AJARCDE
ASIAN JOURNAL OF APPLIED RESEARCH FOR COMMUNITY DEVELOPMENT AND EMPOWERMENT

Journal home page: http://ajarcde-safe-network.org ISSN 2581-0405

The Influence of the Proportion of Bones and Meat Catfish (Clarias batrachus) and Frying Time on the Quality of Catfish Floss

Khusnul Qotima[1], Sri Winarti[1].*

[1]*Food Technology Department, Faculty of Engineering, Universitas Pembangunan Nasional "Veteran" Jawa Timur, Surabaya, Indonesia.*

ARTICLE INFO

Article History:
Received: 24 May 2024
Final Revision: 27 June 2024
Accepted: 29 June 2024
Online Publication: 30 June 2024

KEYWORDS

Catfish floss, catfish, catfish bones

CORRESPONDING AUTHOR

*E-mail: sriwinarti.tp@upnjatim.ac.id

A B S T R A C T

Catfish is a freshwater fish that is often found but has not been used optimally. One alternative use of catfish is processed into catfish floss. This research aims to determine the effect and best treatment of the proportion of bones and meat of catfish with frying time. This research used a completely randomized design (CRD) factorial with 2 factors and 2 replications. Factor I is the proportion of bone: meat of catfish (30:70, 50:50, 70:30). Factor II is the frying time (60 minutes, 90 minutes, 120 minutes). Observation data were analyzed using ANOVA with a level of 5%. If there were significant differences between treatments, the DMRT test was continued. The best treatment in this study was a long frying treatment of 60 minutes with the proportion of bone: catfish meat (30:70) producing shredded catfish with calcium levels (6.78%), water content (8.81%), ash content (7.04%), fat content (27.02%), TBA number (0.18mg.MDA/kg), color scoring test 1.28 (yellow) and aroma scoring test 4.48 (slightly burnt).

1. INTRODUCTION

1.1. Research Background

Catfish is a source of animal protein and is a leading fishery commodity in Indonesia, so domestic catfish production is quite large [1]. According to statistical data from the East Java Province Maritime and Fisheries Service in 2024, catfish is the 3rd highest superior commodity, with a total catfish production of 157,770 tonnes [2]. This large fisheries production sector needs to be balanced with the development of the processed fishery products produced.

Processed catfish products usually only use the meat, resulting in waste that is not utilized, namely the skin, bones and head of the catfish, which is quite large, between 60-70% of the weight of the catfish [3]. With the increase in catfish production, the catfish waste produced will also increase, and this waste will become food waste, causing environmental problems if it is not handled and utilized properly. Most of the waste handling carried out only involves burying fishery waste products [4]. Therefore, further processing is needed so that catfish bone waste does not become waste that can pollute the environment.

Fish floss is a form of preparation generally made from shredded meat, added spices, and then fried [5]. Many consumers like shredded catfish because it tastes delicious, is tasty, lasts a long time and can be used as a side dish for staple foods or snacks [6]. Regarding consumer preferences, fish floss has a high reference level in terms of taste, structure, and texture because it is easier to digest [7].

The use of catfish bone waste is still not managed well. Therefore, this research aims to utilize catfish bones as an addition to making catfish floss. Catfish skeletons and heads can be used to develop calcium-rich supplements. Various studies show that calcium consumption has the advantage of improving the structural integrity of bones. Bones come from the frame and head and are removed after the tissue is boiled [8]. Catfish bones have a calcium content of 6.33% [9].

The length of frying time is the main factor in changing the quality of fish floss. The longer the frying time, the more the color and aroma of fish floss can be affected. Determining the optimal frying time can maintain the color and taste of the fried food.

Several factors play a role in maintaining the quality of food products, including frying time and storage time, which can affect the quality of catfish floss, so it is important to pay attention to this. Indicators of changes in the quality of shredded meat can be

seen from changes in aroma to rancidity, changes in water content, which affect the texture of the shredded meat and the growth of mold due to microbiological activity that occurs during storage. Shredded catfish stored for some time will have different quality characteristics because quality degradation occurs, affecting shelf life [10].

The influence of fish type and cooking method on the quality of fish floss shows that the process of cooking fish meat has a very significant effect on protein content, fat content, water content and ash content ($P \leq 0.01$) and has no significant effect on the organoleptic values of texture, color and aroma. and taste on the quality of fish floss [11]. The process of rancidity and a decrease in taste will occur during the shredded storage process. Based on preliminary research conducted by the author, the catfish shredded product was overgrown with mold and experienced changes in sensory properties after 9 days of frying treatment for 60 minutes. Therefore, this research was conducted to determine the effect of frying time and the proportion of meat to the skin on making shredded catfish (clarias batrachus). Therefore, this research assessed the impact of frying time and the proportion of meat to catfish bones on making shredded catfish (clarias batrachus).

1.2. Research Objective

This research aims to determine the effect of variations in the proportion of bone and meat catfish and frying time on the characteristics of catfish floss.

2. MATERIALS AND METHODS

2.1. Material and Tools

The ingredients used in making catfish floss include catfish, shallots, garlic, salt, brown sugar, lime leaves, bay leaves, lemongrass, ginger, galangal, coriander, pepper, turmeric and candlenuts. The materials used in the analysis of catfish floss are TBA reagent, acetic acid, chloroform, potassium iodide, Na-thiosulfate, starch solution, PDA (Potato Dextrose Agar), H2SO4, distilled water, NaCl, HCl, hexane, distilled water and starch.

Tools used in making catfish floss include a spinner, oven, blender, basin, spoon, stirrer, frying pan, spatula, cutting board, stove and knife. The tools used in the analysis of catfish floss are glass ware, porcelain dishes, petri dishes, inoculation cases, desiccators, erlenmeyer, measuring cups, bunsens, ose needles, micropipettes, autoclaves, vortexes, blenders, measuring flasks, fat flasks, ovens, stirrers , drop pipettes, volumetric pipettes, test tubes, and analytical balances.

2.2. Design Experiment and Analysis

The research design used in this study was a Completely Randomized Design (CRD) with 3 treatments and proportions of fish meat and bone in 3 treatments. A total of 9 treatments were carried out, each treatment was administered twice, so that the total number of treatments was 18 experimental units.

In this study there were 2 different factors, namely the frying time with 3 treatments (60, 90 and 120 minutes) and the proportion of bone: meat with 3 treatments (30:70, 50:50 and 70:30). The data obtained were tested using analysis of variance (ANOVA). If there is a real difference, a further test is carried out using the DMRT test with a confidence level of 5%.

2.3. Analysis Procedure

2.3.1. Water content

Determination of water content is based on the difference in sample weight before and after drying. The porcelain cup is first dried for approximately 1 hour at 105oC then cooled in a desiccator for 30 minutes and weighed until the weight remains constant (A). the sample is weighed at approximately 2 g (B) in the cup, dried in an oven at a temperature of 100-105oC for 5 hours or constant weight. The cup containing the sample is cooled in a desiccator for 30 minutes and then weighed until the weight remains constant (C). Water content is calculated using the formula:

$$Water\ content\ (\%) = \frac{(A+B)-C}{B} \times 100\%$$

2.3.2. Ash content

A total of 3-5 g of sample is weighed into a porcelain cup which has been dried first and the weight is known, then placed in an ashing furnace at a temperature of around 600ºC until gray ash is obtained or until the weight is constant, cooled in a desiccator and then weighed.

$$Ash\ content\ (\%) = \frac{ash\ weight}{sample\ weight} \times 100\%$$

2.3.3. Fat content

The fat flask used in the Soxhlet extraction tool is dried in the oven, cooled in a desiccator, and then weighed. 1-2 g of sample was weighed onto filter paper, weighed and tied using fat-free wool thread. Add enough fat solvent into the fat flask. The lead is inserted into the Soxhlet extraction tool and attached, then heated and extracted for 3-4 hours (5-6 cycles) then the fat flask is dried in an oven at a temperature of 105OC until constant.

$$Fat\ content\ (\%) = \frac{fat\ weight + flask}{sample\ weight} \times 100\%$$

2.3.4. Thiobarbituric acid

A sample of 3 grams was then dissolved using 50 ml of distilled water. The sample was put into a 1000 ml distillation flask while washing with 48.5 ml of distilled water and adding 1.5 ml of 4 N HCl, then put in 3 boiling stones and apply vaseline to the surface of the distillation flask lid. Attach a set of distillation tools and turn on the ON button and wait for the heating process for 10 minutes, you will get a result of 50 ml. The resulting distillate was transferred into a test tube and 5 ml of TBA reagent (0.02 M thiobarbituric-acid solution in 90% glacial acetic acid) was added. The next stage, the reaction tube was cooled with running water, then the absorbance was measured at a wavelength of 528 nm with distilled water as the zero point. Analysis of TBA figures is calculated in ppm units. TBA calculation according to the formula:

$$TBA\ number = \frac{3 \times wavelength \times 7.8}{sample\ weight} \times 100\%$$

2.3.5. Organoleptic

Organoleptic testing is done by sensing or sensory assessment, which utilizes the human five senses to evaluate texture, color, shape, aroma and taste. One type of organoleptic testing is the

scoring test. The parameters to be tested are color and aroma. This test was carried out on 25 moderately trained panellists.

2.4. Implementation of Research

2.4.1. Making catfish floss

The catfish are sorted first and then washed using clean water. Additional ingredients such as shallots, garlic, kaffir lime leaves, bay leaves, lemongrass, ginger, galangal and turmeric are also washed first. The catfish is separated into bones and meat to facilitate the boiling stage and divide the proportions, while the human and fish parts of the catfish are discarded. Then boil the catfish bones using a pressure cooker for 45 minutes, and boil the catfish meat for 15 minutes. Destroying catfish bones using a food cooper, shredding catfish meat manually, and making fine spices to make shredded meat. The ground spices include shallots, garlic, coriander, candlenuts, turmeric, galangal, bay leaves, lime, lemongrass and ginger. The next stage is weighing to determine the proportion of catfish bones and meat made into catfish floss. The proportions of the catfish have been weighed, followed by frying and mixing other ingredients. The pan is heated first, then the ground spices are added. At this stage, if you can smell the flavour of the spices, add the crushed catfish bones and meat and stir until the spices are evenly distributed. The frying process uses the pan frying method. The advantage of using the shredded-making process is that it only requires a little oil so the shredded meat dries quickly.

3. RESULT AND DISCUSSION

3.1. Chemical Analysis

Chemical analysis of catfish floss with the influence of frying time and the proportion of bones and meat consisting of water, ash, fat, and thiobarbituric acid (TBA). Results of chemical analysis of catfish floss with long frying treatment and differences in catfish bones and meat proportions.

The water content, ash content, fat content and TBA number of catfish floss are presented in Table 1.

Table 1. Results of chemical analysis of catfish floss

Chemical analysis	Treatment								
	A1B1	**A1B2**	**A1B3**	**A2B1**	**A2B2**	**A2B3**	**A3B1**	**A3B2**	**A3B3**
Water content (%)	8.81 ± 0.01^{h}	8.49 ± 0.09^{g}	8.10 ± 0.11^{f}	7.64 ± 0.01^{e}	7.35 ± 0.05^{d}	7.22 ± 0.01^{d}	6.91 ± 0.03^{c}	6.53 ± 0.01^{b}	6.15 ± 0.02^{a}
Ash content (%)	7.04 ± 0.02^{a}	7.16 ± 0.01^{b}	7.31 ± 0.01^{c}	7.46 ± 0.01^{d}	7.58 ± 0.11^{e}	7.87 ± 0.04^{f}	8.06 ± 0.05^{g}	8.25 ± 0.01^{h}	8.65 ± 0.00^{i}
Fat content (%)	27.02 ± 0.01^{c}	26.38 ± 0.25^{b}	24.30 ± 0.07^{a}	30.28 ± 0.07^{e}	29.41 ± 0.40^{d}	27.32 ± 0.32^{c}	32.41 ± 0.07^{h}	31.67 ± 0.08^{g}	30.86 ± 0.06^{f}
TBA number (mg.MDA/kg sample)	0.18 ± 0.02^{c}	0.12 ± 0.00^{b}	0.09 ± 0.01^{a}	0.26 ± 0.01^{e}	0.22 ± 0.00^{d}	0.18 ± 0.00^{c}	0.38 ± 0.00^{h}	0.36 ± 0.01^{g}	0.34 ± 0.00^{f}

Note: values accompanied by different letters indicate significant differences at $p \leq 0.05$

3.1.1. Water content

Water content is the water content contained in a material. High water content causes products to deteriorate more quickly due to the presence of destructive microorganisms that utilize the large amount of water in the product for their growth. The results of the analysis of the water content of catfish floss with long frying treatment and the proportion of bone to catfish flesh ranged from 6.15-8.81%. The results of the water content analysis can be seen in Table 1.

Based on the results of the analysis, it can be seen that the frying time treatment of 120 minutes and the proportion of bone: catfish meat (70:30) produced the lowest water content value of 6.15%, while the frying time treatment was 60 minutes and the proportion of bone: catfish meat (30:70) produces the highest water content value of 8.81%. The longer you fry the catfish floss, the greater the proportion of bones, and the less meat used, the lower the water content. The frying time significantly affects the water content of the shredded fish because the frying process causes the water contained in the catfish floss to evaporate so that the water content decreases. This statement is supported by the literature showing that the water content in the shredded meat decreases during the roasting process. This process occurs because the water in the material can evaporate [12].

The proportion of catfish bones influences the water content in catfish floss because the water content in catfish bones is less than in catfish meat, causing catfish floss with a higher proportion of bones to have a low water content value. According to the literature, fresh catfish bones have a water content of 24.7% [13], while fresh catfish meat, according to the literature, has a water content of 77.05% [8]; it can be seen that the water content in catfish bones is less. Rather than the water content of catfish meat, the more catfish bones are used, the lower the water content of the shredded beef.

3.1.2. Ash content

Ash content is the substance that remains when a sample of food is completely burned in an ashing furnace. Determining the ash content is closely related to the mineral content contained in a material and the purity and cleanliness of a material. The results of the analysis of the ash content of catfish floss with long frying treatment and the proportion of bone to catfish flesh ranged from 7.04-8.65%. The results of the ash content analysis can be seen in Table 1.

Based on the results of the analysis, it can be seen that the frying time treatment of 60 minutes and the proportion of bone: catfish meat (30:70) produced the lowest ash content value of 7.04%, while the frying time treatment was 120 minutes and the proportion of bone: catfish meat (70:30) produces the highest ash content value of 8.65%. The longer you fry the catfish floss, the greater the proportion of catfish bones; the smaller the proportion of meat added, the higher the ash content produced. The process of frying catfish floss causes the water content to evaporate so that other components in the floss increase, one of which is the

 https://doi.org/10.29165/ajarcde.v8i2.424

ash content. This statement follows the literature that the longer catfish floss is fried, the higher the ash content is due to the large amount of minerals [14].

The proportion of catfish bones in the material influences the ash content in catfish floss. The greater the proportion of catfish bones used, the higher the ash content produced because catfish bones mostly contain minerals and only have a small amount of fat. In the literature, catfish bones have an ash content of 40.9% [13], while in other literature, catfish meat has an ash content of 4.58% [8]. This is because the main constituent components of fish bones are minerals, supported by the statement in the literature that bones contain living cells and intracellular matrix in the form of mineral salts. Mineral salt is a component that consists of 80% calcium phosphate and the remainder consists of calcium carbonate and magnesium phosphate [15].

3.1.3. Fat content

Fat is one of the macro components found in food other than carbohydrates and protein, therefore, the role of fat in determining the characteristics of food is quite large. The results of the analysis of the fat content of catfish floss with long frying treatment and the proportion of bone: meat of catfish ranged between 24.30-32.41%. The results of the fat content analysis can be seen in Table 1.

Based on the results of the analysis, it can be seen that the frying time treatment of 60 minutes and the proportion of bone: catfish meat (70:30) produced the lowest fat content value of 24.30%, while the frying time treatment was 120 minutes and the proportion of bone: catfish meat (30:70) produces the highest fat content value of 32.41%. The longer you fry the catfish floss, the greater the proportion of catfish bones, and the smaller the proportion of meat added, the lower the fat content produced. This is because the longer the frying causes the fat content to increase and increases the evaporation of the catfish floss; literature statements support this that the longer the frying, the more oil enters the fish floss to replace the water content so that the taste of the shredded fish becomes savoury [16]. Frying will increase fat content and water evaporation [15].

Catfish floss, with a greater proportion of catfish bones than catfish meat, has a lower fat content because most fish bones comprise minerals. According to the literature, catfish bones have a fat content of 8.7% [13], while catfish meat has a fat content of 14.56% [8]. This causes the use of bones in a greater proportion to produce less fat content.

3.1.4. Thiobarbituric acid (TBA)

The TBA number is a rancidity test that can be used on various materials. TBA testing is a specific test for the oxidation results of unsaturated fatty acids. The results of the analysis of TBA numbers for shredded catfish with long frying treatment and the proportion of bone: meat for catfish ranged between 0.09-0.38 mg.MDA/Kg. The results of the TBA number analysis can be seen in Table 1.

Based on the results of the analysis, it can be seen that the frying time treatment of 60 minutes and the proportion of bone catfish meat (70:30) produced the lowest TBA figure of 0.09 mg.MDA/Kg, while the frying time treatment was 120 minutes, the proportion of bone: catfish meat (30:70) produced the highest TBA figure of 0.38 mg.MDA/Kg. The longer the frying of the catfish floss, the greater the proportion of catfish bones, and the smaller the proportion of meat added, the lower the TBA number in the catfish floss. The longer the frying time, the more the TBA number increases due to oxidation, so the fat contained in the floss is damaged, causing the taste and rancid aroma. The hydroperoxides formed in the previous reaction are unstable, so they can decompose quickly and form secondary compounds such as aldehydes, ketones, acids and esters, which cause a rancid aroma. The TBA number indicates damage to a material characterized by a putrid odour. Oxidation begins with the formation of peroxides and hydroperoxides. The next level is the decomposition of fatty acids accompanied by the conversion of hydroperoxides into aldehydes, ketones and free fatty acids [17].

Catfish floss with a higher proportion of meat has a higher fat content, resulting in a higher TBA. The higher the TBA value, the lower the quality of the shredded product. According to the literature, catfish meat has a fat content of 14.56% [8], while catfish bones have a fat content of 8.7% [13]. High-fat content can cause an increase in TBA numbers because when frying, free fatty acids are formed. The greater the proportion of catfish meat added, the higher the shredded fat content. This is because the fat content in beef is higher than in fish bones. This follows the literature statement that fat will be degraded into fatty acids so that the TBA number increases with the fat content [18].

3.2. Sensory Analysis

To determine the effect of long frying treatment and the proportion of bone: catfish meat on the sensory properties of catfish floss by distributing questionnaires to 25 panellists using a scoring test method on color and aroma parameters.

Table 2. Average scoring test for color and aroma of catfish floss

Treatment	Color	Aroma
A1B1	1.28 ± 0.46^{a}	4.48 ± 0.51^{f}
A1B2	1.60 ± 0.50^{b}	4.32 ± 0.48^{f}
A1B3	2.32 ± 0.56^{c}	3.84 ± 0.69^{e}
A2B1	2.72 ± 0.46^{d}	3.16 ± 0.55^{d}
A2B2	3.04 ± 0.68^{e}	3.00 ± 0.76^{cd}
A2B3	3.28 ± 0.46^{e}	2.80 ± 0.50^{c}
A3B1	3.76 ± 0.44^{f}	2.40 ± 0.50^{b}
A3B2	3.92 ± 0.64^{f}	1.72 ± 0.46^{a}
A3B3	4.52 ± 0.65^{g}	1.56 ± 0.51^{a}
Colour Description:		Aroma description:
1 = yellow		1 = very burnt
2 = slightly dark yellow		2 = burnt
3 = light brown		3 = slightly burnt
4 = brown		4 = a bit burnt
5 = slightly dark brown		5 = not burnt

The scoring test on the color of shredded catfish using long frying treatment and the proportion of bone to the meat of catfish obtained an average value of between 1.28-4.52. The long frying treatment of 120 minutes and the proportion of bone: catfish meat (70:30) got the highest score with an average value of 4.52 (slightly dark brown), while the long frying treatment was 60 minutes and the proportion of bone: catfish meat (30: 70) got the lowest score with an average value of 1.28 (yellow). The smaller the proportion of bones, the higher the color scoring value. The increase in colour value indicates that the colour of the resulting shredded meat is getting darker brown. The dark color change can be caused by long frying; heating causes a browning reaction, so if heating continues for a long time, the browning reaction will take longer. This is in accordance with the literature that the

Maillard reaction will occur at high temperatures due to frying, namely a non-enzymatic browning reaction due to the reaction between proteins in meat and reducing sugars [19].

The scoring test on the aroma of shredded catfish using long frying treatment and the proportion of bone to meat of catfish obtained an average value of between 1.56-4.48. The long frying treatment of 60 minutes and the proportion of bone: catfish meat (30:70) got the highest score with an average value of 4.48 (slightly burnt), while the long frying treatment was 120 minutes and the proportion of bone: catfish meat (70:30) got the lowest score with a mean value of 1.56 (very burnt). The longer the process of frying shredded meat, the greater the proportion of bones, and the lesser the proportion of meat, the more the value of liking the aroma decreases. This is because the longer the heating takes, the fish's distinctive aroma disappears because the resulting shredded meat is burnt, so the resulting aroma smells slightly burnt. According to the literature, the longer the frying time, the more the aroma of the resulting product will change [12]. Frying will produce a burning effect (off flavour). This is supported by other literature showing that changes in physical, chemical, and sensory properties occur during frying [19].

Apart from the heating time, the proportion of meat also determines the preferred aroma of shredded beef. The greater the proportion of meat, the more distinctive the resulting aroma. This is because fish meat contains protein, which contains amino acids that contribute to the aroma compounds produced in an ingredient. This follows the literature that the greater the proportion of fish meat, the more the aroma of shredded meat is preferred. Apart from the proportion of meat and bone, the spices used in shredded meat also affect the aroma of shredded meat [12].

4. CONCLUSION

There is a real interaction between the long frying treatment and the proportion of bones and meat of catfish on water content, ash content, fat content, TBA number and scoring of color and taste of catfish floss. The best treatment is shredded catfish with a frying time of 60 minutes and the proportion of bone to catfish meat (30: 70), which produces a water content of 8.81%; ash content 7.04%; fat content 27.02%; TBA figure 0.18 mg.MDA/kg; color scoring test 1.28 and aroma 4.48.

ACKNOWLEDGMENT

Thank you to the lectures of Food Technology at Universitas Pembangunan Nasional "Veteran" Jawa Timur for providing direction and support in writing this manuscript.

REFERENCE

[1] Hendrawan, AK, Soolany, C., Aji, DO, Al Ahmad, FK, and Rohman, SH 2022. Training in Making Technology-Based Catfish Shredded Fish Products to Increase Income in the Balepa Farmer Group, Bulupayung Village, Kesugihan District, Cilacap Regency. Abditeknoyasa Community Service Journal. Vol 3(2), 18-123

[2] Maritime Affairs and Fisheries Service. 2020. Marine and Fisheries Statistics for East Java Province. Surabaya: East Java Province Maritime and Fisheries Service

[3] Suprihatin., Edahwati, L and Sutiyono. 2021. Utilization of Catfish Bone and Spiny Waste into Nutritious Snacks for Catfish Bone Sticks. Journal of Mechanical Engineering Community Service. Vol 1 no 2. Pp 8-12

[4] Astiadi. 2022. Feasibility Analysis of the Milkfish Bone Floss (Chanos-chanos) Business in Tanralili District, Maros Regency. Thesis. Faculty of Marine and Fisheries Sciences. Hasanuddin University. Macassar.

[5] Miranti, Danil, M., Nuh, M., Barus, WBJ, & Novrini, S. 2022. Training in Making Catfish Shredded Fish for Pkk Women and the Community in the Ptpn Iii Mount Pamela Environment, North Sumatra. UISU Journal, 59–66.

[6] Edahwati, L., Sutiyono, Asrori, & Khadik, M. 2020. Efforts to Increase the Selling Value of Catfish (Clarias Gariepinus) into Shredded Fish. Jatekk Journal of Chemical Engineering Community Service, 01(1), 6–11.

[7] Sundari, RS, Umbara, DS, Fitriadi, BW, & Sulaeman, M. 2019. Consumer Preference on Catfishes (Patin and Lele) Sweetmeat Product. Journal of Physics: Conference Series, 1179(1).

[8] El-Shennawy EA, Ez-El-Rigal AI, Sulieman AM, and El-Badwi AA,. 2017. Improving Quality Properties of Catfish Mince. Food and Diary Research. Vol. 44. No. (6B).

[9] Bechtel, PJ, Watson, MA, Lea, JM, Bett Garber, KL, and Bland, JM 2019. Properties of bone from Catfish heads and frames. Food Science & Nutrition, 7(4), 1396–1405.

[10] Setyani, S., Rusdin, I., and Kusumaningrum, I. 2022. The Effect of Comparative Formulas for Meat and Bones for Catfish and Yellow Pumpkin on the Sensory Characteristics of Fish Snacks. Journal of Tropical Agrifood vol 4(2). 77-82

[11] Anwar C., Irhami, Kemalawaty M.,. 2018. The Effect of Fish Type and Frying Method on the Quality of Fish Floss. Journal of Fishery Products Technology. Vol. 7.No. 2. Page:138-147.

[12] Gaga, L., Tahir, M. and Antuli, Z. 2022. The effect of frying time on the physicochemical characteristics of snakehead fish (Channa striataI) floss with banana heart substitution. Jambura Journal of Food Technology Vol 4(1).

[13] Mahmoodani F., Ardekani .VS, See SF, Yusup SM, Babji AS,. 2014. Optimization and Physical Properties of Gelatin Extracted from Pangasius Catfish (Pangasius sutchi) bones. J. Food Sci Technol.

[14] Kasmiati, Nurfitri, E., Asnani, Suadi, and Amir, H. 2020. Quality and Level of Consumer Preference for Fly Fish Floss (Decapterus sp). Journal of Indonesian Fishery Product Processing, 23(3), 470-478.

[15] Aditya HP, Herpandi, Lestari S.,. 2016. Physical, Chemical and Sensory Characteristics of Fish Floss from Various Low Economic Fish. Journal of Fishery Products Technology. Vol. 5. No.1. Page: 61-72.

[16] Cintia, Meylla. 2018. Dissemination of the Best Formulation for Making Pelagic Fish Shreds (Case Study of UKM KaTaMer, Rajegwesi). Thesis. Brawijaya University.

[17] Husna and Nurlela. 2020. Analysis of Peroxide Number on the Quality of Cooking Oil Before and After Repeated Use. Redox Journal. Vol.5, No.1.

[18] Riyandi, DF, Sya'di, YK, and Nurhidajah. 2022. Total Bacteria, TBA Number and Sensory Properties of White Basic Paste Seasoning Based on Storage Time. Journal of Food and Nutrition. Vol. 12, No. 1.

[19] Muchtadi, TR and F. Ayustaningwarno. 2008. Food Processing Technology. Bandung: Alphabeta.

 https://doi.org/10.29165/ajarcde.v8i2.424