

# *Influence of Star Fruit and Bamboo Sprout on Nutritional and Organoleptic Values on Nugget From Snakehead Murrel and Jackfruit Seed Flour*

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**Abstract-** This study aims to determine the effect of adding starfruit extracts and bamboo sprout on snakehead murrel nuggets substituted with jackfruit seed flour on nutritional value and storage time. The addition of starfruit extracts and bamboo sprout in fish nuggets serves as an antioxidant and antibacterial. This study uses a Completely Randomized Design (CRD) consisting of 4 variations of the composition (NG0, NG1, NG2, and NG3) and stored for 6 weeks in the refrigerator. Observation data were analyzed with ANOVA and continued with the Tukey test. F test analysis on the variation of 4 compositions significantly showed significant differences ( $P < 0.05$ ) on water content, protein, fat, crude fiber and organoleptic values (color, odor, taste and texture). The best value is obtained in the treatment of NG3 with 43.77% water content, 9.59% protein content, 1.76% fat content and 1.18% crude fiber content. The results obtained meet the SNI 7758-2013 quality standard requirements.

**Keywords-** Starfruit Extract, Nutritional Value, Snakehead Murrel Nugget, Tukey Test.

## I. INTRODUCTION

Nugget is a processed meat product that is quite popular especially among children and adolescents. The main ingredient of nuggets usually comes from beef and chicken meat. In addition to beef and chicken, the main ingredients for making nuggets can use snakehead murrel. Snakehead murrel (*Channa striata*) is an economically valuable type of fish. This species has a distinctive taste, thick and white meat texture so that the price is quite expensive both in the form of fresh and dried (salted fish) [6].

Snakehead murrels have high protein content, especially albumin and essential amino acids, fats especially essential fatty acids, minerals especially zinc (Zn) and some vitamins that are very good for health [2]. This is supported by research results from [8]Pratiwi et al., (2016) that snakehead murrel is a food product rich in protein, phosphorus

and calcium needed for bone growth and free from cholesterol. Snakehead murrel processing is generally made fresh processed, such as fried or baked. This snakehead murrel has the potential to be developed into processed products that have added value, one of which is the raw material for making nuggets. The use of snakehead murrel in the making of nuggets can be an alternative diversification of processed fish products [8] (Pratiwi et al., 2016).

Making fish nuggets requires ingredients that contain carbohydrates as a binder so that the ingredients are bound to one another in dough that is useful for improving texture. Binder which is often used is various types of flour containing carbohydrates, such as flour from grains, wheat flour from wheat, rice flour and glutinous rice. Fiber is a complex carbohydrate and can be classified as soluble and insoluble. According to [8], processed fish in general have the disadvantage of not containing the fiber needed in the digestive process. The addition of vegetable resources in making nuggets can mask these weaknesses. One potential biological resource is jackfruit (*Artocarpus heterophyllus*).

Jackfruit seeds have a high nutrient content, such as carbohydrates, proteins, fats, iron, calcium, phosphorus, water, vitamin C and vitamin B1. There have been many studies conducted on the potential of jackfruit seeds as food products. A study conducted by [9] uses jackfruit seeds into flour to make various processed food products from jackfruit seed flour. According to [12], community acceptance of processed products from jackfruit seed flour can be accepted, as evidenced from the processed "onde-onde ketawa biji nangka" which have a shape with an average value ranging from 2.86 - 3.60 and taste with an average value of 2.89 - 3.57 which is the same as the original product or without the addition of jackfruit seed flour, only slightly different aroma of processed jackfruit seed flour products, with an

average value ranging from 2.94 - 3, 51 a bit unpleasant but people still like it.

Sweet star fruit (*Averrhoa carambola* L) contains calcium, iron, beta-carotene, vitamin B1, vitamin B2, vitamin C, and flavonoids, tannins, saponins, and alkaline. Star fruit is often used as an anti-inflammatory, antimicrobial, antimalarial, antipyretic, and antidote [3]. Phytochemical analysis of this fruit shows the presence of saponins, alkaloids, flavonoids and tannins. This fruit is rich in antioxidants, especially proanthocyanidins, epicatechin and vitamin C. Star fruit extract has good anti-microbial activity against both gram-positive and gram-negative bacteria, including *Staphylococcus aureus*, *Bacillus cereus*, *Escherichia coli*, *Pseudomonas aeruginosa* and *Streptococcus typhimurium* [13].

Raw bamboo sprouts have a compound content of about 85.63 grams of water and about 9.10 grams of fiber [14]. Bamboo sprout extracts are reported to supplement antioxidants that occur naturally in the human body or are consumed in food, reducing oxidative stress in the human body and , thus, the risk of developing chronic diseases. Furthermore, the presence of natural antioxidants in meat products has been shown to increase the acceptance of health-conscious consumers [13].

Starfruit and bamboo sprouts have abundance and great potential as antioxidants and antimicrobials in processed meat products. Meat nuggets made by adding several variations of star fruit extract and bamboo sprout using flour. The addition of star fruit extract variations are 1%, 2%, 3%, 4%, 5% and 6%, and as for the sprout extract are 1%, 2%, 4%, 6%, 8% and 10%. As a result of several variations of extract addition into the nugget, the researchers obtained optimal results in the treatment of 4% starfruit extract and bamboo sprout extract 6%, each increasing the storage period of the nugget for at least two weeks, from 14 days to 35 days at  $4 \pm 1$  ° C compared to control [13]. Therefore, the authors are interested in conducting further research to determine the effect of adding starfruit extract and bamboo sprouts on snakehead murrel nugget with jackfruit seed flour. This research was conducted to see the effect of treatment on the nutritional value of proximate namely water content, protein content, fat content and crude fiber content.

## II. RESEARCH METHOD

The research carried out was the manufacture of snakehead murrel nuggets with the addition of star fruit extract and bamboo sprout extract which was substituted with jackfruit seed flour. The preliminary research stage was making jackfruit seed flour referring to the research of [10], making both starfruit extracts and bamboo sprouts, making snakehead murrel nugget spice formulation by modifying the seasoning formulation.

This study uses an experimental method, which is adding star fruit extracts and bamboo sprout extract with different amounts in the processing of snakehead murrel nuggets. The addition of star fruit extract and bamboo extract on the nugget dough was carried out at a concentration of 4% for starfruit extract and 6% for bamboo extract. The research finding of [13] obtained optimal results in the addition of extracts of 4% and 6% into meat nuggets.

The experimental design used was a two factorial Complete Randomized Design (CRD) consisting of 4 levels of treatment namely, NG0 treatment (nuggets without the addition of extracts) as a control, NG1 treatment (nuggets with the addition of 4% star fruit extract), NG2 treatment (nuggets with the addition of bamboo sprout extract 6%), and NG3 treatment (nuggets with the addition of star fruit extract 4% and bamboo extract 6%), performed with two repetitions. Organoleptic test was carried out on 20 untrained panelists, and then the organoleptic value was taken from the best nutritional value.

The process of making snakehead murrel nuggets is based on the method of [5]. After the nuggets are cooked, the water content, protein content, fat content and crude fiber content will be analyzed (SNI 01-2891-1992), while organoleptic testing (SNI 7758-2013) in the nugget condition is fried.

## III. RESULTS AND DISCUSSION

### Proximate Analysis

#### Close Analysis

The results of the analysis of the nutritional value of snakehead murrel nuggets obtained in this study can be seen in Table 1.

**Table 1. Analysis Result of the Nutritional Value of Snakehead Murrel Nugget**

Week	Code	Water Content	Protein Content	Fat Content	Crude Fiber Content
0	NG <sub>0</sub>	50,36 <sup>a,b</sup>	9,28 <sup>b</sup>	1,43 <sup>f</sup>	1,31 <sup>c</sup>
	NG <sub>1</sub>	49,36 <sup>b</sup>	<b>9,61<sup>a</sup></b>	<b>2,00<sup>a</sup></b>	1,16 <sup>e,f</sup>
	NG <sub>2</sub>	49,30 <sup>b</sup>	9,51 <sup>a</sup>	1,92 <sup>b</sup>	1,26 <sup>c,d</sup>
	NG <sub>3</sub>	<b>50,66<sup>a</sup></b>	9,49 <sup>a</sup>	1,43 <sup>f</sup>	<b>1,63<sup>b</sup></b>
3	NG <sub>0</sub>	47,57 <sup>c</sup>	8,63 <sup>d</sup>	1,04 <sup>h</sup>	1,15 <sup>e,f</sup>
	NG <sub>1</sub>	46,55 <sup>c</sup>	8,87 <sup>c</sup>	1,01 <sup>h</sup>	1,15 <sup>e,f</sup>

Week	Code	Water Content	Protein Content	Fat Content	Crude Fiber Content
	NG <sub>2</sub>	46,44 <sup>c</sup>	<b>9,53<sup>a</sup></b>	1,29 <sup>g</sup>	<b>1,26<sup>c,d</sup></b>
	NG <sub>3</sub>	<b>47,65<sup>c</sup></b>	<b>9,43<sup>a,b</sup></b>	<b>1,34<sup>g</sup></b>	1,23 <sup>c,d,e</sup>
6	NG <sub>0</sub>	43,52 <sup>d</sup>	8,37 <sup>c</sup>	<b>2,02<sup>a</sup></b>	1,69 <sup>b</sup>
	NG <sub>1</sub>	42,59 <sup>d</sup>	8,51 <sup>d,e</sup>	1,60 <sup>e</sup>	<b>2,01<sup>a</sup></b>
	NG <sub>2</sub>	42,54 <sup>d</sup>	8,92 <sup>c</sup>	1,83 <sup>c</sup>	1,09 <sup>f</sup>
	NG <sub>3</sub>	<b>43,77<sup>d</sup></b>	<b>9,59<sup>a</sup></b>	1,76 <sup>d</sup>	1,18 <sup>d,e</sup>

Description: The numbers followed by different letters show significant differences (P<0,05).

### Organoleptic Assessment

Based on the results of organoleptic assessment conducted by 20 panelists who have not been trained on the value of color, odor (aroma),

texture and taste in snakehead murrel nuggets with the addition of starfruit extract and bamboo sprout extract substituted with jackfruit seed flour, the following data were obtained.

**Table 2. The Average Value of Organoleptic Snakehead Murrel Nugget**

Code	Color	Odor	Taste	Texture	Quality Requirement
NG <sub>0</sub>	8,15 <sup>b</sup>	8,0 <sup>b</sup>	8,1 <sup>a</sup>	8,6 <sup>a</sup>	Min 7 (Score 3-9)
NG <sub>1</sub>	8,45 <sup>a</sup>	8,2 <sup>a</sup>	8,1 <sup>a</sup>	8,1 <sup>c</sup>	
NG <sub>2</sub>	8,15 <sup>b</sup>	7,5 <sup>c</sup>	7,8 <sup>a</sup>	8,2 <sup>b,c</sup>	
NG <sub>3</sub>	7,75 <sup>c</sup>	7,6 <sup>c</sup>	7,8 <sup>a</sup>	8,4 <sup>a,b</sup>	

Description: The numbers followed by different letters show significant differences (P<0,05).

### Water Content Analysis

Based on the results of research on snakehead murrel nugget water content with the addition of starfruit extract and bamboo sprout extract substituted with seed flour experienced a decrease in each treatment (Table 1). The value of water content ranges from 42.54% to 50.66%. The lowest decreased water content was obtained from the treatment of NG<sub>2</sub> (snakehead murrel nugget + bamboo sprouts), namely at week 0 = 49.30%, week 3 = 46.44% and week 6 = 42.54%. The highest value of water content was obtained in the treatment of NG<sub>3</sub> (snakehead murrel nugget + second extract), ie at week 0 = 50.66%, week 3 = 47.65% and week 6 = 43.77%.

Decrease in the value of water content in snakehead murrel nuggets allegedly due to the influence of the material used has different water content, as well as an increase in the value of fat and protein content. The addition of extract significantly (P <0.05) reduced the water content of snakehead murrel nugget, shown in snakehead murrel nugget with bamboo sprout extract (NG<sub>2</sub>) which had a lower water content value than other treatments (Table 1). Snakehead murrel nuggets with the addition of both extracts (NG<sub>3</sub>) have a higher value than other treatments allegedly because starfruit and bamboo sprouts have high water content of 86.91% and 85.63% [14].

### Protein Content Analysis

Protein is a source of amino acids consisting of elements C, H, O and N. Protein content in food varies both in quantity and type. Based on the research results, protein content showed a decrease in each treatment during storage except NG<sub>3</sub> treatment (Table 1). Snakehead murrel nugget protein content ranged from 8.37% - 9.61% in accordance with SNI 7758-2013 quality requirements regarding fish nuggets with a minimum limit of 5.0%. Significant decrease in protein content occurred in the treatment of NG<sub>0</sub> (nuggets without the addition of extracts), namely week 0 = 9.28%, week 3 = 8.63% and week 6 = 8.37%. In contrast, the nugget added the two extracts (NG<sub>3</sub>) did not experience a significant or permanent decrease, namely at week 0 = 9.49%, week 3 = 9.43% and week 6 = 9.59%. This is because both starfruit extracts and bamboo sprouts have a high enough protein content, as well as due to the addition of wheat flour, jackfruit seed flour and snakehead murrel which have high albumin and protein content. According to research conducted by [4], the nugget protein content is influenced by the components of its constituent ingredients. In addition to its constituent ingredients, an increase in protein content can also be influenced by increased water content as well, because water content can reduce the percentage of food production.

## Fat Content Analysis

Fat is a potential source of energy that is more effective than carbohydrates and protein. The most widely used energy source for metabolism is fat. The fat content in food serves to improve the shape, texture, add nutritional value and calories and provide flavor in food. Based on the analysis of the Tukey test, it showed a significant difference ( $P < 0.05$ ) on 4 variations of treatment and duration of storage. The level of fat of snakehead murrel nugget NG0 (nugget without extract) treatment increased at week 0 = 1.43, week 3 = 1.04 and week 6 = 2.02. The increase in the value of fat content in NG0 is caused by the decrease of the value of NG0 water content.

In the treatment of NG1 (nuggets with star fruit extract), it decreased at week 0 = 2.00, week 3 = 1.01 and week 6 = 1.60, whereas for NG2 treatment (nuggets with bamboo extract) and NG3 (nuggets with both extracts) did not significantly decrease or increase fat content (Table 1). Decrease in the value of fat content in snakehead murrel nuggets allegedly due to the influence of the material used has a different fat content. The addition of extract significantly ( $P < 0.05$ ) reduced the fat content of snakehead murrel nugget, shown in snakehead murrel nugget with star fruit extract (NG1) which had decreased fat content than in other treatments. Decrease in fat content in NG1 treatment was due to low starfruit fat content that is 0.3%. The maximum fat content according to SNI 7758-2013 is 15.0% and in this study the fat content obtained for each treatment during the 6-week storage process meets the quality requirements. Even the fat content obtained is far below 15.0%.

## Crude Fiber Analysis

Crude fiber is a part of food that cannot be hydrolyzed by chemicals and are used to determine levels of crude fiber, namely sulfuric acid ( $H_2SO_4$ ) and sodium hydroxide (NaOH), while food fiber is a part of food that cannot be hydrolyzed by enzymes digestive enzymes. Therefore, the value of crude fiber is lower than food fiber because sulfuric acid and sodium hydroxide have more ability to hydrolyze food components compared to digestive enzymes [7].

Based on the research results obtained, crude fiber content showed that the value of crude fiber content of each treatment and storage time of 0, 3 and 6 weeks for all variations of the nugget were significantly different ( $P < 0.05$ ). Crude fiber content of snakehead murrel nugget treatment NG0 (nugget without extract) and NG1 (nugget with star fruit extract) increased, whereas in NG2 treatment (nugget with sprout extract) and NG3 (nugget with both extracts) decreased (Table 1). The results of the average value of crude fiber snakehead murrel nugget with the addition of starfruit extract and bamboo sprout extract substituted with jackfruit seed flour obtained ranged from 1.09% - 2.01%. Decrease and increase the value of crude fiber content in snakehead murrel nuggets due to the influence of the material used has different fiber content. Indonesian National

Standard 7758-2013 regarding fish nuggets does not include the standard fiber content in the nuggets, so the fiber content of all treatments is considered as added value of the nuggets.

## Organoleptic Assessment

Organoleptic assessment is one way of evaluating to know the acceptability of a product and assess the quality of a food. This study conducted a test of preference on panelists whose function was to determine the preferences of panelists on a product. The panelists in this study were 20 panelists who had not been trained. Snakehead murrel nugget products in this study were tested by giving a code to each sample tested. The organoleptic testing panelists were asked to provide an assessment of snakehead murrel nugget products which included an assessment of color, odor, texture and taste.

### 1. Color

The color of a food product is the main attraction before consumers know and like other properties. Consumers by looking at color can assess the quality of food easily and quickly [11]. The results of organoleptic assessment of snakehead murrel nugget color can be seen in Table 2. Based on the results of organoleptic tests conducted by 20 panelists on 4 variations of the treatment of extract addition with different concentrations, the average color values of snakehead murrel nuggets ranged from 7.75-8, 45.

This study uses the addition of the same Jackfruit Seed Flour (TBN) in each treatment formulation. The addition of TBN can cause a decrease in the color value of the snakehead murrel nugget, with this addition causing the color of the nugget to turn brownish yellow even close to pale which initially (only the addition of wheat flour) is bright yellow/golden. After the frying process, the color of the nugget turns yellowish brown. TBN has a yellowish white color, while white flour can be thought to affect the color of the resulting nugget, besides the change of color in the nugget possible from the frying process. The highest organoleptic color assessment is found in the NG1 treatment (addition of 4% star fruit extract) with an average value of an average of 8.45 and the lowest average value in the NG3 treatment (addition of both extracts) with an average value of 7.75.

Based on the results of the color organoleptic assessment, it was obtained that the organoleptic assessment of the colors had fulfilled the SNI-7758-2013 quality requirements with a minimum value of 7 (score 3-9).

### 2. Odor

The odor (aroma) can also be referred to as a remote tasting because humans can recognize the delicious food that has not been seen just by smelling it from afar. The odor (aroma) of a lot of food determines the delicacy of food and the taste of food itself [15].

Organoleptic test results carried out by 20 panelists on 4 variations of the treatment of extract addition with different concentrations obtained the average value of odor (aroma) in snakehead murrel nugget ranged from 7.5 to 8.3. This can be seen in Table 2. Based on organoleptic assessment of odor (aroma), the highest average value was found in the treatment of NG1 (addition of starfruit extract) which was 8.3 and NG0 (without the addition of extract) with an average value of 8 close to the specific strength criteria of nuggets, producing odors that panelists preferred. According to the panelists' assessment, they chose the treatment of NG0 and NG1 because it had a fragrant smell of nuggets and the smell of complementary spices such as garlic and scented onions compared to other treatments, which were considered to have a less strong specific odor nugget. According to [16], the aroma is influenced by the amount of seasoning added to the dough, the more seasoning added the more sharp the aroma.

Based on the organoleptic assessment of odors obtained, the organoleptic assessments for odors have met the SNI-7758-2013 quality requirements with a minimum value of 7 (score 3-9).

### 3. Taste

Taste is a very important factor in determining panelist acceptance or rejection of food. Taste can also be assessed as a response to stimuli derived from chemical compounds in a food that gives the impression of sweet, bitter, acidic and salty [11]. The average value of organoleptic testing of snakehead murrel nugget flavor with the addition of starfruit extract and bamboo sprout extract substituted with jackfruit seed flour can be seen in Table 2.

Organoleptic test results conducted by 20 panelists on 4 variations of the treatment of extract addition with different concentrations, it is obtained that the average value of the cork fish nugget ranged from 7.8 to 8.1.

Based on the organoleptic assessment, the NG0 and NG1 treatments had the highest mean value of 8.1 approaching the specific nugget-specific criteria, producing a taste that panelists preferred. According to the panelists' assessment, they chose the NG0 and NG1 treatments because they had a taste that was in line with the nugget and snakehead murrel taste more than the other treatments.

Based on the organoleptic assessment results, it is obtained that the average value of the taste organoleptic produced meets the quality requirements of SNI-7758-2013 with a minimum value of 7 (score 3-9).

### 4. Texture

The nugget texture is formed during the heating process. The content in the binder will undergo a gelatinization process, aiming to form a compact, easily printed and cut texture. Organoleptic test results carried out by 20 panelists on 4 variations

of the treatment of extract addition with different concentrations obtained the average value of the texture of the snakehead nugget ranged from 8.1-8.6, this can be seen in Table 2. Based on the results of organoleptic assessment NG0, NG1, NG2 and NG3 treatments have almost equal high mean values, namely NG0 (8.6), NG1 (8.1), NG2 (8.2) and NG3 (8.4), approaching the rather dense criteria or rather compact, producing textures that are preferred by panelists. Texture is strongly influenced by water content, the lower the water content of a material, the more compact and dense the texture produced [1].

Based on organoleptic assessment, the taste and texture for NG0 and NG3 treatment is preferred, but for odor (aroma), it is less preferred. The results obtained can be said that the organoleptic assessment of the resulting texture has fulfilled the SNI-7758-2013 quality requirements with a minimum value of 7 (score 3-9).

## CONCLUSION AND SUGGESTIONS

### Conclusion

Based on the analysis that has been done, it can be concluded that the effects of adding starfruit extract and bamboo sprout extract substituted with jackfruit seed flour to the nutritional value of snakehead murrel nuggets are as follows.

1. Snakehead murrel meat and jackfruit seed flour can be used as raw material for snakehead murrel nuggets by adding starfruit extracts and bamboo sprouts.
2. Variation in the composition of the nugget and variations in storage time affect the nutritional value. From some NG0, NG1, NG2 and NG3 treatments, the best value was obtained in the NG3 treatment with a water content of 43.77%, protein content of 9.59%, fat content of 1.76% and crude fiber content of 1.18%.
3. Good storage for 6 weeks does not affect changes in nugget nutrition.
4. Snakehead murrel nuggets produced in this study meet SNI 7758-2013 quality standards for all variations of treatment.

### Suggestions

1. In future studies, it is recommended to conduct microbiological tests on 4 treatment variations in order to find out which treatment formulation is better.
2. Further research needs to be done for the formulation of snakehead murels in multiply so that the taste and protein content values are higher.
3. Further research needs to be done by replacing the addition of extracts to the nugget formulation with other extracts.

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