Agrointek Volume 16 No 3 September 2022: 322-329

p-ISSN: 1907-8056
e-ISSN: 2527-5410

AGROINTEK
Jurnal Teknologi Industri Pertanian

journal homepage: journal.trunojoyo.ac.id/agrointek

Combination of tuna fish and green spinach on the quality of nuggets

Faizah Hamzah, Bella Vista, Rahmayuni, Angga Pramana*

Teknologi Pertanian, Universitas Riau, Pekan baru, Indonesia

Article history
Received:
3 January 2022
Revised:
15 January 2022
Accepted:
11 March 2022

Keyword
green spinach;
nuggets;
tuna fish;

ABSTRACT

Tuna is an adequate source of animal protein tall. Animal-based food ingredients such as tuna have high protein content but low in fiber so it is necessary to add materials that contain fiber to meet the nutrients the body needs. Fiber that is contained in plant materials such as vegetables and nuts, one of which is found in green spinach. Nutritional content in green spinach which is quite high and the availability of many ingredients, provide opportunities to be utilized in processing diversification foods such as nuggets. Nuggets are processed products made from ground meat mixture and may or may not contain other ingredients or approved food additives. Nuggets in this study were made from cobs and green spinach. The study aims to get the best formulations of cobs nuggets and green spinach that meet the best sensory and chemical properties. The study's design is a Complete Randomized Design (RAL) with five treatments and three repeats. The data was statistically analyzed using variance analysis (ANOVA) and Duncan's test (DMRT) at a level of 5%. Treatment consists of TB1 (cob and spinach [90:10]), TB2 (cob and spinach [80:20]), TB3 (cob and spinach [70:30]), TB4 (cob and spinach [60:40]), and TB5 (cob and green spinach [50:50]). In this study, the combination of cobs and spinach affected water content, ash content, fibre and protein, and the sensory assessment of nuggets in terms of colour, aroma, taste, and texture. The best treatment is TB2 (cobs and green spinach [80:20]) with a moisture content of 56.82%, ash content of 1.44%, protein content of 13.74% and fibre content of 2.45%, with preferred TB2. Panellists rated the nuggets as greenish-grey, highly flavorful cobs, flavoured cobs and chewy textures.

* Corresponding author
Email : pramana.angga@lecturer.unri.ac.id
DOI 10.21107/agrointek.v16i3.13205

INTRODUCTION

Tuna is one of the species from Indonesian marine harvests whose production has increased. Based on Indonesian marine and fishery statistics, the volume of tuna fish production in 2016-2017 increased by 10% compared to 2012, which was only 9.35%, and the processing of tuna-based food products is still very rarely done. Tuna has a relatively high nutritional value, such as protein 13.70 g, fat 1.50 g, ash 2.10 g, water 74.70 g, carbohydrates 8 g, and energy 100 kcal from 100 g of material (Izwardy et al., 2017). The content of omega-3 fatty acids in tuna can prevent atherosclerosis, reduce triglyceride levels in the blood,

Tuna has a dark red flesh color and is thick and not scaly, making it easier to process. Utilization of tuna in making nuggets can be an alternative to diversify processed fish products. Cause tuna has a high protein content of around 24%, while the fat content of tuna is very low at around 1%, so it is good for processing as food (Angela et al., 2021). Processing of tuna meat as nuggets contains high levels of protein and fat content but is low in fiber, so to complement the fiber content of tuna fish nuggets, food sources containing fiber are added. Previous researchers have added fiber materials, such as oyster mushrooms (Hakim, 2014) and Moringa leaves (Hasanah et al., 2017), in making nuggets. Sources of dietary fiber are found in vegetables and beans. One of the vegetables that are rich in fiber is green spinach.

Green spinach is a vegetable that is rich in fiber. Specifically, the nutritional content of green spinach per 100 g includes carbohydrates 5.80 g, protein 1.80 g, fiber 1.20 g, and energy 100 kcal (Izwardy D et al., 2017). Green spinach is also rich in vitamins and minerals, such as vitamins A, B, and C, niacin, thiamin, phosphorus, riboflavin, sodium, potassium, and magnesium (Nasution, 2016). This content can be used as a source of additional nutrients in tuna nuggets. In addition, the availability of ingredients in the market provides an opportunity to be used as diversification in food processing, as nuggets.

Nuggets are processed products that are formed, cooked, and frozen, made from a mixture of ground beef coated with or without the addition of other food ingredients and permitted food additives (Badan Standardisasi Nasional, 2013). Nuggets processed products usually use the main ingredients derived from chicken and beef. Nowadays, nugget processed products can also be processed using fish. Research on nuggets made from fish has been carried out a lot, such as tuna nuggets (Nento dan Ibrahim, 2017), skipjack nuggets (Pade, 2018), and tuna nuggets(Asrawaty, 2018).

Hasanah (2015) has researched the combination of Moringa leaf nuggets and tuna. The ratios of each Moringa leaf and tuna treatment in this study were as follows 20:80, 30:70, 40:60, 50:50, 60:40, 70:30, 80:20. This study produced the best nuggets, namely the combination of moringa leaves and tuna 20:80 with a protein content of 17.80%, which met the quality standard of chicken nuggets (SNI 01-6683-2002), and from a sensory assessment point of view, the color was greenish-yellow, fish-flavored. It has a distinctive taste of tuna and a chewy texture that the panelists like. Vebrianty et al. (2021) research added spinach flour of 0.5-1.5%, which resulted in fibre content of 0.16-0.27%, which showed potential as a source of dietary fibre in nuggets.

The use of tuna and green spinach in the production of fish nuggets, in addition to fulfilling nutritional intake, especially protein and fiber, also plays a role in food diversification and provides other forms of processed tuna and green spinach, which have been less attractive to the public, especially consumers in their presentation. Based on this description, research has been conducted with a combination of tuna and green spinach on nugget quality. This study aims to obtain the best formulation of tuna and green spinach nuggets that meet the sensory and chemical characteristics.

METHODS

Research Materials

The raw materials used in this study were green spinach, tuna fish meat (*Euthynnus affinis*), tapioca, and flour. The additives used include fillers and spices, including skim milk, soy protein isolate, bread flour, water, chicken eggs, garlic, shallots, pepper powder, salt, and cooking oil. The analytical materials used were 26.5% H_2SO_4, 45% NaOH, 10% K_2SO_4, 1% H_3BO_3, 95% alcohol, distilled water, and filter paper.

The equpment used in nugget processing include analytical scales, knives, blenders, containers, baking sheets, basins, stoves, trays,

pans, cooking spoons, scales, and freezers. Organoleptic test equipment is a room. The tools used for analysis include porcelain dishes, desiccators, ovens, furnaces, spatulas, Erlenmeyer, measuring flasks, funnels, dropper pipettes, filter paper, baking sheets, clamp, Kjeldahl flask, burette, and soxhlet.

Research methods

This study was conducted using a non-factorial, completely randomized design (CRD) with 5 treatments and 3 replications so that 15 experimental units were obtained. The treatments in this study were the ratio of tuna fish meat and green spinach: TB1 = tuna fish meat and green spinach (90:10), TB2 = tuna fish meat and green spinach (80:20), TB3 = tuna fish meat and green spinach (70:30), TB4 = tuna and green spinach (60:40), TB5 = tuna and green spinach (50:50)

Research Implementation The process of making green spinach porridge

Spinach is selected, which is still fresh and then washed with running water, to remove dirt and then drained, then spinach is blanched for one minute at 80°C.°C then mashed using a blender until smooth with the addition of 2:1 water.

Preparation of tuna

The fish used is tuna which is still fresh—washed thoroughly of innards and cut, splitting the tip of the tail to the head so that the meat is separated from bones and head. The tuna fillet was then washed twice. The first tuna fillet was washed using running water and the second washing added 3% salt to the washing water, this washing aims to eliminate the potential for microbial contamination during the shipping process and fillet process.. The ratio of the amount of washing water with tuna was 3:1. During the fillet washing process, stirring was carried out and allowed to stand for 5 minutes to remove fat. After the washing process, the fillets are pressed with a clean cloth by hand to reduce the water content. The fillet is then added with 15% ice by weight and crushed or crushed using a food processor.

Preparation for making nuggets

The tuna and spinach pulp that had been mashed were weighed according to the treatment. All ingredients and spices are mixed until homogeneous, and then the dough is molded using a baking sheet, then the dough is steamed for ± 45 minutes at a temperature of ± 70°C. After the steaming process is complete, the nugget dough is left at room temperature for ± 30 minutes not to stick. This solid dough is called half-baked dough, and then the dough is cut into small squares with a size of approximately 4x4 cm. Then the nuggets are covered with egg and tapioca, then coated with breadcrumbs, then stored in the freezer at a temperature of ±3ºC for 24 hours. It Aims to glue the nuggets and breadcrumbs, then the oil is heated at a temperature of ± 80ºC and fried for ± 1 minute until golden brown, remove and drain.

Data analysis

The data obtained were analyzed statistically using the analysis of variance (ANOVA). If the calculated F is greater than or equal to the F table, then the analysis is continued with Duncan's Multiple Range Test (DMRT) at a 5% level. The data were processed using SPSS 23 software..

RESULTS AND DISCUSSION

Proximate Analysis

The variance test showed that this study's tuna and green spinach ratio significantly affected water, ash, dietary fiber, and protein content. The average test results after further testing DMRT at the 5% level are presented in Table 1.

Moisture content is one of the characteristics in foodstuffs that significantly affects these processed foods' quality and shelf life. According to Winarno (2009), the water content in foodstuffs affects the durability of foodstuffs against microbial attack because the higher the water content, the easier it is for bacteria, molds, and yeasts to breed. The variance results showed that the ratio of tuna meat and green spinach pulp had a significant effect on the water content of the nuggets.

Table 1 shows the water content of the nuggets in this study ranging from 56.74 to 60.82%. The lowest water content was obtained in the treatment of TB1, TB2, and TB3 of 56.74%, 56.82%, and 57.87%, which were significantly different from treatments. The highest water content of nugget was found in TB5 treatment of 60.82% and showed a significant difference with other treatments. The water content of the nuggets increased along with the amount of green spinach porridge used and the decrease in the added tuna. It is because fresh green spinach has a higher water content than tuna, which is 83.35%, while the water content of tuna is 61.05%. In addition, in the manufacture of spinach porridge, water is also

added so that it also plays a role in increasing the water content.

The results obtained by the treatment of the less use of tuna meat and the more use of green spinach used, the higher the moisture content of the nugget produced. Based on the results of the analysis of the water content of tuna nuggets in each treatment, the quality standard of fish nuggets (SNI 01-7758-2013) was a maximum of 60%. This research is in line with Hasanah (2015) on the production of tuna and moringa leaf fish nuggets, which resulted in the water content of the nuggets tending to increase with the addition of moringa leaves and the minor addition of tuna. The average moisture content ranged from 57.65–67.48%. The primary ingredients' water content influenced the difference in water content in the five treatments.

Ash is an inorganic substance leftover from the combustion of organic material at high temperatures to become ash, where the ash is composed of various types of minerals with varying compositions depending on the type and source of food (Andarwulan et al., 2011. The variance results indicate that tuna meat and green spinach porridge significantly affected the ash content of the nuggets produced.

Table 1 shows that the ash content of tuna and green spinach nuggets ranged from 1.35-1.71%. The lowest nugget ash content was obtained in the TB1 treatment, which was 1.35% which was significantly different from other treatments, and the highest ash content was obtained in the TB5 treatment, which was 1.71% which was significantly different from other treatments. The ash content of nuggets increased along with the decrease in the use of tuna and the increasing use of green spinach. This thing is because the ash content in green spinach is more than in tuna meat. The analysis results showed that the tuna meat contained 0.82%, and the ash content of green spinach was 56.90%.

The less the addition of tuna meat and the more green spinach used, the higher the ash content of the nuggets produced. This is due to the high ash content in green spinach. Based on the analysis of the raw materials, green spinach has an ash content of 1.17%, while the ash content of tuna is 0.82%.

Fiber is part of food that cannot be hydrolyzed by chemicals used to determine dietary fiber content, namely sulfuric acid (H2SO4) and sodium hydroxide (NaOH), while dietary fiber is part of plants that enzymes cannot hydrolyze. digestion (Muchtadi et al., 2010). The variance results showed that tuna meat and green spinach significantly affected the fiber content produced.

The fiber content in this study ranged from 2.28-3.04%. The lowest dietary fiber content of nuggets was obtained in TB1 treatment, which was 2.28% which was not significantly different from TB2 and TB3, and the highest dietary fiber content was obtained in TB5 treatment, which was 3.04% which was significantly different from other treatments. The dietary fiber content of nuggets decreased along with the higher use of green spinach and lower use of tuna. This is due to differences in the dietary fiber content of the raw materials. The analysis results showed that green spinach contains 2.16% dietary fiber, while the dietary fiber content of tuna is 1.94%.

Table 1 Nuggets proximate analysis results

Treatment	Moisture **content (%)**	**Ash content (%)**	**Dietary fiber content (%)**	**Protein content (%)**
TB1	56.74a	1.35a	2.28a	14.81d
TB2	56.82a	1.44b	2.45ab	13.74c
TB3	57.87a	1.52c	2.58ab	13.70c
TB4	59.18b	1.65d	3.83b	13.42b
TB5	60.82c	1.71e	3.04c	12.69a

Note: The numbers followed by different lowercase letters show a significant difference (P<0.05)

Table 2 Nuggets sensory assessment

Observation parameters	Treatment				
	TB1	TB2	TB3	TB4	TB5
Descriptive sensory test					
Deep color	1.87a	2.33b	2.80c	3.33d	3.53d
Outer color	1.87a	2.37b	2.60b	3.37c	2.83c
Flavor	1.73a	2.10b	2.60c	3.17d	3.77e
Scent	1.96a	2.26b	2.90bc	3.20cd	3.33d
Texture	1.76a	2.00a	2.63b	3.23c	3.60d
Overall hedonic sensory test	1.72a	2.04a	2.58b	2.86bc	2.97bc

Note: The numbers followed by different lowercase letters show a significant difference (P<0.05). Color descriptive score in 1. Greenish white; 2. Greenish gray; 3. Slightly green; 4. Green; 5. Very green Outer color descriptive score: 1. Yellow; 2. Brownish-yellow; 3. Golden brown; 4. Light brown; 5. Dark brown. Taste descriptive score: 1. The very distinctive taste of tuna; 2. The typical taste of tuna; 3. Tastes like tuna and green spinach; 4. The typical taste of green spinach; 5. Very green spinach taste. Descriptive score: 1. The very distinctive taste of tuna; 2. The distinctive aroma of tuna; 3. Flavored with tuna and green spinach; 4. Distinctively flavorful green spinach; 5. Very flavorful green spinach. Descriptive score: 1. Very supple; 2. Chewy; 3. Slightly chewy; 4. Soft; 5. Very soft. Hedonic score: 1. Dislike very much, 2. Dislike, 3. Somewhat like, 4.

The TB5 treatment had the highest fiber content, which was 3.05%, and showed a significant difference from the other three treatments, while the lowest fiber content was 2.28%. The quality standard of fish nuggets (SNI 01-7758-2013) does not include the standard of fiber content in the nuggets so that the fiber content of all treatments is considered an added value of the nuggets. The less use of tuna meat used and the more use of green spinach, the higher the fiber content of the nugget produced. This is due to the high fiber content in green spinach. Based on the analysis of the fiber content of the raw materials, the fiber content of green spinach was higher than the fiber content of tuna. Green spinach has a fiber content of 2.16% and tuna fish fiber content of 1.94%

Nuggets fiber content in this study was influenced by the amount of green spinach used in making nuggets. This is in line with Andaruni and Indrawati (2014) research that adding 30% of green spinach makes catfish nuggets result in 1.20% fiber content. Rusilanti and Kusharto (2007) stated that the increase in fiber content caused green spinach, increase fiber content.

Protein is one of the crucial molecules in food and is a fundamental substance for the body because it functions as a building block and regulatory substance. The variance results showed that the use of tuna and green spinach significantly affected the protein content of the nuggets produced.

Protein levels in this study ranged from 12.69-14.81%. The lowest protein content of nuggets was obtained in the TB5 treatment, which was 12.69% which was significantly different from other treatments, and the highest protein content was obtained in the TB1 treatment, which was 14.81% was significantly different from the other treatments. The protein content of nuggets increased along with the increasing use of tuna and the decreasing use of green spinach. This is because tuna has a higher protein content than green spinach. The analysis results showed that tuna contains 11.5% protein while green spinach protein content was 1.9%.

The results of research conducted from the higher the use of tuna and the lower the use of green spinach, the higher the protein content obtained. This is influenced by the use of different ratios in the treatment. The protein content of tuna nuggets in each treatment has met the quality standard of fish nuggets (SNI 01-7758-2013), at least 12%. The results of Hakim's research (2014) stated that the higher the percentage of tuna and the lower the oyster mushroom in making nuggets, the higher the yield of 14.32%. This is in line with Hasanah's (2015) research on the manufacture of tuna nuggets and Moringa leaves, which produced the highest protein content of 17.80% obtained from the treatment of 80% tuna and 20% Moringa leaves.

Protein content can also be obtained from additional ingredients used such as egg whites, soy protein isolate, tapioca, pepper, garlic, shallots which increase the protein content of the resulting nuggets. According to (Izwardy D et al., 2017), egg whites contain 10.8% protein, 85.35% soy

protein isolate, 1.1% tapioca, 11.5% pepper, 4.5% garlic, and 1.5% shallots.

Sensory Assessment

The sensory assessment was carried out to see the panelists' response in describing and stating the preference level for the resulting nugget product. The resulting nugget sensory assessment data can be seen in Table 2.

Color

Color is one of the essential factors in determining the value of quality and the degree of acceptance of a product because color is a visual character that the eye can judge. In addition to factors that determine quality, color can also be used to indicate freshness and maturity, so the color is used as an organoleptic attribute to see panelists' responses to a product (Winarno, 2009). the average descriptive nugget color assessment score ranged from 1.87-3.53% (greenish-white to green). The lowest color scoring score was obtained in TB1 treatment, which was 1.87% significantly different from other treatments, and the highest color scoring score was obtained in TB5 treatment, which was 3.53%, not significantly different from TB4. Based on Table 2 data, it can be seen that the less use of tuna and the more use of green spinach, the more green the nugget color will be. Green spinach contributes to natural green dyes (chlorophyll), while tuna meat has a brownish-gray color contribution. The greenish-white to greenish color inside of the nugget is influenced by the use of tuna meat and green spinach in making nuggets. According to Indraswari et al. (2017), green spinach has a significant effect on the color of the nuggets produced. In contrast, the greenish-white color on the nuggets comes from tuna and other supporting materials. Green spinach contributes to natural green dyes (chlorophyll), while tuna meat has a brownish-gray color contribution. The greenish-white to greenish color inside the nugget is influenced by the use of tuna meat and green spinach in making nuggets. According to Indraswari et al. (2017), green spinach has a significant effect on the color of the nuggets produced. At the same time, the greenish-white color on the nuggets comes from tuna and other supporting materials. Green spinach contributes to natural green dyes (chlorophyll), while tuna meat contributes brownish-gray color. The greenish-white to greenish color inside of the nugget is influenced by the use of tuna meat and green spinach in making nuggets. According to Indraswari et al. (2017), green spinach has a significant effect on the color of the nuggets produced. At the same time, the greenish-white color on the nuggets comes from tuna and other supporting materials. the use of green spinach has a significant effect on the color of the nuggets produced. At the same time, the greenish-white color on the nuggets comes from tuna and other supporting materials. the use of green spinach has a significant effect on the color of the nuggets produced. In contrast, the greenish-white color on the nuggets comes from tuna and other supporting materials.

The average descriptive assessment of the exterior color of the nugget ranges from a score of 1.87-2.83 (yellow to brownish-yellow). The lowest color score was obtained in the TB1 treatment, which was 1.87, which was significantly different from other treatments, and the highest score was obtained in the TB5 treatment, 2.83, which was not significantly different from the TB3 and TB4 treatments. Based on Figure 4, the exterior color of the nugget, it can be seen that the brown color was obtained after the frying process occurred due to the Maillard reaction. According to (Winarno, 2009), brown color results from the Maillard reaction through an active polymerized aldehyde without including an amino group or an amino group that forms a brown compound called melanoidin. The intensity of the resulting color depends on the length of frying.

Flavor

Taste is one factor that determines the taste of food and significantly affects consumer acceptance of a product (Setyaningsih et al., 2010). According to Asyari et al. (2016), food taste is influenced by elements in food such as protein, fat, and carbohydrates. Nugget taste assessment descriptively produced ranged from 1.73-3.77% (very distinctive taste of tuna to the taste of tuna and green spinach). The lowest score of taste assessment was obtained in TB1 treatment, which was 1.73, which was significantly different from other treatments, and the highest score was obtained in TB5 treatment, which was 3.77, which was significantly different from other treatments. The difference in descriptive sensory assessment of taste is due to differences in the use of tuna meat and green spinach to affect the taste of the resulting nuggets. The more green spinach to use, the greener the nuggets will taste. This is in line with Aksamina's research (2019), which states that the more

spinach is added, the less distinctive fish taste will be.

Scent

The aroma of food comes from the molecules that evaporate from the food, which is then captured by the nose as a sense of smell (Setyaningsih et al., 2010). descriptive panelists' assessment of the attributes of tuna and green spinach nuggets ranged from 1.96-3.33 (very distinctively flavored with tuna to tuna and green spinach). The lowest score for assessing the aroma of nuggets was obtained in the TB1 treatment, which was 1.96, which was significantly different from other treatments, and the highest score was obtained in the TB5 treatment, which was 3.33, which was significantly different from the other treatments. The more use of tuna used, the more flavored nuggets of tuna are obtained, while the use of green spinach is obtained nuggets that are flavored with tuna and green spinach.

Texture

The texture is defined as the properties of food ingredients detected by the eyes, skin, and muscles in the mouth, including roughness, smoothness, graininess, Etc. The texture and concentration of an ingredient will affect the taste caused by the material (Setyaningsih et al., 2010). Meanwhile, according to (Lawless dan Heymann, 2010), the texture is an essential aspect of food quality, sometimes more important than smell, taste, and color. Descriptive assessment of the nugget texture ranged from 1.76 to 3.60% (very chewy to soft). The lowest score of nugget texture assessment was obtained in TB1 treatment, which was 1.76, which was not significantly different from TB2 treatment, and the highest score was obtained in TB5 treatment, 3.60, which was significantly different from other treatments. The more addition of green spinach causes the texture to become soft. The water content also influences the texture of the nuggets. The higher the water content, the softer the resulting nugget texture. The TB5 treatment had the highest water content of 60.82 (Table 2), so that the texture produced in the TB5 treatment was soft.

The ingredients influence the texture of tuna and green spinach nuggets and the proportion of ingredients added. In addition, the texture of nuggets is also closely related to the protein content and frying time of the nuggets. The less protein produced, the softer the resulting texture. Based on the data in Table 2, the TB1 treatment had the highest protein content, namely 14.81% (Table 1), so that the TB1 treatment had a chewy texture. This is in line with the research conducted by Nugroho et al. (2014) that the binder and frying time affect the quality of nuggets. The longer the frying time, the texture becomes denser and more complex. Long frying time will damage the protein so that protein denaturation occurs, which results in a complex texture in the final product of nuggets.

Overall Hedonic Rating

The hedonic test is a sensory assessment that aims to determine the level of preference of the panelists as a whole. Table 2 shows that the average overall hedonic assessment ranges between 1.72-2.97 (very much like to like). The level of preference of the panelists as a whole is different for the product because each panelist has different tastes. Overall, the panelists preferred TB1 and

CONCLUSION

Based on the data and analysis of the research results, it can be concluded that the difference in the amount between tuna and green spinach has a significant effect on the overall sensory assessment parameters and chemical observations of nuggets. TB2 treatment with the ratio of tuna and green spinach meat (80:20) is the best treatment and has met the quality requirements of fish nuggets (SNI 01-7758-2013) obtained moisture content is 56.82%, ash content is 1.44%, protein content is 13.74%, fiber content is 2.45%, with a descriptive greenish-gray color, has a distinctive aroma of tuna, with a taste of tuna, and has a chewy texture.

REFERENCES

Andaruni, H., dan V. Indrawati. 2014. Pengaruh proporsi daging ikan patin (*Pangasius hypophtalmus)* dan penambahan bayam (*Amaranthus* spp) terhadap tingkat kesukaan nugget. Jurnal Tata Boga. 3(3): 125-130.

Angela, G. C., H. Onibala, F. Mentang, R. Montolalu, D. Sumilat, dan A. Luasunaung. 2021. Profil asam amino kecap ikan tongkol (*Euthynnus affinis*) yang difermentasi dengan penambahan nanas. *Media Teknologi Hasil Perikanan*. 9(2): 82–88.

Asrawaty. 2018. Perbandingan berbagai bahan pengikat dan jenis ikan terhadap mutu fish

nugget. *Jurnal Galung Tropika*. 7(1): 33-45.

Asyari, M., E. Afrianto, dan I. Pratama. 2016. Fortifikasi surimi lele dumbo sebagai sumber protein terhadap tingkat kesukaan donat ubi jalar. *Jurnal Perikanan Kelautan.* 7(2): 71-79.

Badan Standardisasi Nasional. 2013. Nugget Ikan. SNI 7758-2013. Badan Standardisasi Nasional. Jakarta.

Hasanah, M., B. Maharani, E. Munarsih, S. Tinggi, I. Farmasi, B. Pertiwi, dan S. Selatan. 2017. Daya antioksidan ekstrak dan fraksi daun kopi robusta (*Coffea robusta)*. IJPST. 4.

Hermanaputri, D. I., F. W. Ningtyias, dan N. Rohmawati. 2017. Pengaruh penambahan bayam (Amaranthus tricolor) pada nugget kaki naga lele (Clarias gariepinus) terhadap kadar zat besi, protein, dan air. *Jurnal Penelitian Nutrisi dan Makanan.* 40(1):9-16.

Izwardy D, Mahmud MK, Hermana, dan Nazarina. 2017. *Tabel Komposisi Pangan Indoensia 2017*. *Kementerian Kesehatan Republik Indonesia*.

Lawless, H. T., dan H. Heymann. 2010. *Sensory Evaluation of Food*.

Nasution, S. B. 2016. Analisa kadar besi (Fe) pada bayam hijau sesudah perebusan dengan masa simpan 1 jam, 3 jam dan 5 jam. *Jurnal Ilmiah Pannmed.* 11(1): 1-3.

Nento, W. R., dan P. S. Ibrahim. 2017. Analisa kualitas nugget ikan tuna (Thunnus sp.) selama penyimpanan beku. *Journal of Agritech Science*. 1(2): 75–81.

Pade, S. W. 2018. Analisis tingkat penerimaan nugget ikan cakalang (*Katsuwonus pelamis* L) dengan penambahan bonggol pisang. *Journal of Agritech Science.* 2(2): 90-95

Setyaningsih, D., A. Apriyantono, dan M. P. Sari. 2010. *Analisis Sensori untuk Industri Pangan dan Agro*. *IPB Press*. PT Penerbit IPB Press.

Vebrianty, E., H. Hajrawati, W. Hatta, dan S. Suharyanto. 2021. *The effect of addition of water spinach (Ipomoea aquatica forsk) on physico-chemical characteristics and antioxidant activity of Bali beef meatballs*. *IOP Conference Series: Earth and Environmental Science*. 788(1).

Winarno, F. G. 2009. *Kimia Pangan dan Gizi*. Gramedia Pustaka Utama: Jakarta.