-square test. The statistical formula used in the Friedman test is as follows:

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

Information:

- X^2 = Friedman Test Statistics
- b = Repeat
- k = Treatment
- R_j = Total rank for each treatment

If there is the same number, a Correction Factor (CF) is calculated using the following formula:

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

$$H_c = \frac{x^2}{CF}$$

Description:

$$T = N(t_3 - t)$$

t = The number of observations is the same for one rank.

N = The same number of observations for a rank with the same t value.

The significant value of the H_c observation price can be known using the Chi-square critical prices table with $db = k - 1$; $\alpha = 0.05$. Decision rules for hypotheses, namely:

H_0 = The treatment of giving TSP of 30% does not give a significant difference at the level of $\alpha = 0.05$

H_1 = The treatment of 30% TSP gives a significant difference in level $\alpha = 0.05$

If the price is $H_c < x_{2\alpha}(K-1)$, then accept H_0 and reject H_1 , and if the price is $H_c > x_{2\alpha}(K-1)$, then H_0 is rejected and H_1 is accepted. If H_1 is accepted, then the treatment gives a real difference and the test is continued to find out the median value is not the same and to know the difference between treatments with multiple comparison tests with the following formula [39]:

$$|R_i - R_j| \leq Z\{\alpha/k(K-1)\} \sqrt{bk(k+1)/6}$$

Description:

$R_i - R_j$ = Difference in average rank

R_i = Average rating of the i sample

R_j = Average rating of the jth sample

a = Experiment wise error

b = Number of data

k = Number of treatments

Z = Value in table Z for multiple comparisons

Furthermore, to determine the best treatment, the Bayes method is used. Bayes method is one technique that can be used to carry out analysis in the best decision making from several alternatives to produce gains that consider various criteria. The criteria in question are parameters of colour, aroma, texture and taste. The bayes equation is as follows:

$$Total\ score_i = \sum_{i=1}^m score_{ij} (Crit_j)$$

Description:

Total score = Total final value of alternative to - i

Value of = alternative value to - i in the criteria to j

Critj = Level of importance (weight) criteria to - j

I = 1,2,3, n; n = number of alternatives

J = 1,2,3, n; n = number of criteria

The results obtained are then discussed descriptively. The existence of treatment is a criterion that needs to be considered in selecting selected samples. The best selection of samples

with the Bayes method is based on the highest total value of each treatment. The parameters given weight include organoleptic characteristics (colour, aroma and texture).

The value of the importance of each organoleptic parameter used consists of 5 several values, where 1 represents not important, 2 represents less important, 3 represents normal, 4 represents importance, and 5 represents very importantly. Value of interest can be obtained from the results of the panelist questionnaire or experts.

3. RESULT

3. 1. Hedonic Test

3. 1. 1. Appearance

The observed features include color, uniformity in size, shape, surface appearance and inner appearance. The appearance of nila with TSP addition treatment can be seen in Figure 3.

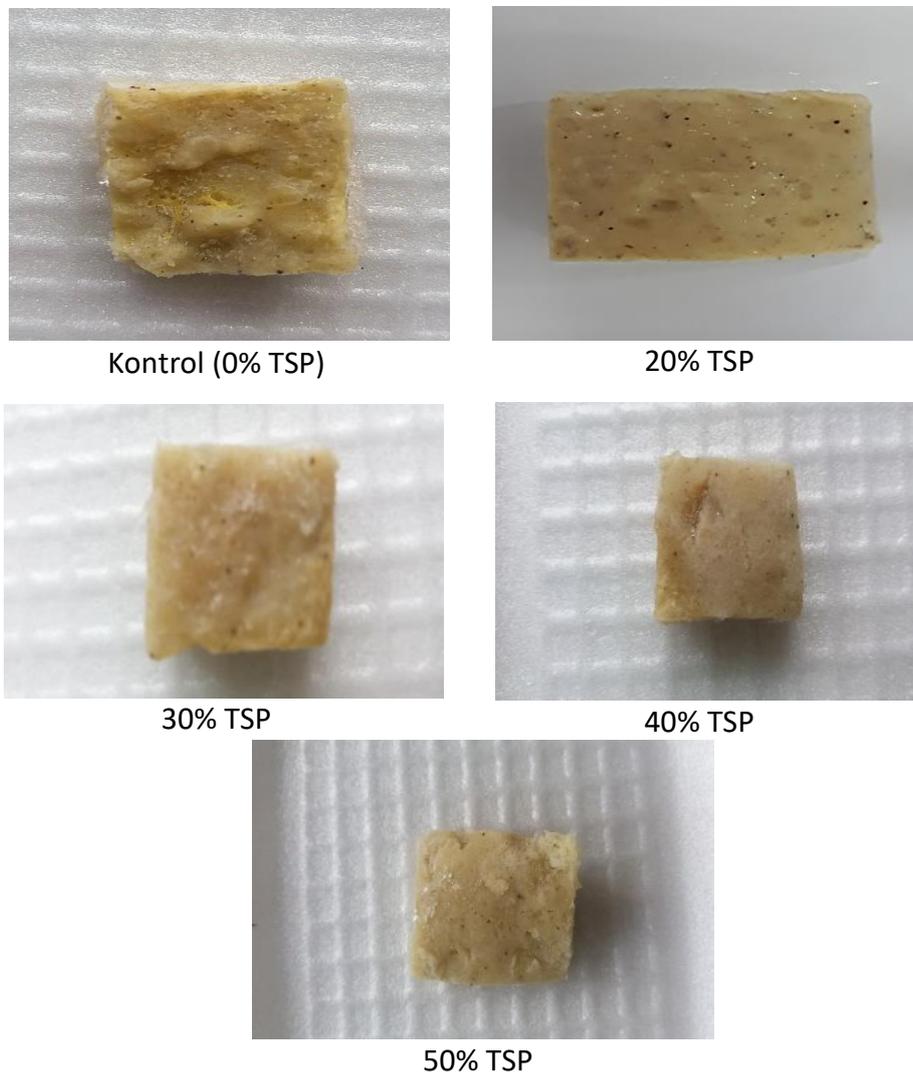


Figure 3. Nila Nugget Appearance Based on Treatment Addition Treatment

The hedonic test results on the appearance of nila nuggets with the addition of TSP are presented in Table 2.

Table 2. Average Nila Nugget Appearance Based on TSP Comparison.

Treatment TSP (%)	Median	Average
0	7	6,1 ^a
20	7	7,1 ^{ab}
30	9	8,6^b
40	7	7,4 ^{ab}
50	7	7,0 ^a

Description: The average treatment number followed by the same letter indicates no significantly different according to the test of the multiple comparison level of 5%

Based on the results of the Friedman test, the addition of TSP has a significant effect on the appearance of nila nuggets. The treatment of addition of 30% is the most preferred addition of appearance by the panelists, with the highest average value is 8.6 with the appearance of flat and intact nuggets, slightly brownish yellow in color, no cavities have been found, compared to the appearance of control treatment nuggets (0% TSP) has an average appearance value of 6.1 appearance of brownish yellow nuggets, intact shape but the surface of the nugget is uneven and slightly hollow on the inside. The treatment of 20% TSP addition found the average value of appearance of 7.1 with the appearance of a brownish yellow nugget, the shape is intact and there are still cavities, the surface is almost close to flat. The addition of 40% TSP received an average value of 7.4 in the form of a whole, white and not hollow. The appearance of a nugget with a 50% TSP addition treatment has an average value of 7.0 with a very pale yellowish-brown appearance and a slightly uneven and flat shape, there is no cavity. The treatment of 20% TSP addition found the average value of appearance of 7.1 with the appearance of a brownish yellow nugget, the shape is intact and there are still cavities, the surface is almost close to flat.

Based on the results of observations, there was a color change in nila nuggets in each TSP addiction treatment. Changes found in the color of the nugget become whiter and darker as the number of TSP increases because soy has a pigment that is naturally attached, which is white and has an additional Maillard reaction. The maillard reaction is a reaction between carbohydrates, specifically production sugars and protein amino acid groups that form *hydroxymethylfurfural* compounds and then these compounds continue to become *furfural*, *furfural* which forms will form melanoidin compounds which cause the color of the nugget to brown [48].

The surface of the nugget treated without TSP and the addition of 20% some cavities arise due to the process during steaming. The steaming process causes the development of starch granules due to starch gelatinization from the addition of tapioca flour, which is known not to return to its original state. The mechanism of the gelatinization process that is initiated by starch

granules will absorb water and break down amylose crystals and break the helical structure bonds of the molecule. The addition of water and heating will cause amylose to diffuse out of the granule so that the granule only contains a portion of amylopectin and will break out forming a matrix with amylose called gel explained that tapioca can be seen as a filler or a simple protein gel binder. The amino acid that becomes an emulsifier from TSP is lecithin.

TSP added also acts as a binder, according to High Water Holding Capacity (WHC) due to the addition of binding materials will increase the strength of the gel matrix and decrease the cavity structure of beef meatballs. Explained that the greater the concentration of protein, the higher the absorption of water. The amino acid composition also plays a role in water absorption. The more amino acid composition of the polar group, the better the water-binding capacity. Suggests that protein components are the ones that most influence water absorption. In this study, TSP contains high protein and can bind water. Proteins and starches (polysaccharides) can form a network of complex molecules that are composed of a single component of gel formation (Single Component Gel) and a mixture of two-component gelling (Mixed Two Components). The single-component of the polymer network is the simplest form of gel polymer that makes the product elastic, compact and supple. This can reduce the appearance of cavities in the nugget, according to that the fewer and the absence of cavities that are formed indicate the quality of nuggets is increasing, this is because the addition of binding materials causes a reduction in hollow structure thereby increasing the texture of nuggets.

3. 1. 2. Aroma

The aroma is an organoleptic parameter that gives rise to a special attraction that consumers have in determining a food product. Generally, the aroma that can be received by the nose and the human brain is fragrant, sour, rancid and charred. The results of observations of hedonic tests on the aroma of nila with the addition of TSP are presented in Table 3.

Table 3. Average Aroma of Nila Nugget Based on TSP Addition Treatment.

Treatment TSP (%)	Median	Average
0	7	7,9 ^a
20	9	8,1^a
30	7	7,9 ^a
40	7	7,5 ^a
50	7	7,3 ^a

Description: The average treatment number followed by the same letter indicates no significantly different according to the test of the multiple comparison level of 5%

Based on the results of the Friedman test, the addition of TSP did not have a significant effect on the aroma of nila nugget. The aroma of the nugget produced smells of spices and is typical of fish. The highest average value of nugget aroma was found in the treatment with the

addition of 20% TSP with a value of 8.1, based on observations of the distinctive aroma of fish and spices on the nugget and not much different from the aroma without the addition of TSP (control). The treatment of 30% TSP addition has a value of 7.9 with a distinctive aroma of fish and nuggets that still smell but not too thick. The treatment of a 40% TSP addition has a value of 7.5 and the treatment of 50% TSP addition has an average value of 7.3 with a distinctive aroma of fish that is reduced and has a slight smell of unpleasant (typical soy/plant odor).

The higher the amount of TSP added, it will affect the assessment of nugget aroma because of the content of vegetable protein sources contained in it. The more content of germination soybeans was used, the lower the scent score. Soybeans have an off-flavor which results in flavors and aroma products that affect the assessment when consuming processed products. The off-flavor compounds found in soybeans are groups of glucoside and saponin compounds, these compounds must be deactivated or eliminated so that the product can be favored.

Based on the results of the Friedman test, the addition of TSP did not have a significant effect on the aroma of nila nuggets. All treatments show the same median value, 7 and 9, classified by the panelists. The aroma of the nugget produced smells of spices and is typical of fish. The highest average value of nugget aroma was found in the treatment with the addition of 20% TSP with a value of 8.1, based on observations of the distinctive aroma of fish and spices on the nugget and not much different from the aroma without the addition of TSP (control). The treatment of 30% TSP addition has a value of 7.9 with a distinctive aroma of fish and nuggets that still smell but not too thick. The treatment of a 40% TSP addition has a value of 7.5 and the treatment of 50% TSP addition has an average value of 7.3 with a distinctive aroma of fish that is reduced and has a slight smell of unpleasant (typical soy/plant odor).

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3. 1. 3. Texture

The most typical organoleptic parameter in fish jelly products is texture. The addition of TSP to fish jelly products will certainly have an influence on the texture of the product. Texture assessment is done by fingering and olding nila nuggets. The hedonic test results on the texture of the nila with the addition of TSP treatment are presented at Table 4.

Table 4. Average Texture of Nila Nugget Based on TSP Addition Treatment.

Treatment TSP (%)	Median	Average
0	7	6,2 ^a
20	7	7,3 ^{ab}
30	9	8,3^b

40	9	8,2 ^b
50	9	8,2 ^b

Description: The average treatment number followed by the same letter indicates no significantly different according to the test of the multiple comparison level of 5%

The Friedman test results show that the addition of TSP has an effect on the texture of nila nuggets. The nugget texture with a control treatment (0% TSP) had an average value of 6.2 with the most dense texture compared to other treatments and was chewy. The texture of nila nugget with a 20% TSP addition treatment has an average value of 7.3 and has a dense texture, slightly increasing in elasticity. The texture of nila nuggets with the treatment of 30% TSP addition has the highest average value of 8.3 having the right texture in the density of a nugget, supple, flexible and compact compared to previous treatments. 40% TSP addition treatment has an average value of 8.2 and has a characteristic texture that is chewy and has no density or can be categorized as very soft. In the biggest treatment, the addition of 50% TSP on nila nuggets has an average value of 8.2 and has the most elastic texture to resemble tofu or fish meatballs which are very thick. Surimi also has a strong gel so that it can produce a characteristic product that is chewy because the addition of 2-3% salt and milled together will become a thick paste, in the process of making surimi in the process of making nuggets.

TSP used also plays a role in binders. Binders have used to increase the binding capacity of meat water, reduce shrinkage during cooking, improve emulsifying stability, increase flavor and increase the characteristics of the product slices. TSP is also made from wheat flour that has gluten compounds. Gluten is a compound found in wheat flour that has the elasticity and elasticity that can affect the texture of processed products.

3. 1. 4. Flavor

Taste is one of the organoleptic characteristics that play a role in the assessment of a product that aims to determine the level of acceptance of a product. The results of observations of the hedonic test for taste in nila with various TSP treatments are presented in Table 5.

Table 5. Average Texture of Nila Nugget Based on TSP Addition Treatment

Treatment TSP (%)	Median	Rata-rata
0	7	6,9 ^a
20	7	7,7 ^{ab}
30	9	8,3 ^b
40	9	8,5 ^b
50	9	8,6^b

Description: The average treatment number followed by the same letter indicates no significantly different according to the test of the multiple comparison level of 5%

The Friedman test results show that the addition of TSP affects the taste of nila nuggets. Control treatment or not added TSP has an average value of 6.9 with a savory taste and a distinctive taste of processed fish. In the treatment of TSP addition of 20% has an average value of 7.7 and has the same savory taste with the control treatment there is no other taste of the addition of TSP and still has a distinctive taste of fish. The taste of nuggets with the addition of 30% TSP has the highest average value of 8.3 with a more savory taste, savory taste typical of soybeans and still feels typical of fish. The taste of nuggets with the treatment of adding 40% TSP has an average value of 8.5 with a savory taste and has a distinctive taste of soybeans. The taste of nuggets with the addition of 50% TSP has an average value of 8.6 with the most savory flavor but reduces the distinctive taste of fish.

Based on the panelist assessment of nila taste, it was concluded that the nila nugget with the addition of TSP was favored by panelists. This is due to the high addition of TSP to vegetable protein which reinforces statements from research on organoleptic quality especially the taste of cork nuggets influenced by variations in the addition of soy flour which is assumed to be based on TSP, soybeans, with protein content height, of course, can affect the taste of fish nuggets from amino acids contained. One of the amino acids that affect the savory taste in this research is glutamic acid. Proteins containing several amino acids include glutamic acid. Glutamic acid plays a role in making a delicious or tasty taste in processed foods. Glutamic acid, histidine, methionine, and Valine are certainly contained in soybeans and nila. Furthermore, only the nila is glycine, alanine, and arginine. Besides flavor can arouse the taste through the aroma that is spread, more than just bitter, salty, sour and sweet. Through the process of giving aroma to a food product, the tongue can taste other tastes according to the aroma given.

3. 1. 5. Decision Making with the Bayes Method

Bayes method is one technique that can be used to analyze the best decision making from several alternatives to produce optimal gains. Producing optimal decisions requires consideration of various criteria. The results of the calculation of criteria can be seen in Table 6.

Table 6. Value of Nila Nugget Criteria Weight.

Criteria	Criteria Weight
Appearance	0,09
Aroma	0,10
Texture	0,39
Flavor	0,42
Jumlah	1

Based on the results of calculations on the parameters of appearance, aroma, texture, and taste, the results showed that the highest criterion weighting value, namely in the taste parameter

with the criteria weight value of 0.42. This shows that the flavor parameter is the most important criterion for the process of nila nugget with the addition of TSP. The parameters that are considered important in fish nugget products are characteristic of importance to the acceptance of panelists is the sense of subsequent texture, aroma, appearance, and color. Decision making on the relative weight values of the criteria for appearance, aroma, texture, and taste in nila is done by pairwise comparison method (Pairwise comparison). The data from pairwise comparison of the criteria for appearance, aroma, texture, and taste of nila from the 15 semi-trained panelists on the level of preference of nila with the addition of TSP are presented in Table 7.

Table 7. Nila Nugget Assessment Decision Matrix Using the Bayes Method.

Treatment	Kriteria				Alternative Value	Priority Value
	Appearance	Aroma	Flavor	Texture		
A	7	7	9	9	8.62	0.17
B	7	7	7	7	7.00	0.18
C	9	7	9	9	8.79	0.22
D	7	6	7	7	6.90	0.21
E	9	7	7	7	7.18	0.21
Alternative Value	0.09	0.10	0.42	0.39	38.48	1.00

Based on the overall results of the data including the assessment of appearance, aroma, texture, and taste, it can be concluded that the treatment of TSP addition of 30% is the most preferred treatment by panelists compared to other treatments. This is based on the opinion that the highest alternative value by considering criteria can be used to analyze the best decisions.

The treatment of adding TSP to nila nuggets of 0% to 50% is still accepted by the panelists, but the treatment of the addition of 30% TSP results in the most preferred nugget.

3. 2. Best TSP Addition

Based on the analysis in decision making from several alternatives in determining the best TSP addition treatment by considering the criteria of appearance, aroma, taste, and texture of nila nuggets that have been tested, nila nuggets with TSP additions of 30% are the most preferred treatment by panelists or the best treatment.

The addition of 30% TSP is best according to the study, that the best 30% addition of TVP on analogue nuggets decreases the force needed to separate samples and swallows, therefore TVP decreases the work to chew samples. The tests conducted on nila with the addition of the best TSP and nila without TSP are presented in Table 8.

Table 8. Results of Overall Observations.

Observations	Addition Treatment TSP (%)				
	0	20	30	40	50
Folding Test	A	A	AA	AA	AA
Physical Test (gForce)					
Hardness	3379,89	-	1445,90	-	-
Springiness	2,92	-	4,37	-	-
Composition Chemical					
Water Content	29,09	-	29,13	-	-
Ash Content	1,41	-	1,66	-	-
Fat Content	13,73	-	14,28	-	-
Protein Content	20,89	-	20,92	-	-

3. 2. 1. Folding Test

Based on the results of the folding test on nila nugget with the addition of TSP > 5 quality was obtained from the TSP addition treatment of 0%, 20%, 30%, 40%, and 50%. This shows that balanced TSP in the treatment of 30%, 40%, and 50% is referred to as very elastic with quality of > 5 and is ranked as AA (Very Springy). This is due to the addition of TSP which affects the elasticity of nila nuggets. Soybeans contain a lot of natural emulsifier lecithin and can work with gluten to impose dough structure. TSP with a high protein content can act as a binder so that it can improve the emulsion properties of the product.

This is inseparable from the influence of the raw materials used in the manufacture of nila nuggets, namely in the form of surimi nila, because in the process of making surimi through the stages of dozing, washing and giving salt. The surimi washing process will remove sarcoplasmic protein and dissolve protein myofibrils, especially myosin and actomyosin. The myofibril protein will form the gel during heating due to denaturation, interaction, and aggregation. Nila is very suitable for making surimi because of its thick meat and high white meat content. The white meat contained in nila has the advantage of the average high protein content of 26 mg and also has a myosin content of 50-58% and actin 15-20% of the total protein contained. Fish with high actin and myosin content will form more actomyosin. Actomyosin will also form a gel when the heating process so that it will get a texture that is more supple in surimi.

3. 2. 2. Physical Test

Product texture is an important parameter as a determinant of the quality of food products. Texture testing on nugget samples was conducted to find out how much the hardness and

springiness hardness value. Hardness is the maximum peak at the first pressure or at the first bite while springiness can be interpreted as the recovery time between the end of the first bite and the second bite.

Based on the results of the texture analysis test found differences in the texture of nila nugget with a control treatment (0% TSP) with the addition of 30% TSP or the treatment most preferred by panelists. The addition of TSP based on texture analysis can reduce the hardness of nila nugget from the control treatment 3379,89 gForce added 30% TSP decreases with a value of 1445,90 gForce so that a reduction in hardness of 1933, 99 gForce is found. Furthermore, the control treatment springiness value (0% TSP) amounted to 02,92 gForce and after 30% TSP increased to 4,37 gForce. Based on the analysis, it was found that TSP addition could affect the texture properties of nuggets to elastic according to [10] texture (hardness, adhesiveness, cohesiveness, springiness, gumminess, chewiness, shear force and work of shearing) so that the texture becomes softer resembling the structure of raw materials.

3. 2. 3. Composition Proximate Chemical

a. Water Content

Based on the test results, the water content of nila nuggets with the control treatment had a water content value of 29.09%, while the most preferred treatment was the addition of 30% TSP having a slightly higher moisture content of 0.4% to 29.13%. This shows that there is a slight increase in water content in the addition of TSP. This supports the opinion in his research chemical analysis of TSP pizza toppings showed an increase in water content along with the increase in the amount of TSP in sprinkling chicken pizza toppings which also influenced the moisture retention of toppings.

It also reinforces the opinion that the addition of TVP increases the percentage of liquid separation from 0 to 1.58%. The results show that when TVP concentrations increase, fluid absorption also increases. This is probably because the composition of nuggets contains gluten from wheat flour. Generally gluten proteins play an important role in determining the unique quality of wheat flour by increasing water absorption capacity, compactness, viscosity and elasticity in the dough. Gluten can absorb about twice the TSP dry weight to form a hydrated visco-elastic.

After being observed it was found that the increase in water content was not too large, this could be caused by the addition of fillers added in the form of carbohydrates (starch / amylopectin), namely tapioca flour which can cause an increase in starch granules with protein. Water cannot be maximally absorbed in processed products, because the hydrogen bonds that are supposed to be used to bind water have been used for the mechanism of tapioca (starch) bonds with meat protein stated that each increase in one unit of tapioca flour addition would reduce six units of water binding capacity nugget.

The water quality requirements on fish nuggets based are a maximum of 60%. The water content produced in nila nugget is below the range of maximum values required or can be said to meet the criteria.

b. Ash Content

Based on the test results, the concentration of nila nugget ash with the addition of 0% TSP (control) was 1,41%, while the treatment ash content of the most preferred TSP was 1.66%. This shows the effect of ash content on nila increases with the addition of TSP. The higher the

composition of the addition of soybean ingredients increases the ash content in white snapper nugget, caused by the mineral content of soybeans as a raw material for making nuggets such as calcium and phosphorus. Soybeans contain 8 mg of iron, 195 mg of calcium and phosphorus of 554 mg, while other minerals are in very small amounts (smaller than 0.003%), namely boron, magnesium, beryllium, and zinc. Ash content can also be influenced by minerals from other materials such as fish, salt, spices.

The quality requirements for fish nuggets ash content based are a maximum of 2.5%. The ash content produced in nila nuggets is below the range of maximum values required by [5] or can be said to meet the criteria.

c. Fat Content

Concerning the test results, it can be concluded that the addition of 30% TSP can increase the fat content on nugget by 0.03%. The amount of fat added to the addition of TSP with nila nuggets is relatively small because TSP is processed by extrusion and high temperature (Dry base), forming a porous structure so that it is very low fat (USDA 1999).

The quality requirements of fish nuggets fat content based are a maximum of 15%. The fat content produced in nila nuggets is above the range of maximum values required by %. The high level of fat in a product can be caused by the type of processing used or the high level of fat from the ingredients used, it can be said to come from meat and other additives.

d. Protein Content

Based on the test results, the levels of nila protein in the treatment of 0% TSP addition (control) obtained results of 13.73%, whereas in the comparative treatment, 30% TSP was added to the protein content of 14.28%. This shows that the addition of TSP to nila can affect protein levels, where protein consumption needs for adults (> 8 years) are 0.8 g / kg body weight. The protein content in TSP ranges from 11 mg from 21 g TSP according to the USDA-Nutrient Laboratory; CHS Ultra-Soy (2017). The quality requirements for fish nugget protein levels based are a minimum of 5%. The protein content produced in nila nuggets is above the minimum value range required.

4. CONCLUSIONS

Based on the research results on the level of preference of tilapia nuggets with the addition of TSP, it can be concluded that the addition of TSP for all treatments was favored by panelists because it had the smallest average value (7) on the hedonic scale and fold test results with a level (AA) no cracks when folded four. Based on the decision making with the Bayes method the addition of 30% TSP has the highest alternative value (8.66) which is the most preferred tilapia nugget by the panelist (n) = 15 with the average value of appearance (9), aroma (7), texture (9), and taste (9).

The results of testing the effect of 30% TSP addition obtained an analysis of chemical test results, namely an increase in water content by 0.04%, 0.25% ash content, 0.03% fat content and 0.55% protein content. The results of the texture test showed that 30% TSP addition could reduce the hardness value by 1933.99 gForce and the springiness value of 1.45 gForce.

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