Formulation of Cookies with Substitution of Fish Cork *(Channa Striata)* and Moringa *(Moringa Oleifera)* Flour as Foods Functional Protein Wealthy

Roby Muhamad Sopandi and *Dini Nur* Hakiki*

Universitas Terbuka, Food Technology Department, 15437 South Tangerang, Banten, Indonesia

Abstract. This research aims to develop cookies with fish meal supplementation cork and moringa flour for protein-wealthy functional food. The formulations of cookies with percentage variations, namely in F1 (70% wheat flour: 30% cork fish flour), F2 (60% wheat flour: 40% cork fish meal), F3 (50% wheat flour: 50% cork fish meal). All the treatment using the addition of 2.5% moringa flour. The analysis is protein, fat, moisture content, ash, and crude fibre. The data was analysed using One-Way ANOVA and a differential test using Duncan's Post Hoc. The result showed cork fish substitution significantly affect protein, water content, and carbohydrate. The organoleptic test combination 70% what flour and 30% cork fish meal high acceptance in texture and taste. The best combination was cookies F3 with 50% wheat flour and 50% cork fish meal that have 17.40±0.06% protein content; 15.47±0.02 fat; 2.28±0.23 water content; 1.54±0.04 ash; 63.31 carbohydrate, and 1,96±0,03% crude fibre.

1 Introduction

Functional foods are foods that have health benefits. Protein is an important nutrient that plays a role in the formation and repair of tissues in the body, muscle growth, and various other functions in the body. Functional biscuits high in protein (complete amino acids) can be found in cookies supplemented with cork fish meal. Fishmeal-based cookies are suitable for toddlers because the quality of nutrients in them is better than ordinary cookies which usually have high carbohydrate and fat content and are less balanced in other nutrients [1]

Fish Cork (Channa Striata) is one type of fish that has extraordinary potential to be utilized and processed into various useful products. One of its main uses is to make fish snack which is rich in nutrients, while the waste can be processed into animal feed. The specialty of Fish Cork lies in its excellent nutritional content for human health. This fish is rich in protein, especially albumin, as well as fats containing essential fatty acids. Fish Cork also contains very valuable mineral elements such as zinc and several essential vitamins that provide optimal support for the health of the body. In addition, fish cork protein concentrate

* Corresponding author: dini-hakiki@ecampus.ut.ac.id

supplements in clinical interventions has been shown to be effective in speeding up the healing process of patients after undergoing surgery. The presence of albumin in Fish Cork has a crucial role in preventing edema in the lungs and kidneys, and have functions as a carrier of blood clotting factors. In fact, serum albumin produced by the human body is also used medically to heal wounds, including burns and post-operative wounds. Fish Cork has indeed become a valuable food and has great potential for further development in the field of food and health industry [2]

Fish Cork, with its incredible protein wealth, exceeds other sources of protein such as eggs, chicken, and beef. In every 100 grams of Fish Cork, there are 20.0 grams of protein which is unmatched by eggs containing only 12.8 grams, chicken meat with 18.2 grams, and beef with 18.8 grams of protein. In addition, the digestion of Fish Cork is also amazing, stepping on an efficiency rate of more than 90%. Fish Corkmeal processing through steaming and fat extraction has proven to be the most optimal processing method thoroughly. The flour produced by this method has a dissolved protein content that reaches a peak of 10.88%, and has a low water content of only 7.46%, a yield of 15.79%, and obtained a positive response from organoleptic test that are generally preferred by panellist [3]. In the culinary, Fish Cork deserves to be the main star in quality flour preparations. Not only has a low water content of 2.94%, maintained fat with a content of 13.81%, and high fibre of 21.83%, but also protein that reaches 65%, in accordance with strict standards of the Food and Agriculture Organization (FAO).

Moringa oleifera L., popularly known as moringa, is a prominent species among thirteen species in the genus Moringa. One part of the Moringa tree that is widely used by the community is its leaves. Moringa leaves can be processed into flour which is useful as an additive in various food products, as well as increasing its nutritional value. Every 100 grams of Moringa leaf flour contains 358 kcal of energy, 27.10 grams of protein, 2.30 grams of fat, 38.20 grams of carbohydrates, 28.20 mg of iron, and 19.20 grams of fibre. In addition, Moringa (Moringa oleifera) is also famous as a medicinal plant in the tropics, with crude protein content of 26.79% and contains many beneficial vitamins and minerals [4]

In poor nutritional conditions, protein deficiency will damage the life of the individual with the impact of decreasing the immune system, resulting in disruption in antibody production. This makes it easier for harmful or infectious microorganisms to enter the body. According to research by Susanto and Maslikah in 2011, protein intake through food can stimulate the production of serum albumin which plays an important role in protein regulation in the body. This study focuses on replacing cork fish meal with moringa flour as the main raw material of cookies and analysing of proximate analysis and organoleptic test. The main goal is to initiate the development of cookies using cork fish meal and moringa flour as protein-rich functional foods.

2 Materials and Methods

2.1 Materials and Tools

The ingredients used to produce cookies are wheat flour, cork fish meal, moringa leaf meal, margarine, corn starch, egg yolk, refined sugar, salt, milk powder and developer. Using scales, mixers, containers, manual moulding, baking pans, and ovens.

2.2 Experiment Design

The formulation of cookies using different concentrations of wheat flour and fish cork. There are 3 formulations consist of 70% wheat flour and 30% Fish Cork meal (F1), 60% wheat

flour and 40% cork fish meal (F2), and 50% wheat flour and 50% cork fish meal (F3). Each of these formulas is enriched with an additional 2.5% moringa flour. The formulation of cookies presented in Table 1. Briefly, yolk eggs and margarine were stirred then mixed with n moringa flour, cork fish meal, corn starch, wheat flour, salt, milk powder, refined sugar. The cookies weighed 7 g per sample. The cookies were baked at 180 °C for 20 min. After this, the cookies were packed in laminated pouches and stored at ambient temperature for further analysis.

Table 1. Formulation cookies

Material	Unit	Ingredients Per Formula		
		F1	*F2*	*F3*
Wheat Flour	g	56	48	40
Cork Fish Meal	g	24	32	40
Moringa flour	g	2,5	2,5	2,5
Corn Strach	g	15	15	15
Margarine	g	50	50	50
Yolk	g	30	30	30
Salt	g	1,5	1,5	1,5
Developer	g	1,5	1,5	1,5
Refined sugar	g	45	45	45
Milk Powder	g	10	10	10

Research is conducted in the laboratory to analyse data and identify the content of nutrients in cookies, such as protein, fat, water, ash, and crude fibre. The data was then analysed using the One-Way ANOVA method, and a differentiation test was carried out using Duncan's Post Hoc method.

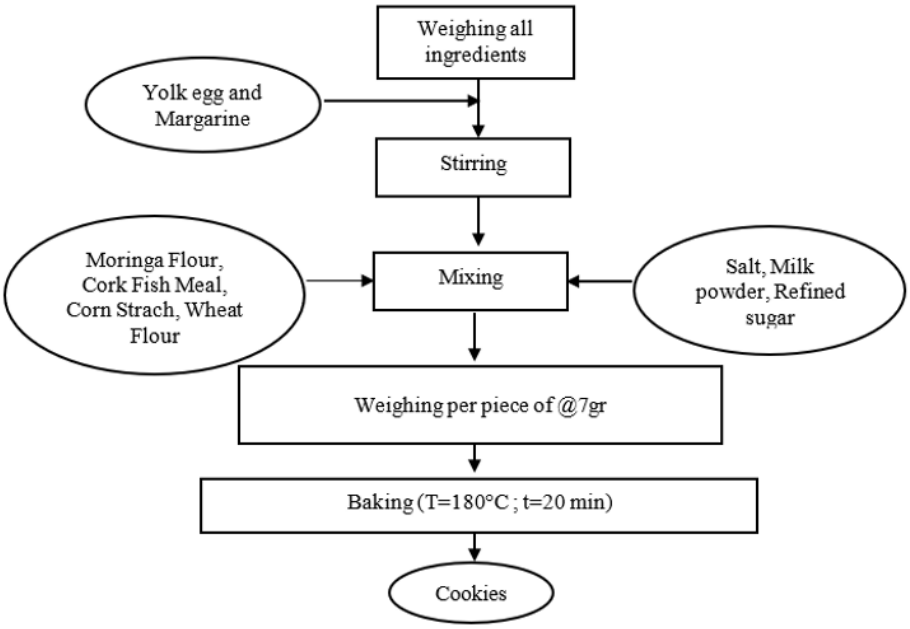

Fig. 1. Flowchart of Cookies Production

2.3 Proximate Analysis Method

2.3.1 Protein Test Method (Micro Kjedahl) (SNI 01-2973-2011)

Cookies saple weighed 1 - 5 g. Then, put the sample into the Kjedahl flask. Add 15.00 g of K_2SO_4, 1 mL of $CuSO_4.5H_2O$ catalyst solution, or 1 gram of selene mixture, as well as 8 to 10 boiling stone grains and 25 mL of concentrated H_2SO_4 to the combustion Heat the combustion using an electric heater until it reaches boiling point and produces a clear solution with a greenish-green color. Then sample was cooled and diluted by distilled water. Add 75 mL of 30% NaOH solution, distilled for a few minutes to 10 minutes until volume reached about 150 mL. Added as 50 mL of 4% H_3BO_3 solution to hold the distillate, and clean the cooling tip with distilled water. Then titrated the distillated mixture solution using 0.01N HCl solution, and also determine the blank value as a reference. Then, calculate protein content.

2.3.2 Method of Determining Fat Content (Soxhlet) (AOAC, 2005)

Sample dried in the oven at 105°C for 30 minutes, cooled for 15 minutes in the desiccator container, and weighed. As 2-5 g sample covered by filter paper, then fold and tie it with a woolen cotton. Put the fat solvent into the fat flask as needed, then put the weighed sample into the soxhlet extraction device and pair it with the fat flask. Then, heating to the container with fat and extraction for 3-4 hours with 5-6 rounds of cycles. Remove the fat-containing container and dried in the oven at 105°C until the weight reaches the point of consistency, cooled in desiccator for 30 minutes and weighed.

2.3.3 Method of Determination of Water Content (Gravimetry) (SNI 01-2973-2011)

The cup containing the sample is heated in an oven at 130°C for one hour. Then the cup is lifted and cooled in a desiccator for 30 minutes. As 2 g weighed, dried in the oven at 130°C for one hour. Then, the cup is lifted and cooled in a desiccator for 30 minutes, weighed until it reaches a stable weight.

2.3.4 Method of Determining ash content (Gravimetry) (SNI 01-2973-2011)

Heat porcelain dried in the oven at 105°C for 5 minutes and cooled in desiccator for 15 minutes. Crushing the cookies by using a mortar, then weighed 2 g cookies into porcelain cup. Preheat to the furnes for 1.5 hours at temperatures between 500°C and 600°C then cooled in a desiccator for 15 minutes and weighed. Repeat this process until the weight is constant or at least 3 times.

2.3.5 Method of Determining Fiber Content (Gravimetry) (AOAC, 2005)

A number of fibrebags, including fibrebags for blanks, are dried in the oven at 105°C for one hour, cooled in a drying chamber and weighed. The spacer glass is inserted into a fibrebag and then placed inside the carausel. After the fibertherm process is complete, samples that have undergone fat reduction are taken from the fibrebag and put into platinum dishes for weighing. Platinum dishes are heated in an oven at 105°C for 5 minutes and cooled in a drying chamber for 15 minutes. Then, the empty weight of the platinum dish is weighed, mashed and weighed. The platinum dish containing the sample is placed in an oven for 24 hours at 105°C. The sample in platinum dish was put into the furnace at 650°C for 2 hours. The platinum dish containing the sample is burned in a furnace until the sample becomes ash. The furnace containing the ash is weighed until the weight is constant, and then the fiber content is analyzed.

2.3.6 Carbohydrates by Difference (AOAC, 2005)

The purpose of this method is to measure the amount of total carbohydrates in food. The basic principle of this method is to subtract 100% by the content of protein, fat, water, and ash in the material. Thus, carbohydrate content can be determined based on these reduction factors. This method is important because carbohydrates have a significant impact on the composition of other nutrients.

3 Results and discussion

3.1 Proximate Analysis

3.1.1 Protein Levels

The level of protein tends to increase with the addition of Fish Cork meal. The results of the analysis showed that the protein content in F1 treatment cookies was 13.13%, and the highest was found in F3 treatment cookies with a content of 17.40% in accordance with National Standardization Agency of Indonesia, which is at least 9%. The higher Fish Cork meal included in cookies, the protein will increase significantly because Fish Cork meal has a very high protein content. The measurable presence of protein is strongly influenced by the degree of dehydration of the materials used. If there is significant water loss, the protein content will

increase [5]. The properties of proteins effect the moisture content and texture of cookies. Flour that contains high protein tends to be difficult to mix evenly and absorbs a lot of water during the dough making process. This can be seen from the increase in protein levels which results in a decrease in water content, as well as cookies that have a harder texture.

Table 2. Nutritional content of cookies.

Test Parameters	Unit	Treatment				Test Method
		F1	*F2*	*F3*	*Stdv.T*	
Protein Levels	%	13,13±0,08^{b}	15,41±0,05^{b}	17,40±0,06^{a}	±2,13	Kjeldhal
Fat Content	%	15,52±0,06^{a}	15,48±0,02^{a}	15,47±0,02^{a}	±0,02	Soxhlet
Water Content	%	2,94±0,35^{a}	2,76±0,11^{a}	2,28±0,23^{b}	±0,34	Gravimetry
Ash content	%	1,10±0,03^{a}	1,36±0,04^{a}	1,54±0,04^{a}	±0,18	Gravimetry
Carbohydrates	%	67,26^{a}	64,99^{ab}	63,31^{b}	±1.96	By Difference
Crude Fiber	%	2,18±0,05^{a}	2,08±0,03^{a}	1,96±0,03^{a}	±0.11	Gravimetry

The quantity of protein in pastries will be affected by the amount of protein contained in additional fish meal, given that fish meal is famous for its abundant protein content. In addition to the contribution of fish meal, the use of eggs, moringa leaf meal, and corn starch also plays a role in increasing protein levels in cookies, but the difference is not so significant because of the use of the same variety of ingredients in each formula.

3.1.2 Water Content

F1 treatment has the highest water content, which is 2.94%, while the F3 treatment has the lowest water content, which is 2.28%. The more cork fishmeal added to cookies, the lower the moisture content. The process of evaporating water when baking cookies goes well and with the same parameters, in accordance with the moisture content standard set by National Standardization Agency of Indonesia, which is a maximum of 5%. The data shows an overall standard deviation of ±0.34, which means each formula has low volatility and is close to 0. The results of the variation study show that the incorporation of shark meal can have a striking impact on water concentration.

This difference in moisture content is influenced by the baking process in cookies, and the moisture content in the starting material. The water content of Fish Cork meal is smaller, namely 7.46% - 9.18% [3]. Compared to the water content of wheat flour which is 13%, thus affecting the result of the higher product moisture content in the addition of less Fish Cork meal.

During the baking process, there is a lot of water evaporation from the cookie dough. The required baking conditions are set with the same parameters, but each dough with different treatments will produce different results, depending on the formulation and structure formed and the amount of water that must be removed. Baking process will reduce moisture content by 1% to 4%. During baking, water loss occurs from the surface of the product through a continuous evaporation process in the oven. This occurs as a result of a drop in wheat flour, which also results in a decrease in amylose. Amylose is a kind of linear macromolecule that has the ability to take water efficiently because it contains a hydroxyl group bonded together with amylopectin, which is part of the starch component and is easily soluble in water. In addition, there is the potential that cork fishmeal, which has an affinity for water, can also bind to water molecules. Low moisture content can cause cookies to feel burnt and have a slightly dark color due to excessive heating. It can also affect the structure of cookies so that they break more easily, as well as speed up taste changes during storage. The moisture

content also affects the shelf life of the product, where the higher the moisture content, the lower the shelf life of the product [6]

3.1.3 Ash content

The ash content in cookies is influenced by the initial minerals present in the raw material. The ash content produced rise along with the F1 treatment by 1.18% and the F2 treatment which reached the highest point of 1.54%. The more cork fishmeal added in cookies, the higher the ash content. This is due to the addition of animal minerals contained in the raw materials of cork fish meal. The ash content of the three treatments meets the standards set by National Standardization Agency of Indonesia, which is a maximum of 1.5%.

Fish cork meal did not have a significant effect on the ash content. The higher the concentration of mineral deposits in foodstuffs, the more abundant the nutrients contained in them. The ash content in food is a remaining minerals that are not burned and do not evaporate during the heating process. The level of ash residue presence in a food can be a clue about unsuitability for consumption because it has the potential to cause unexpected effects [7].

3.1.4 Fat Content

The fat content in cookies showed an insignificant decrease of about 0.02%. This is due to the low-fat content in Fish Cork meal, which does not have a significant difference in the result. The fat content in cookies only comes from margarine ingredients. Nevertheless, these results still meet the fat content standard set by National Standardization Agency of Indonesia, which is at least 9.5%. The results of variation investigations indicated that the inclusion of Fish Cork powder did not indicate an acceptable effect on fat content.

3.1.5 Crude Fiber Content

Food fiber is a complex substance found in cell structures. Some of these substances do not belong to the group of polysaccharides or cell wall-forming compounds, based on the results of crude fiber analysis tend to decrease with the addition of cork fish meal to cookies. F1 cookies produce the highest crude fiber at 2.18%, while the lowest in F3 cookies is 1.96%, this crude fiber shows results that meet the standard of 5%, the richer the fiber in food, the process of digestion and absorption of nutrients becomes more inhibited [8].

3.1.6 Carbohydrate Levels by Difference

Carbohydrate levels in proximate testing are strongly influenced by the composition of other nutrients, namely protein, fat, water, and ash, so that the results also vary and tend to decrease. F1 cookies produced the highest carbohydrate content at 67.23%, while the lowest in F3 cookies at 63.31%. these results have not met the carbohydrate standards set by National Standardization Agency of Indonesia, which is a minimum of 70%. The carbohydrate content in the product is a concern because of the influence of the contribution of adding food ingredients such as cork fish meal and the processing process which results in complex sugars decompose into simpler molecules. Changes in humidity that occur can affect the accuracy of measuring carbohydrate content.

During the baking process, cookies undergo changes that occur due to heating treatment. Heating leads to a reduction in pigment color because carotenoids are unstable at high temperatures. This effect results in cookies with a brighter appearance, which is preferred by

consumers. Research, nonenzymatic browning reactions occur when carbohydrates react with proteins when exposed to heat, which results in a slightly dark to brownish color. This is what happens in the process of baking cookies, resulting in a final product with a slight brown color on the surface [9].

3.2 Organoleptic Test

F1 F2 F3

Fig. 2. F1 (Formulation 1 cookies after cooking), F2 (Formulation 2 cookies after cooking), and F3 (Formulation 1 cookies after cooking).

Organoleptic testing was carried out involving 20 semi-trained panelists. This organoleptic test involves four parameters, namely color, aroma, taste, and texture. This is because consumer preferences for a product are influenced by these four parameters. The assessment was conducted using a line scale method with a range of 1 to 7, which describes the favorability level of the panelists. A scale of 1 indicates "very dislike" while a scale of 7 indicates "very like".

Tabel 3. Test organoleptic cookies.

Treatment	Sensory parameters			
	Color	Flavor	Taste	Texture
F1	4,60±1,30^{ab}	4,30±1,26^{b}	4,95±0,94^{a}	5,20±0,77^{a}
F2	3,90±1,3 ^{a}	5,05±0,99^{a}	4,25±1,02^{a}	4,95±0,82^{a}
F3	5,15±0,87^{a}	4,43±1,35^{b}	3,95±1,27^{b}	4,80±0,83^{b}

Significant differences are seen in the texture specifications of cookies when using different concentrations of fishmeal in functional cookies processing. The selected formula is determined referring to organoleptic test results that indicate the level of fish meal that gives the best results.

3.2.1 Color

Percentage variation data obtained from panelists' responses revealed that Fish Cork extract concentrations had an acceptable consequence ($p<0.05$) on cookie color. The results found

significant differences so that a further Duncan post hoc test was carried out, the results of numbers followed by superscript letters of real difference. In terms of color, respondents prefer F3 cookies with an average panelist score of 5.15 because the coloring of cookies tends to be more striking and attractive than F1 and F2 cookies, this is influenced by the baking process in cookies, although with the same parameter treatment, but the results will be different because coloring can be influenced by the amount of moisture content contained in the material, and the presence of browning reactions in materials involving carbohydrates. The higher the water content contained in the material, the better and more attractive the color will be, but on the other hand, if the water content contained is low, the darker the color will be.

3.2.2 Flavor

Percentage variation data obtained from panelists' responses revealed that Fish Cork extract concentration had an acceptable consequence ($p>0.05$) on the aroma of cookies, respondents preferred F2 cookies with an average panelist value of 5.05 because the aroma was more balanced between the basic aroma of cookies and Fish Cork functional cookies, compared to the aroma of F1 cookies which is more towards ordinary aroma, and F1 cookies have an excessive fishy aroma due to the use of a higher percentage of Fish Cork than other formulas, the fishy aroma typical of Fish Cork is pungent, especially in after taste. Some panelists did not like the aroma affected by fish meal and Moringa leaves, which affected the panelists' assessment results.

3.2.3 Taste

Percentage variation data obtained from panelists' responses revealed that the concentration of Fish Cork extract had an acceptable consequence ($p<0.05$) on the taste of cookies, The results found significant differences so that Duncan post hoc follow-up tests were carried out, the results of numbers followed by superscript letters the level of real difference. Respondents prefer F1 cookies with a value of 4.95 because in terms of taste more balanced between sweet, salty and savory compared to F3 cookies which taste strange and fishy typical of fish, the addition of Moringa leaf flour there is no significant taste comparison because its use does not vary in each formula, but in response panelists the addition of moringa to cookies is not too strange or in fairly standard levels. However, some panelists felt strange and were not used to the distinctive taste of Moringa, which affected the sensory results

3.2.4 Texture

Percentage variation data obtained from panelists' responses revealed that Fish Cork extract concentrations had an acceptable consequence ($p>0.05$) on cookie texture. However, some respondents prefer F1 cookies with an average panelist score of 5.20 because the texture is crispier than F1 and F2 cookies. Texture is not effect significantly in the use of raw materials in cookies, some respondents consider that F3 cookies are harder than other cookies, this can be influenced by the contribution of fishmeal ingredients that contain a lot of protein causing a hard texture in the product. The higher the flour used in the formula, the harder the texture of the biscuit.

4 Conclusion

The substitution of wheat flour with Fish Cork meal as a functional food for protein-rich cookies has an influence on the results shown by the protein content of F3 formula cookies, which is 17.40%, exceeding the quality standard set by National Standardization Agency of Indonesia, which is 9%. The organoleptic product has no significant effect so that it remains suitable for consumption as protein-rich functional food. However, the flavour of the fish is still too distinct for some people, so more work needs to be done to get customers to accept it well and to evaluate the cookies' shelf life.

References

1. F. Ophiocephalus, D. K. Sari, S. A. Marliyati, L. Kustiyah, A. Khomsan, and T. M. Gantohe, "Uji Organoleptik Formulasi Biskuit Fungsional Berbasis Tepung Ikan Gabus (Ophiocephalus striatus)[Organoleptic Test of Functional Based Biscuit Formulation (Ophiocephalus striatus)]," vol. 34, no. 2, pp. 120–125, 2014, doi: 10.22146/agritech.9501.
2. M. Asfar, A. B. Tawali, and M. Mahendradatta, "Potensi Ikan Gabus (Channa striata) Sebagai Sumber Makanan Kesehatan (Review)[Potential of Snakehead Fish (Channa striata) as a Health Food Source (Review)] Pros. Semin. Nas. Teknol. Ind. II, no. October 2014, pp. 150–154, 2014.
3. Mardiana and Fatmawati, "Analisa Tepung Ikan Gabus sebagai Sumber Protein [Analysis of Snakehead Fish Meal as a Source of Protein]," Octopus J. Ilmu Perikan., vol. 4, no. 1, pp. 235–243, 2014.
4. E. A. Rimbawanto, B. Hartoyo, S. Rahayu. "Potensi Konsentrat Protein Daun Kelor (Moringa oleifera) Sebagai Bahan Pakan Sumber Protein [Potential of moringa leaf protein concentrate (Moringa oleifera) as a protein source feeding ingredient] Pros. pp. 14–15, 2022, [Online]. Available: http://jnp.fapet.unsoed.ac.id/index.php/psv/article/view/1607%0Ahttp://jnp.fapet.unsoed.ac.id/index.php/psv/article/download/1607/666
5. D. Kartika Sari, S. Anna Marliyati, L. Kustiyah, A. Khomsan, and T. Marcelino Gantohe, "Uji Organoleptik Formulasi Biskuit Fungsional Berbasis Tepung Ikan Gabus (Ophiocephalus striatus) [The Organoleptic Functional Biscuit Formulation Based on Snakehead Fish (Ophiocephalus striata)] Flour," Agritech, vol. 34, no. 2, pp. 120–125, 2014.
6. F. Kusnandar and D. R. Adawiyah, "Pendugaan Umur Simpan Produk Biskuit Dengan Metode Akselerasi Berdasarkan Pendekatan Kadar Air Kritis [Accelerated Shelf-life Testing of Biscuits Using a Critical Moisture Content Approach]," vol. XXI, no. 2, pp. 1–6, 2010.
7. R. I. Pratama, I. Rostini, and D. E. Liviawaty, "Karakteristik Biskuit dengan Penambahan Tepung Tulang Ikan Jangilus (Istiophorus Sp.) [Characteristics of Biscuits with the Addition of Jangilus Fish Bone Meal]", Jurnal Akuatika, vol 5, no. 1, pp. 30-39.
8. Hardiyanti and K. Nisah, "Analisis Kadar Serat Pada Bakso Bekatul Dengan Metode Gravimetri [Analysis of Fiber Content in Rice Bran Meatballs Using the Gravimetric Method] ," Amina, vol. 1, no. 3, pp. 103–107, 2021, doi: 10.22373/amina.v1i3.42.
9. I. L. Ardian, L. D. Puspareni, A. Fauziyah, and I. M. B. Ilmi, "Analisis Kandungan Gizi Dan Daya Terima Cookies Berbahan Dasar Tepung Bekatul Dan Tepung Ikan Tuna Untuk Balita Gizi Kurang [Analysis of nutritional content and acceptability of

cookies made from rice bran flour and tuna fish meal for malnourished toddlers],” J. Nutr. Coll., vol. 11, no. 1, pp. 42–50, 2022, doi: 10.14710/jnc.v11i1.31177.

10. AOAC. (2005). Official methods of analysis of the As- sociation of Analytical Chemist. Virginia USA: Association of Official Analytical Chemist, Inc.
11. Wijaya, H. (2010). Kajian Teknis Standar Nasional Indonesia Biskuit SNI 012973-1992 [Technical Study of the Indonesian National Standard for Biscuits SNI 012973-1992]. Balai Besar Industri Argo, Kementrian Perindustrian.
12. Winarno, F. G. (2008). Kimia Pangan dan Gizi [Food Chemistry and Nutrition]. Jakarta : Gramedia. Pengolahan Universitas
13. Wirawan, W., Ikan, Bahan, S., & Olahan, D. (2018). Analisis Karakteristik Kimia Dan Sifat Organoleptik Tepung Ikan Gabus Sebagai Bahan Dasar Olahan Pangan [Analysis of Chemical Characteristics and Organoleptic Properties of Snakehead Fish Meal as a Basic Ingredient for Processed Food]. Jurnal Sains Dan Kesehatan, 1(9), 479–483.