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The Effect Of Adding Snakehead Fish Meat On Acceptability And Nutritional Content In Nugget Production

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ABSTRACT
Fish is one of them a large source of animal protein consumed society, it's easy got it, but the price is relatively not cheap. In 100 grams of fresh fish less more contains 17% protein, 4.50% fat, 2.52 - 4.5% minerals, and 76% water. From composition the can seen that fish have High protein value and content the fat low so that Lots give benefit health for body man. By general content nutrition of fish is very good For growth, esp growth for age children. The fish protein content is sufficient big namely 20% with almost identical amino sequence The same with arrangement amino acids from human protein so that absorption the protein more maximum. objective study For know Effect of adding meat fish There is no doubt about the acceptability and nutritional content of making nuggets. study This use design Completely Randomized Design (CRD), which was carried out from January to February 2023, involving 30 authors with 4 treatments. Research purposes This is For know Effect of adding meat fish There is no doubt about the acceptability and nutritional content of making nuggets. Analysis results study using organoleptic tests and analysis chemistry or mark nutrition. The panelists' evaluation of the best formulation from the overall samples of nuggets with the addition of snakehead fish meat showed that the treatment sample (A4 = 200g of wheat flour + 100g of snakehead fish meat) had the highest average score of 3.91, categorized as "liked." This A4 treatment provided the best overall acceptance in the hedonic test conducted in this study. The sample with the lowest average score was (A1 = 200g of wheat flour + 0g of snakehead fish meat), with an average score of 2.74.

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INTRODUCTION

Nutritious food contains all important nutrients in sufficient amounts to fulfill the body's needs. There are six types of essential nutrients that the body requires: carbohydrates, fats, proteins, vitamins, minerals, and water. Except for water, each group of nutrients is composed of various elements, some of which are classified as essential nutrients(Masitah & Sulistyadewi, 2020)

Carbohydrates, fats, and proteins are sources of energy. These substances are used as fuel to provide energy for bodily functions and heat. Additionally, proteins and water are crucial for building and repairing tissues. Proteins, along with mineral salts, vitamins, and water, assist in internal bodily processes by facilitating oxidation. Vitamins and minerals are

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known as micronutrients because the body only requires them in small amounts. However, even in small quantities, vitamins and minerals are absolutely necessary for supporting the body's metabolism (Masitah & Sulistyadewi, 2020).

Fish is a significant source of animal protein consumed by the public. It is readily available, although its price is relatively high. One hundred grams of fresh fish contain approximately 17% protein, 4.50% fat, 2.52-4.5% minerals, and 76% water. From this composition, it is evident that fish have a high protein value and low-fat content, providing numerous health benefits. Generally, the nutritional content of fish is excellent for growth, especially for children. The protein content in fish is quite high at 20%, with an amino acid sequence almost identical to that of human protein, resulting in better protein absorption(Darmadi et al., 2019).

One of the minerals found in snakehead fish meat is phosphorus. Phosphorus is essential for human health as it plays a vital role in bone development and growth. It is also important for maintaining healthy teeth and nails, ensuring they remain strong and durable with age. Phosphorus can prevent osteoporosis or the decline in bone mineral density often experienced with aging. Despite its benefits, fish is not always immediately appealing to everyone, particularly children. Therefore, it is necessary to offer various fish-based products to make them more attractive, such as fish nuggets (Darmadi et al., 2019).

Snakehead fish, also known as Channa striata, is particularly beneficial. It is rich in albumin, a protein in the blood that enhances the body's immune response, regulates water balance in cells, removes waste products, and provides nutrients for cell formation, which accelerates the healing of tissues after surgery or injury. Snakehead fish is high in protein and typically consumed as a side dish. This group of foods is the primary source of protein in the diet and includes both animal and plant-based proteins. All animal-sourced foods, including side dishes like meat, fish, and eggs, are included(Agusta et al., 2020)

The production of fish-based nuggets has been widely developed and accepted by the community, including catfish nuggets, tuna nuggets, tilapia nuggets, and eel nuggets. One type of fish that can be used in nugget production is snakehead fish. Snakehead fish has a snake-like head and a fishy odor, making it unpopular among many people and underutilized. By utilizing snakehead fish in nugget production, it is hoped that the consumption of snakehead fish will increase within the community. The advantage and distinction of this research are that snakehead fish nuggets do not have a fishy taste because snakehead fish has different meat characteristics compared to other fish. Snakehead fish meat is denser and has a lower fat content, which reduces the strong fishy smell often produced by fish oils. Additionally, snakehead fish contains high-quality amino acids and proteins that help diminish the fishy odor. Proper processing techniques in nugget production also contribute to eliminating the fishy smell, such as using appropriate seasonings and good processing methods. This makes snakehead fish nuggets more appealing to consumers who are sensitive to the fishy smell in fish products.

The addition of snakehead fish meat in nugget production has been shown to positively impact both acceptability and nutritional content. Studies have demonstrated that incorporating snakehead fish meat in nuggets can enhance protein content, fiber content, and

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water content, leading to a more nutritious final product(Muliani et al., 2022). Furthermore, the combination of snakehead fish with other ingredients like white oyster mushroom has been found to significantly affect various nutritional aspects such as moisture, ash, fat, protein, and fiber content, as well as sensory attributes like color, flavor, aroma, and texture, resulting in a well-received product(Ashari et al.,2022). Additionally, the utilization of snakehead fish in nuggets has been shown to improve the overall organoleptic quality, with formulations containing snakehead fish receiving higher preference scores in terms of taste, color, smell, and texture, making them more acceptable for consumption (Islamy and Senas, 2023;Ayu et al., 2022).

Snakehead fish can be an alternative protein source, such as in the production of fish flour for making nuggets or other processed products. This motivated the writer to develop a nugget product using snakehead fish meat as the primary ingredient. Snakehead fish is a valuable protein and albumin source, containing essential compounds for human health, including high levels of protein, fat, water, and minerals such as zinc (Zn). To create a ready-to-eat product, the raw food material needs to be processed. Generally, the purpose of food processing is to convert raw materials into semi-finished or ready-to-eat foods, resulting in a product that meets our dietary preferences.

Based on the above background, the researcher is interested in studying "The effect of adding snakehead fish meat on the acceptability and nutritional content of nuggets." The aim of this research is to determine the impact of adding snakehead fish meat on the acceptability and nutritional content of nuggets.

METHODS

This study uses an experimental design with organoleptic tests, specifically a Completely Randomized Design (CRD) consisting of four treatments. The organoleptic test involves hedonic evaluations conducted by 30 moderately trained panelists, who are students from the STIKBA Nutrition Science Study Program. The data is analyzed using Analysis of Variance (ANOVA) for CRD and further tested with Duncan's Multiple Range Test or Honestly Significant Difference (HSD) test.

Tukey Test/HSD (Honestly Significant Difference)

The Tukey test is a method for comparing the means between treatment groups using a comparison table called the Tukey table, which uses a single comparison value.

Moisture Content by Oven Method (AOAC 1984)

The oven method is one of the direct heating methods used to determine the moisture content in food. Heating is carried out at a specific temperature until all the water evaporates, which is indicated by the constant weight of the food. The weight loss of the food shows the amount of water it contains (AOAC 1984). The procedure for determining moisture content is as follows:

a. Prepare materials, equipment including the oven with a working thermostat, and tools for handling the dry residue.

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b. Dry the empty dish with its lid in the oven at 105°C for 15 minutes. Cool in a desiccator for 10 minutes for aluminum dishes and 20 minutes for porcelain dishes. Weigh the dish until a constant weight is achieved.
c. Place the sample in the dish, then, with the dish open, place it in the oven at 100-102°C for 6 hours.
d. After heating, cool the dish in a desiccator with the lid on for 10-20 minutes, then weigh the dish containing the dried sample.

Carbohydrate Content by Luff-Schoorl Method

The procedure for determining carbohydrate content is as follows:

a. Weigh approximately 5 g of the sample into a 500 ml Erlenmeyer flask.
b. Add 100 ml of 0.1 HCL.
c. Connect to a condenser and boil for 3 hours using an autoclave, then cool.
d. Test the pH, prepare a beaker, rinse with distilled water, and transfer the carbohydrate content to the beaker.
e. Add 1-2 drops of PP indicator and prepare the pH meter.
f. Adjust the pH to 5.5 using NaOH.
g. Pour the solution into a 200 ml volumetric flask, dilute with distilled water, homogenize, and filter through filter paper.
h. Take 1 ml of the filtered sample, dilute to 10 ml with distilled water, then add 15 ml of distilled water and 25 ml of Luff-Schoorl solution.
i. Heat the mixture to boiling within 3 minutes and continue boiling for 10 minutes.
j. Cool the mixture with ice in a bath without shaking.
k. After cooling, add 15 ml of 20% KI and 25 ml of 25% H_2SO_4, then titrate with thiosulfate until light yellow.
l. Add 1-2 drops of starch, then titrate again with thiosulfate until the solution turns milky white.

Protein Content by Kjeldahl Method

Protein analysis is carried out using the Kjeldahl method (AOAC, 2005), which involves oxidizing carbohydrate-containing materials and converting nitrogen into ammonia by sulfuric acid. The ammonia reacts with excess acid to form ammonium sulfate. The ammonium sulfate is decomposed, and the solution is made basic with NaOH. The evaporated ammonia is captured by boric acid. The nitrogen content in the solution is determined by titration with a standard base solution. The procedure for determining protein content is as follows:

a. Weigh approximately 0.5 g of the sample, depending on the protein content, and place it in a Kjeldahl flask.
b. Add 2.5-5 g or 0.5-1 spoon of selenium mix or a mixture of 5 g $CuSO_4$ and $KMnO_4$ (1:9) and 25 ml concentrated H_2SO_4, along with some boiling stones.
c. Initially heat with a low flame, then increase the flame until the solution turns clear greenish and the SO_2 vapor disappears.
d. Transfer to a 100 ml volumetric flask and dilute to the mark. Pipette 10 ml into a distillation flask, add 10 ml of 10% NaOH or more, then distill.

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e. Collect the distillate in 20 ml of 3% boric acid solution. Continue distillation until the distillate is no longer basic (test with pH paper). After distillation, rinse the condenser tip with distilled water.
f. Titrate the boric acid solution with standard HCL using a metal red indicator.

Fat Content by Gravimetric Method

Fat analysis involves dissolving the fat in the sample with a solvent (ether). The fat content is determined by calculating the amount of dissolved material. The fat used is not pure fat but a mixture of several substances, including chlorophyll, xanthophyll, and carotene, and the resulting extract is called crude fat. The procedure for determining fat content is as follows:

a. The equipment used includes an analytical balance, funnel, filter paper, water bath, oven, round bottom flask, and aluminum foil.
b. The material used is n-hexane.
   Procedure: Weigh 2 g of the sample, then wrap it in aluminum foil. Dry in an oven at 105°C. Cool. Add 20 ml of petroleum ether. Let stand for 30 minutes. Repeat steps 4 and 5 three times. Extract with n-hexane using a Soxhlet extractor. Collect the extract in a round bottom flask. Cool in a desiccator. Weigh the fat container and the container without fat.

Fiber Content (AOAC, 1984)

Crude fiber is a compound that is insoluble when boiled in H2SO4 and NaOH solutions. The addition of H2SO4 aims to break down nitrogen compounds in the sample, while NaOH breaks down fat in the sample so that the undigested residue remains. The difference between the initial residue and the residue weight after ashing indicates the crude fiber content. The procedure for determining fiber content is as follows:

a. Dry filter paper in an oven at 105°C for 1 hour, then weigh.
b. Weigh 1 gram of the sample.
c. Place in a beaker, add 50 ml of 0.3 N H2SO4, and boil for 30 minutes.
d. Quickly add 50 ml of 1.5 N NaOH and boil again.
e. Filter the solution with known weight filter paper using a Buchner funnel connected to a vacuum pump.
f. Wash the filter paper with the residue using 50 ml of hot water, 50 ml of 0.3 N H2SO4, 50 ml of hot water, and acetone.
g. Place in a clean porcelain dish and dry in an oven at 150°C until a constant weight is obtained.
h. Cool in a desiccator and weigh.

Ash Content by Oven Method (AOAC 2005)

Ash content is determined using the oven method (AOAC 2005), which involves burning organic materials into water (H2O) and carbon dioxide (CO2), leaving inorganic substances that are not burned. These inorganic substances are called ash. The procedure for determining ash content is as follows:

a. Heat the dish in an oven for 1 hour at 150°C.
b. Cool in a desiccator for 10-20 minutes to remove moisture, then weigh.

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c. Weigh 3 grams of the sample into the dish.
d. Burn over an open flame until no smoke is visible, then continue ashing in a furnace at 600°C until complete ashing, approximately 4-5 hours, until the sample turns white. Cool the ashed sample in a desiccator and weigh.
e. Repeat the furnace burning process until a constant weight is obtained.

The following table presents the types of treatments in the experimental design:

Table 1 Treatment Design for Making Snakehead Fish Meat Nuggets

Treatment
A1: 200 g Flour Flour + 0 g Snakehead Fish Meat
A2: 200 g Flour Flour + 50 g Snakehead Fish Meat
A3: 200 g Flour Flour + 75 g Snakehead Fish Meat
A4: 200 g Flour Flour + 100 g Snakehead Fish Meat

As for composition treatment making design experiment making snakehead fish meat nuggets presented in Table 2 below

Table 2 Composition Treatment Making Design Test Making Snakehead Fish Meat Nuggets

Material	Treatment			
	A1	A2	A3	A4
Flour wheat	200g	200g	200g	200g
Snakehead fish meat	0 g	50g	75 g	100g
Flour Tapioca	100g	100g	100g	100g
Flour panir	50g	50g	50g	50g
Pepper	3 g	3 g	3 g	3 g
Salt	7g	7 g	7 g	7 g
Egg chicken	50g	50g	50g	50g
Onion white	20 g	20 g	20 g	20 g
Celery	20 g	20g	20 g	20 g
Leek	20g	20 g	20 g	20 g
Water	220 ml	220 ml	220 ml	220 ml

Analysis of the data used is Analysis Completely Randomized Design (CRD *).* Analysis variety intended For test hypothesis about influence factor treatment to variety of result data experiment (organoleptic test) Analysis variety This is a hypothesis test carried out according to distribution F, because That also called the F test or F-test. Tukey/BNJ test *(Honestly Significant Different)* is an inter -average test group treatment with table comparison.

RESULTS AND DISCUSSION

Description of Hedonic Test Results

In the table and graph below This can depicted level favorite from the Nugget organoleptic test with addition snakehead fish meat. Analysis table descriptive can seen in table 3 below This :

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Table 3. Analysis Descriptive

Parameter		Average	Standard Deviation	Standard Error
Color	A1 (200g flour+0g fish)	2.83	1,147	0.209
	A2 (200g flour+50g fish)	3.30	1,022	0.187
	A3 (200g flour+75g fish)	3.03	0.999	0.182
	A4 (200g flour+100g fish)	3.30	1,208	0.221
	Total	3.12	1,101	0.101
Aroma	A1 (200g flour+0g fish)	2.70	0.952	0.174
	A2 (200g flour+50g fish)	2.87	0.937	0.171
	A3 (200g flour+75g fish)	2.70	0.988	0.180
	A4 (200g flour+100g fish)	4.20	1,215	0.222
	Total	3.12	1,197	0.109
Texture	A1 (200g flour+0g fish)	2.97	1,006	0.157
	A2 (200g flour+50g fish)	2.93	1,143	0.209
	A3 (200g flour+75g fish)	2.87	1,008	0.184
	A4 (200g flour+100g fish)	3.93	0.980	0.179
	Total	3.18	1,128	0.103
Flavor	A1 (200g flour+0g fish)	2.47	0.860	0.157
	A2 (200g flour+50g fish)	2.93	1,015	0.185
	A3 (200g flour+75g fish)	2.80	1,186	0.217
	A4 (200g flour+100g fish)	4.23	0.858	0.157
	Total	3.11	1,187	0.108

As for the picture detailed from each organoleptic test result the can served as following :

Anova Test Results

Test of variance *One-way ANOVA*, aims For test significance diversity of organoleptic test result data. Testing This based on distribution F value because That also called the F Test or F-Test. Data from the test of variance Anova RAL is presented in the table below This.

Table 4 Anova Test Results

Variable	Sum of Squares	Mean Square	F	Sig.
Color	4,633	1,544	1,282	0.284
Texture	47,500	15,833	14,948	0,000
Taste	23,158	7,719	6,987	0,000
Aroma	54,092	18,031	18,428	0,000

From the data above, it can be seen that all Organoleptic Test results show an F-Test value smaller than p 0.05, except for the color test. Specifically, the color test is (sig 0.284 > p 0.05), while the Aroma, Texture, and Taste tests are (sig 0.000 < p 0.05). Therefore, these parameters (taste, aroma, and texture) can be continued with Analysis of Variance (ANOVA) and Duncan's Multiple Range Test. For the color test, a summary analysis is still needed.

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Overall Acceptance

The overall acceptance results indicate the best treatment based on a combination of hedonic and quality tests carried out by the panelists. This comprehensive evaluation of nugget samples with the addition of snakehead fish meat covers taste, aroma, texture, and color parameters.

The best formulation of nugget products with the addition of snakehead fish meat is determined using the exponential comparison method. Each attribute's hedonic mark is averaged for each treatment (formulation). The average values are then sorted and ranked, with the highest total average value receiving the first rank. The first rank indicates the best overall nugget formulation. This best nugget formulation will be used in further research for nutritional analysis, including water content, fiber level, protein, carbohydrates, ash, and fat, to compare with the control variable.

The overall acceptance with the best nugget treatment results with the addition of snakehead fish meat can be seen in Table 5 below.

Table 5 Best Formulation

Criteria Evaluation						
Treatment	Color	Aroma	Flavor	Texture	Average	Ranking
A1: (200g flour flour + 0g snakehead fish meat)	2.83 [a]	2.70 [a]	2.47 [a]	2.97 [a]	2.74	IV
A2: (200g flour flour + 50g snakehead fish meat)	3.30 [a]	2.87 [a]	2.93 [a]	2.93 [a]	3.00	II
A3: (200g flour flour + 75g snakehead fish meat)	3.03 [a]	2.70 [a]	2.80 [a]	2.87 [a]	2.85	IV
A4: (200g flour flour + 100g snakehead fish meat)	3.30 [a]	4.20 [b]	4.23 [b]	3.93 [b]	3.91	I

The rating level of the panelists for the best formulation from all nugget samples with the addition of snakehead fish meat, based on Table 5 shows that the sample treatment (A4 = 200g flour + 100g snakehead fish meat) resulted in the highest average value of 3.91 with a "Like" category. It can be concluded that treatment A4 provided the best overall hedonic test acceptance in this study. The sample with the lowest average value was (A1 = 200g flour + 0g snakehead fish meat) with an average value of 2.74.

Testing the Nutritional Value of Nuggets with the Addition of Snakehead Fish Meat

Nutritional analysis is conducted to determine the nutrient content of a food material or product, including water content, fiber level, protein, carbohydrates, ash, and fat levels. Information about the nutritional content of a product is crucial for understanding the amount of nutrients it contains. The nutritional composition (moisture content, fiber, protein, carbohydrates, ash, fat) of the best nugget sample with the addition of snakehead fish meat can be presented as follows:

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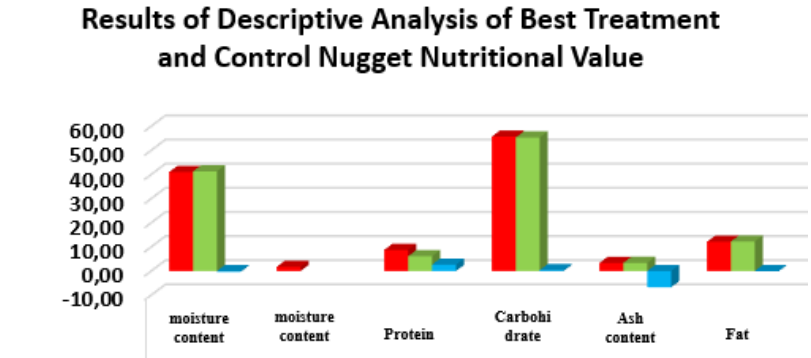

	moisture content	moisture content	Protein	Carbohi drate	Ash content	Fat
Best	41,00	1,73	8,74	55,67	3,33	12,10
Control	41,29		6,12	55,32	3,39	12,22
Change	-0,29		2,62	0,35	-6,71	-0,12

Figure 1. Analysis Results Descriptive Treatment Best and Control Nugget Nutritional Value

From the chart, it can be seen that the comparison of the nutritional composition between the best treatment (A4 = 200g flour + 100g snakehead fish meat) and the control treatment (A1 = 200g flour + 0g snakehead fish meat) shows the following results: Water Content: The best treatment A4 has a water content of 41.00%, which is 0.28% lower than the control A1, which has a water content of 41.28%. Ash Content: The best treatment A4 has an ash content of 3.32%, which is 0.06% lower than the control A1, which has an ash content of 3.38%. Fat Content: The best treatment A4 has a fat content of 12.10%, which is 0.11% lower than the control A1, which has a fat content of 12.22%. Fiber Content: The fiber content in treatment A4 is 1.73%. Protein Content: The best treatment A4 has a protein content of 8.73%, which is 2.61% higher than the control A1, which has a protein content of 6.12%. Carbohydrate Content: The carbohydrate content in treatment A4 is 55.66%, which is 0.34% higher than the control A1, which has a carbohydrate content of 55.32%.

Based on the nutritional analysis results, the protein content in the nuggets with the addition of snakehead fish meat in the most preferred formulation, A4 (200g flour + 100g snakehead fish meat), is 8.73%, compared to 6.12% in the control sample. In treatment A4, there is a 2.61% increase in protein content compared to the control. The protein content in the nuggets with the addition of snakehead fish meat is higher compared to the fiber content in the nuggets without the addition of snakehead fish meat.

Additionally, the carbohydrate content in the nuggets with the addition of snakehead fish meat in the most preferred formulation, A4 (200g flour + 100g snakehead fish meat), is 55.66%, compared to 55.32% in the control. In treatment A4, there is a 0.34% increase in carbohydrate content compared to the control. Carbohydrates are an essential nutrient required by the body to produce energy. Carbohydrates are organic compounds with various molecular structures, though they share common chemical properties and functions. All carbohydrates consist of carbon (C), hydrogen (H), and oxygen (O)(D. E. Wulandari & Arya, 2023). Carbohydrates are classified into two main groups: simple carbohydrates and complex carbohydrates. Simple carbohydrates include monosaccharides (the basic building blocks of carbohydrates), disaccharides (two monosaccharides bound together), and oligosaccharides

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(short chains of sugars like galactose, glucose, and fructose). Complex carbohydrates include polysaccharides (long chains of monosaccharides) and non-starchy fibers. Besides providing energy, carbohydrates also have other functions such as adding sweetness to food, sparing protein, regulating fat metabolism, and aiding in fecal excretion (Triatmaja & Hidayat, 2018;Yudiyanto, 2016)

The taste of food we experience daily is not a single response but rather a combination of taste, smell, and trigeminal sensations, which are further influenced by other senses such as sight, touch, and hearing. Therefore, when we enjoy or perceive food, the pleasure is actually created through the interaction of all five senses. Based on Table 1, as the concentration of carrot flour increases, the preference for the taste of snakehead fish nuggets decreases. Aroma or smell is something that can be perceived through the sense of smell. Aroma comes from volatile compounds that can dissolve in both water and fat. The aroma of snakehead fish nuggets produced indicates that with less carrot flour used, the aroma of the nuggets is more preferred. This is because a high concentration of carrot flour tends to mask the aroma of the snakehead fish(Farhat et al., 2019; Yulianti & Mutia, 2018).

Based on the results of the nutritional analysis, the ash content in the most preferred nugget formulation with the addition of snakehead fish meat (A4: 200g flour + 100g snakehead fish meat) is 3.32%, which is 0.06% lower than the control sample (A1: 200g flour + 0g snakehead fish meat), which has an ash content of 3.38%. This indicates that the ash content in the nuggets with the addition of snakehead fish meat is lower compared to the fiber content in the nuggets without the addition of snakehead fish meat.

Ash content represents the inorganic components or minerals present in a food material (Astuti, 2012). The analysis of ash content is performed to determine the mineral content in food and to evaluate the quality of the food processing process. This process also helps detect potential food fraud(Siregar et al.,2017) (Fatmawati, 2020;). Ash content is measured by heating the material, where the remaining material after heating consists of minerals or metals, as organic elements such as carbon, hydrogen, and oxygen evaporate as water vapor and carbon dioxide gas(Tsunazawa et al.,2016).

Based on the results of the nutritional analysis, the fat content in the most preferred nugget formulation with the addition of snakehead fish meat (A4: 200g flour + 100g snakehead fish meat) is 12.10%, which is 0.11% lower than the control sample (A1: 200g flour + 0g snakehead fish meat), which has a fat content of 12.22%. This indicates that the fat content in the nuggets with the addition of snakehead fish meat is lower compared to the fat content in the nuggets without the addition of snakehead fish meat.

Fat plays a role in the flavor and mouthfeel of food. The main groups of lipids in food are triacylglycerols, phospholipids, and sterols (Siregar et al.,2017). Fat molecules consist of carbon, hydrogen, and oxygen, and sometimes also contain nitrogen and phosphorus (Siregar et al.,2017).

Cork fish nuggets can be considered a food innovation based on the research provided. The study on fish fingers highlighted the use of cork fish in food products, showcasing its quality and potential as an ingredient for processed foods(Wulandari & Anggraini, 2023). Additionally, the service activity in Pangkalan Pisang Village focused on training participants

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in making cork fish biscuits, indicating efforts to develop sustainable small-scale businesses using cork fish as a key ingredient(Dahlia et al., 2019). Furthermore, the research on analog sausages emphasized the formulation of sausages using sea cork fish, demonstrating the versatility of cork fish in creating high-protein food products(Purukan et al., 2013). These studies collectively showcase how cork fish is being utilized in various food innovations, indicating its role in diversifying food products and potentially contributing to addressing nutritional challenges(Saraswati et al., 2021;Anggraini & Andriani, 2021; Rumaseb et al., 2020)

Nuggets containing snakehead fish meat show an increase in protein and essential amino acids compared to conventional nuggets. Snakehead fish has a favorable nutritional profile, with lower fat content and high-quality protein. The addition of snakehead fish also contributes to the improved nutritional value of the nuggets, making them a healthier option. This study reveals that nuggets with snakehead fish meat do not have a dominant fishy taste. This is due to the dense and low-fat characteristics of snakehead fish, as well as effective processing methods that reduce the fishy aroma. Consequently, snakehead fish nuggets are more acceptable to consumers who are sensitive to fish odors.

CONCLUSION

Based on the research results and the discussion about the addition of snakehead fish meat to the organoleptic quality and nutritional value in making nuggets, it can be concluded that the addition of snakehead fish meat has a significant influence on the quality of processed nuggets in terms of organoleptic properties, except for the color parameter. The best treatment overall is A4 (200g flour + 100g snakehead fish meat), which achieved the highest mean score of 3.91 in the aroma, texture, and taste tests. In treatment A4 (200g flour + 100g snakehead fish meat), the following changes in nutritional content were observed Water Content: Decreased by 0.28%. Protein Content: Increased by 2.61%. Carbohydrate Content: Increased by 0.34%. Ash Content: Decreased by 0.06%. Fat Content: Decreased by 0.11%. Fiber Content: 1.73% The analysis results show that the addition of snakehead fish meat led to a decrease in ash and fat content compared to the control, while there was an increase in carbohydrate, protein, and fiber content. Based on the research conducted, the researchers recommend further studies on shelf life and microbial testing to observe the effects of storage time on shelf life and the potential development of microbes. It is also advised to carry out additional research on the production of nuggets with the addition of snakehead fish meat.

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