

Fortification of Tempeh Flour on the Chemical and Organoleptic Properties of Oyster Mushroom Nuggets

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Abstract: The purpose of this study was to determine the effect of fortification of tempeh flour to the chemical and organoleptic properties of oyster mushroom nuggets. Randomized Block Design (RBD) with a single factor and triplicate in order to obtain 18 experimental samples was used as experimental design. The treatments ratio of of tempeh flour to the oyster mushroom are as follows: P1 (30% : 70%), P2 (40: 60%), P3 (50%: 50%) , P4 (60% : 40%), P5(70%: 30%), and P6 (80%: 20%). The parameters to be observed included moisture, fat, protein and organoleptic (taste, color, texture and aroma). Observation data were tested by ANOVA at 5% significance levels and continued by Honestly Significant Difference (HSD) with the same significant level. The results showed that fortification of tempeh flour had a significant effect on all chemical and organoleptic of the nuggets. The treatment of fortified tempeh flour ratio 80%: Oyster mushroom 20% is the best treatment for the chemical quality of nuggets (40.8% moisture content, 10.39% fat content and 13.86% protein content). As well as for the organoleptic quality, the preferable ratio of 60% tempeh flour: 40% oyster mushrooms.

Keywords: Nugget, Oyster Mushroom, Tempeh Flour

I. INTRODUCTION

Nugget is a form of ready-to-eat frozen food products, namely products that have been preheated until they are precooked, then frozen [1]. In sequence with the development of science and technology, nuggets can be made also from various types of fish, beef and chicken meat. According to the Indonesian National Standard [3], the nutritional content of nuggets in 100g is maximum water content of 60g, 12g minimum protein, 20g maximum fat, 25g maximum carbohydrate, 30mg calcium. Nugget usually made of animal ingredients generally contains high fat, then raw materials that are usually made from animal products can be substituted with vegetable products, such as oyster mushrooms. Oyster mushrooms are chosen as raw material for making nuggets, because oyster mushrooms have good nutritional value, physical properties that are chewy like meat, delicious taste, and are easy to obtain, different from products derived from animal ingredients, usually have a relatively expensive and also could not be consumed by vegetarian consumers. Various studies have shown that consumption of plant foods can reduce the risk of cardiovascular disease due to plant foods contain phytochemicals which function as antioxidants. The

processing of oyster mushrooms as nuggets requires the addition of other ingredients such as tempeh flour to increase the nutrient and quality of oyster mushroom nuggets [19]. Tempeh flour as an additional ingredient in making oyster mushroom nuggets because tempeh flour has high enough protein content. The addition of tempeh flour could increase the protein content in the making of oyster mushroom nuggets. Tempeh flour also has fiber content of 1.4% per gram, although it is less than tempeh. The protein content of tempeh equals the protein content of chicken (21%) and beef (20%). Besides that, tempeh flour is rich in the amino acid lysine. Tempeh flour is a good source of nutrition because it contains sufficient amounts of protein, essential amino acids, essential fatty acids, vitamin B complex and fiber [15].

The results of research from Estiningtyas [5], that adding up to 60% of tempeh flour resulted in the highest protein content in sausages that were substituted for tempeh flour. The results obtained were that the higher the substitution of tempeh flour, the levels of protein, iron and β carotene in sausages increased while the levels of carbohydrates and fat decreased. According to Lestari [11], adding tempeh flour to 80% is the best treatment for parameters of protein content, fat content and water content as well as organoleptic parameters of taste, aroma and color of snakehead fish nuggets. Meanwhile, the results of research from Gavi and Martati [6] regarding the effect of substitution of tempeh flour with the addition of tempeh flour to 60% give results that the higher the addition of sword-sword tempeh flour, the increase in protein content of steamed bronies.

Therefore, based on the description above, the authors conducted research on " Fortification of Tempeh Flour on the Chemical and Organoleptic Properties of Oyster Mushroom Nuggets".

II. MATERIAL AND METHODS

The experimental design used was a randomized block design (RBD) with a single factor, namely the ratio of tempeh flour : oyster mushrooms are as followed:

P1: Tempe Flour 30%: 70% Oyster Mushrooms; P2: Tempe Flour 40%: 60% Oyster Mushrooms; P3: 50% Tempe Flour: 50% Oyster Mushrooms; P4: 60% Tempe Flour: 40% Oyster

Mushrooms; P5: 70% Tempe Flour: 30% Oyster Mushrooms; P6: 80% Tempe Flour: 20% Oyster Mushrooms. Each treatment was triplicate in order to obtain 18 experimental samples. Data from physical and organoleptic observations were analyzed using Analysis of Variance (ANOVA) at the 5% level using Excel software. and continued by Honestly Significant Difference (HSD) with the same significant level. And continued is carried out for physical and organoleptic parameters [7].The process of making vegetable nuggets includes are as followed; a. Sorting.--The raw material used is oyster mushrooms. The selected oyster mushrooms are mushrooms that are still fresh, have elastic texture and are white in color. The part of the hood and stalk used for the manufacture of oyster mushroom nuggets;b .. Washing.--Oyster mushrooms are washed under running water and cleaned on the underside of the mushrooms by cutting them with a knife; c. Oyster Mushroom Mill.--Oyster mushrooms that have been cleaned are mashed using a food processor. Then the smooth mushrooms are added with cooled mineral water as much as 20% until evenly distributed. The function of adding cold mineral water is to keep the temperature low during the grinding process; d. Mixing.--Prepared all ingredients such as tempeh flour, white oyster mushrooms and all the spices that have been weighed and mashed. Each experimental unit for oyster mushrooms requires a dose of oyster mushrooms (70%, 60%, 50%, 40%, 30%, 20%, tempeh flour (30%, 40%, 50%, 60%, 70%, 800%) , 10% tapioca flour, 3% onion, 1% garlic, 3% salt, 0.5% pepper, 2.5% sugar, 1% egg and 1% bread flour. Then mix all the ingredients until evenly distributed; e. Steaming.--The ingredients that have been mixed evenly are then put into the pan and steamed at 90oC for 30 minutes; f. Printing.--The steamed material is then printed by cutting it with a size of 2x2x1 cm; g. Coating.--The printed material is then coated with 2g / piece of purebred chicken eggs and breadcrumbs; h. Frying.--Frying the nuggets using cooking oil until cooked, then drained and analyzed sensory of the appearance, taste, aroma and texture produced. The parameters observed in this study consisted of chemical parameters, namely moisture, protein and fat content,[4] organoleptic parameters, namely color, taste, aroma and texture.[4].

III. RESULTS AND DISCUSSION

1. Water Content.

The results of the analysis of variance (ANOVA) show that the addition of tempeh flour with oyster mushrooms has a significant effect on the moisture content of the oyster mushroom nuggets (Fig.1).

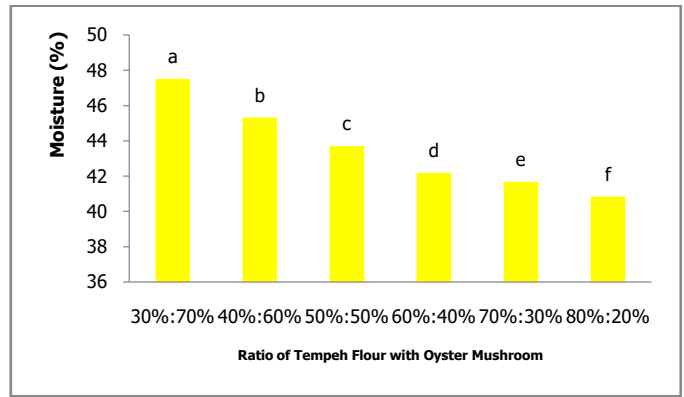


Figure 1. Effect of Addition of Tempeh Flour with Oyster Mushrooms on Moisture Content of Oyster Mushroom Nugget

The higher the concentration of tempeh flour and the lower the concentration of oyster mushrooms added, the lower the water content of nuggets. The highest water content was found in the ratio of 30%: 70% which was 47.51% and the lowest was at the ratio of 80%: 20% which was 40.84%. This is because according to Murni (2014), tempeh flour has a lower water content of 4.11%, apart from tempeh flour produced other factors that affect the moisture content of the nuggets are the addition of oyster mushrooms, where oyster mushrooms are a food ingredient. Which has a water content that is high enough, namely 90.97%, so that in the in the ratio of 80%: 20% where the amount of oyster mushrooms added is the least so that it also affects the moisture content of the nuggets.

2. Protein Levels

Based on observations and analysis results using ANOVA, the addition of tempeh flour with oyster mushrooms has a significantly different effect on protein nuggets (Fig.2).

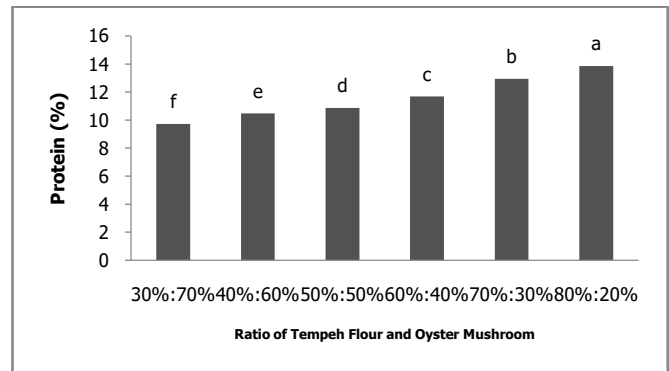


Figure 2. Effect of Addition of Tempeh Flour on Oyster Mushroom Nugget Protein

The involvement of foodstuffs to bind water cannot be separated from the involvement of protein. The ability of proteins to bind water is caused by the presence of hydrophilic groups [10]. So that the higher the concentration of tempeh flour is added, the ability of the protein to bind water is getting stronger which causes decrease of the amount of water in the oyster mushroom nuggets. The yield of tempeh flour

has a fairly high protein, namely 49.60%. So, the higher the concentration of tempeh flour is added, the higher the protein nuggets. This study are agree with Murni [12] that regarding oyster mushroom nuggets with the addition of red bean tempeh flour. With the highest value on the addition of 45% tempeh flour nuggets and the lowest value on the addition of 15% tempeh flour. The protein content of oyster mushroom nuggets with the addition of tempeh flour fulfills the quality requirements of the nuggets (SNI 10-6683-2014) regarding combination chicken nuggets, which is a minimum protein of 9%. This study is in accordance with the results of Lestari [11] on nugget products showing that there is an effect of adding tempeh flour to the moisture content of snakehead fish nuggets. The highest water content was in treatment P1 (tempeh flour 0%) and the lowest water content was in treatment P6 (tempeh flour 100%). According to SNI 01-6683-2014 regarding combination chicken nuggets, the maximum water content is 60%. The oyster mushroom nuggets produced in this study ranged from 40.84 to 47.51%, so they met the SNI requirements. The higher the concentration of tempeh flour and the lower the concentration of oyster mushrooms added, the higher the protein contained in the nuggets. The highest protein was found in the ratio of 80%: 20% of tempeh flour to oyster mushrooms (P6) which was 13.86% and the lowest was at the ratio of 30%: 70% (P1) which was 9.73%. This is influenced by the protein content contained in the main ingredient, namely in tempeh flour, which according to Murni [12].

3. Fat Content

Based on the results of observations and the results of analysis using ANOVA, the addition of tempeh flour with oyster mushrooms has a significantly different effect on the fat content of the nuggets can be seen in Figure 3.

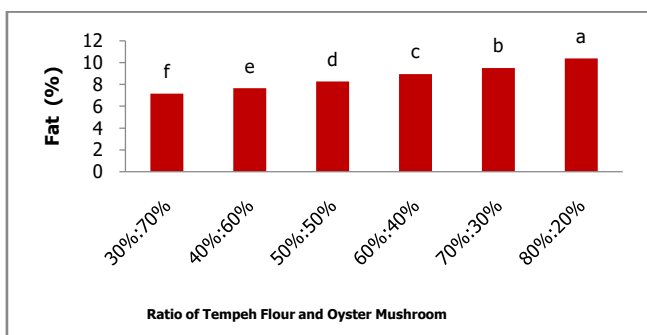


Figure 3. Effect of Fortification of Tempeh Flour on Oyster Mushroom Nugget Fat

The higher the concentration of tempeh flour and the lower the concentration of oyster mushrooms added, the higher the fat content in the nuggets. The highest fat content was found in the ratio 80%: 20% (P6) which was 10.39% and the lowest was at the ratio of 30%: 70% (P1) which was 7.16%. This is due to the high fat content contained in tempe flour, which according to Murni [12], tempeh flour has a fat content of 30.28% while oyster mushrooms have a fat content of 1.41% (FAO, 1992 in Septiana). , 2017). So, the higher the

concentration of tempeh flour, the resulting fat content will also increase. Afrisanti [1], an increase in fat content is followed by a decrease in water content.

The results of this study are consistent with the results of research conducted by Afrisanti [1] on rabbit nuggets. Where the addition of 5% tempeh flour is the lowest fat content and the addition of 25% tempeh flour is the highest fat content value of rabbit meat nuggets. The fat content of oyster mushroom nuggets with the addition of tempeh flour fulfills the quality requirements of the nuggets (SNI 10-6683-2014) regarding combination chicken nuggets, which is a maximum of 20% fat.

Organoleptic Analysis

1. Hedonic Test

Based on the results of observations and data analysis that has been carried out that the addition of tempeh flour. Based on the results of observations of significance and average analysis, there is a significant effect on the level of color preference, taste, aroma and texture of oyster mushroom nuggets (Fig. 4).

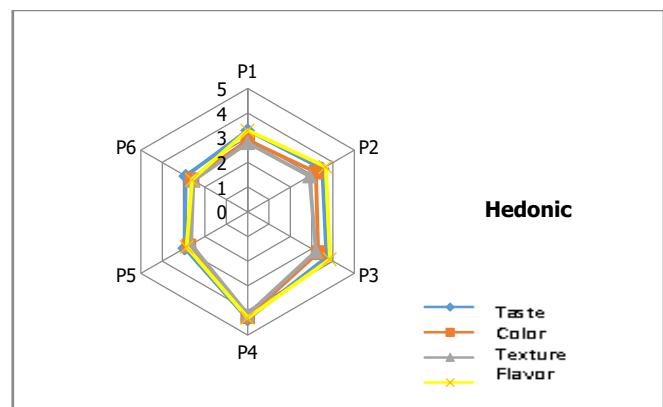


Figure 4. Effect of Addition of Tempe Flour and Oyster Mushrooms on Hedonic Test of Oyster Mushroom Nugget. (Blue = Taste, Red = Color, Green = Texture, Yellow = Flavor).

The value for aroma parameters based on the results of the organoleptic aroma test with the hedonic test obtained values ranging from 2.6 - 4.3. For further information, the organoleptic aroma test average with the highest hedonic test was obtained at a ratio of 60%: 40% (P4) of 4.3 with the criteria of liking and the lowest value of 2.6 was obtained at a ratio of 80%: 20% (P6) with the criteria rather like it. There is a tendency for the panelists' preference to decrease along with the increase in the presentation of the addition of tempeh flour. This can happen because the raw material for making nuggets is tempeh flour which produces an unpleasant aroma which causes the aroma to be less liked by the panelists. Kurniawati and Fitriyono [9], stated that the unpleasant odor in tempeh flour is caused by the activity of the lipoxygenase enzyme which is naturally present in soybean seeds. Based on the results of research by Permatasari and Arintina [14], the lipoxygenase enzyme reacts with fat and produces an organic

compound, namely ethyl phenol which causes unpleasant odors. The values for color parameters based on the results of the color organoleptic test for the hedonic test were obtained values ranging from 2.6–4.25, for further information can be seen in the figure. The color organoleptic test mean with the highest hedonic test was obtained at a ratio of 60%: 40% (P4) of 4.25 with like criteria and the lowest value of 2.6 was obtained at a ratio of 80%: 20% (P6) with a slightly like criteria. This means that the panelists prefer golden yellow nuggets compared to brownish nuggets, because the more the percentage of tempeh flour, the nugget color will be browner. Tempeh flour which is high in protein content causes a browning reaction during frying. Rusdin [16] states that the maillard reaction is a complex reaction involving reducing sugars and amine groups from proteins during frying, producing a new brown compound, namely melanoidin. This is in accordance with the results of the research by Heridiansyah [8], there is a color difference in the tempeh nuggets due to the maillard reaction, namely the reaction between carbohydrates (simple sugars) and protein (amino groups) which causes the color of the nuggets to turn brown.

The value for taste parameters based on the results of the taste organoleptic test for the hedonic test obtained values ranging from 2.9-4.35, for further information can be seen The average taste organoleptic test with the highest hedonic test was obtained at a ratio of 60%: 40% (P4) of 4.35 with like criteria and the lowest score of 2.9 is obtained at a ratio of 80%: 20% (P6) with the criteria rather like. The level of preference for panelists is also due to other factors, namely the unpleasant aroma of the oyster mushroom nuggets produced from raw materials, namely tempeh flour. This difference is caused by a decrease in the taste value which indicates a decrease in organoleptic quality because the increase in the percentage of tempeh flour in the nuggets causes the taste to be less delicious. Aini [2] states that the decrease in the level of preference for the panelists towards the taste of nuggets due to the unpleasant odor of tempeh increases with the increase in the percentage of tempeh flour. Based on the results of Afrisanti [1], this is influenced by the results of other tests (aroma, texture, color), in accordance with the opinion of Winarno [18], taste is a nervous stimulation., taste is nerve stimulation produced by ingredients that are inserted into the mouth, felt mainly by the nerves of smell, taste and mouth stimulation. Values for texture parameters based on the results of the organoleptic texture test for the hedonic test were obtained values ranging from 2.55 - 4.15 (Fig.4). The average texture organoleptic test with the highest hedonic test was obtained at a ratio of 60%: 40% (P4) of 4.15 with like criteria and the lowest score of 2.55 obtained at a ratio of 80%: 20% (P6) with the criteria of being somewhat like. As the percentage of tempeh flour increases, the panelists' preference tends to decrease because the texture of the nuggets is getting denser. This is in accordance with Aini [2], that the more the percentage of tempeh flour is added, the denser texture will be.

2. Scoring Test

Based on the results of significance observations and average analysis, the effect of addition was significantly different on the value of color preference, taste, aroma and texture of oyster mushroom nuggets (Fig. 5).

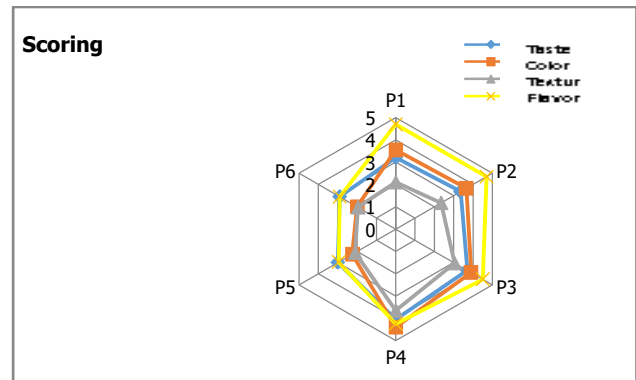


Figure 5. The effect of adding tempeh flour with oyster mushrooms on the scoring test of oyster mushroom nuggets, (Blue = Taste, Red = Color, Green = Texture, Yellow = Aroma).

The results of the scoring test of 20 panelists on the parameters of color, taste, aroma and texture of oyster mushroom nuggets (Fig. 5). The significance table shows that there is a significant difference in the addition of tempeh flour to the scoring test for color, taste, texture and aroma of oyster mushroom nuggets. The values for the organoleptic parameters of aroma with the scoring test obtained values ranging from 2.9-4.7. The organoleptic aroma test average with the highest scoring test was obtained at a ratio of 30%: 70% (P1) of 4.7 with the criteria of very unpleasant smell and the lowest value was obtained at a ratio of 80%: 20% of 2.9 (P6) with the criteria a bit smells unpleasant. According to Kurniawati and Fitrianto [9] this can occur because the unpleasant odor in tempeh flour is caused by the activity of the lipoxygenase enzyme which is naturally present in soybean seeds. Which is based on the results of research by Permatasari and Arintina [14], the lipoxygenase enzyme reacts with fat and produces an organic compound, namely ethyl phenyl ketone which causes unpleasant odors.

The values for color organoleptic parameters based on the scoring test results obtained values ranging from 2-4.4. The color organoleptic test with the highest scoring test was obtained at a ratio of 60%: 40% (P4) of 4.4 with light yellow criteria and the lowest value was obtained at the addition of 80%: 20% (P6) with yellowish. brown criteria. This means that the panelists prefer light yellow nuggets to brownish yellow nuggets. This is because the higher the tempeh flour is added, the browner the nuggets will be. The resulting brown color comes from the protein content contained in tempeh flour which undergoes a browning reaction, where the maillard reaction is a complex reaction involving reducing sugars and amine groups from protein during frying, resulting in a new brown compound, namely melanoidin. [15], so this can reduce the level of preference for the panelists. The value

for the taste organoleptic parameters based on the scoring test results obtained values ranging from 2.9-4.05. The average taste organoleptic test with the highest scoring test was obtained at a ratio of 60%: 40% (P4) of 4.05 tasty and the lowest value of 2.9 was obtained at a ratio of 80%: 20% (P6) with the criteria a bit savory. The savory taste is caused by the presence of fat content in the ingredients added to both the raw materials and the additional materials used. The level of preference for panelists is also due to other factors, namely the unpleasant aroma of the oyster mushroom nuggets produced from raw materials, namely tempeh flour.

Values for texture parameters based on the results of the texture organoleptic test with the scoring test obtained values ranged from 1.95-3.65. The average organoleptic texture test with the highest scoring test was obtained at a ratio of 60%: 40% (P4) of 3.65 with soft criteria and the lowest value of 1.95 was obtained at a ratio of 80%: 20% (P6) with non-soft criteria. According to Kurniawati and Fitriyono [9], the resulting texture is chewy or not because the tempeh flour is hydroscopic or binds water, so the more tempeh flour is added, the resulting in reduce tenderness of the nuggets or becomes less chewy.

IV. CONCLUSIONS

The treatments of fortified of tempeh flour has an effect on chemical properties (moisture content, fat and protein content) and organoleptics (color, aroma, taste and texture) of oyster mushroom nuggets. . The more tempeh flour is added, the higher the protein and fat content of the oyster mushroom nuggets, but the decreases the moisture content. The more addition of tempeh flour to the oyster mushroom nuggets, the more preferred by the panelists, but at the limit of adding tempeh flour of more than 60% it reduced the scores for some organoleptic properties (color, aroma, taste and texture) of the nuggets. The treatment of adding tempeh flour as much as 80% of the total mixture of oyster mushrooms and tempeh flour produced oyster mushroom nuggets with the best chemical properties (moisture content, fat content and protein content). The addition of 60% of the total mixture of oyster mushrooms and tempeh flour produced oyster mushroom nuggets with the best organoleptic properties (color, aroma, texture and taste).

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