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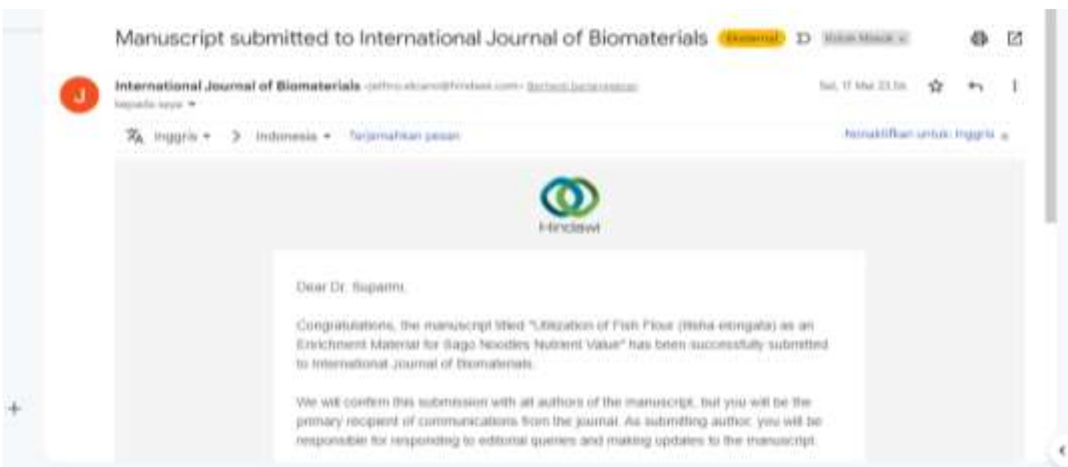

Utilization of *Biang* Fish Flour (*Ilisha elongata*) as an Enrichment Material for Sago Noodles Nutrient Value

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ABSTRACT

This study aims to determine the appropriate concentration of lead fish meal for enriching the nutritional value of sago noodles favored by consumers. The method used is an experimental design using Completely Randomized (CRD) with 4 concentration levels of lead fish meal, namely 4% without a lead fish meal (M0), 6% (M1), 8% (M2), 10% (M3).The Analysis form sagoo noodles were rendement, proximate by AOAC method, amino acids by HPLC, fatty acids by GC, and minerals by HPLC. The results of the study getting the best treatment was a concentration of 8% (M2) with the characteristics of whole sago noodles appearance, attractive, grayish-white color; has a distinctive aroma of sago noodles with a hint of fish; specific taste typical of sago noodles and fish prickly taste, delicious; slightly chewy texture. Sensory evaluation with a taste value of 8.9, aroma 8.6, visual value of 8.9, and texture value 8.8. its nutritional content is 5.58% protein content; air 22.35%; ash 1.69%; fat 1.41%, carbohydrates 68.29%. The proximate values are protein 5.58%, water content 22.35%, ash 1.69%, fat content 1.41%, carbohydrates (different) 68.29% . The mineral content is Ca.P. I, Mg, Zn, and Fe. Amino acids consist of 8 types of essential amino acids namely histidine, arginine, threonine, valine, alanine, methionine, isoleucine, leucine, phenylalanine, and 7 types of nonessential amino acids namely aspartic acid, glutamic acid, serine, glycine, tyrosine. Its fatty acid profile has 13 components of unsaturated fatty acids and 17 components of saturated fatty acids.

Keywords : Fortification, lead fish meal, characteristics, sago noodles, acceptability

1. INTRODUCTION

Sago noodles as special food and in demand by the community, especially Kab. Meranti Islands, Riau Province, Indonesia, this is because noodles are easy to serve, durable, and relatively cheap (Suparmi *et al*., 2020). Indonesian people have experienced changes in consumption patterns, namely by make noodles as a companion or substitute for rice. Sago noodles are made from sago flour which contains 84.7% high carbohydrate content, and 353 kcal energy, but has a low protein content of 0.7%, 0.2% fat content, and low mineral content. However, sago flour as the basic ingredient for making noodles has several advantages compared to other flours, namely, it contains undigested starch and is beneficial for digestive health, namely "resistant starch" (RS) which has effects such as dietary fiber and the use of fishery products in the form of fortification can increase the added value of the product (Suparmi *et al*., 2019).

Process production sago noodels can be produce with applicable technology and several raw material, example surimi powder and addition fish meal (Santana *et al*. 2021;Chin *et al*. 2012). Efforts to increase the nutritional value of sago noodles are by fortifying using highly nutritious ingredients such as fish meal, which has a high nutritional content where the protein content reaches 73.0%, water content 7.12-7.88%, ash content 12.97>11.89% fat content is 8% and has minerals that are important for the growth and development of the body, among others, the fish meal contains calcium (Ca) 8397-8402 mg/kg, phosphorus (P) 169 -183 mg/kg, Iodine (I) 189.44-190.16 mg/kg, magnesium (Mg) 141.32-141.88 mg/kg, zinc (Zn) 152.07-153.02 mg/kg, and iron (Fe) 15.76-15.93 mg/kg, therefore this lead fish meal has the potential to be developed, as well as being able to act as a fortification of other food products based on the fish meal as an effort to increase the nutrition of protein-rich foods (Sumarto *et al*., 2020). Fish meal from biang fish which is a endemic fish Riau Province that content high protein.

Addition of processed fish-based products is one of the efforts to increase fish consumption in the community. Processed fish products developed must lead to products that can be eaten immediately (ready to eat), are easy to carry, and do not take long to cook. Therefore, this study aimed to determine the concentration of the main flour in increasing the nutritional value of sago noodles.

2. MATERIALS AND METHOD

2.1 Material and Tools

The main ingredients used in this study were 50 kg of fresh pike fish size 77-95 g, water, and sago flour. The chemicals used for proximate analysis were methanol, sodium acetate, triethylamine, sulfuric acid, aquades, eluent, sodium acetate buffer, boric acid, sodium hydroxide, hydrochloric acid, PP indicator, diethyl ether, catalyst, and blue reagent.

The tools used in this research are oven, grinder, blender, jar, tray, 80 mesh sieve, basin, spoon, knife, presto, analytical scale, sago noodle ampia machine, sago noodle printing machine, frying pan, pan, basin, dough machine, sago noodles, plastic packaging, label paper, gas stove, stove, and press.

2.2 Research methods

The method used in this research is an experimental design. The research method includes Manufacture of lead fish meal and making sago noodles fortified fish flour.

2.2.1 Manufacture of lead fish meal (Sumarto et al., 2018)

The whole gizzard was removed and washed thoroughly, then pressed for 60 minutes, then dried using an oven for 48 hours at 44.20C, and made flour using a blender. To obtain a uniform flour grain size, filtering is carried out using an 80 mesh sieve.

2.2.2 Making Sago Noodles Fortified Fish Flour

The gelatinization process of sago flour is done by adding a little water to the sago flour (the process of moisturizing the material) until smooth, then the flour is roasted/roasted for about 5-10 minutes. The process of mixing noodle dough ingredients (formulation of ingredients: sago flour 500 g, water 150 mL, a fish meal with treatment level For the M0 treatment, namely without a fish meal, M1 fish meal 6%, M2 fish meal 8%, M3 flour fish starter 10%. Stirred until perfect gelatinization is formed. Then the dough is in the form of small balls and placed in plastic to give a boundary. Printing of dough The dough is formed into small circles and delimited and then printed using amphia to form a sheet.

The results of the dough mold (in long plastic sheets), then a short boiling process is carried out by inserting the dough mold in a container filled with boiling water until cooked, marked with a brownish yellow color (1-2 minutes). The process of draining and aerating in a closed room for 12 minutes. o'clock. The formulation of the fortified sago noodles of the prickly fish flour can be seen in Table 2**.**

Table 2. The formula for making sago noodles

Material	Unit	Treatment			
		M_0	M_1	M_2	M_3
Sago flour	g	500	500	500	500
Biang fish flour	% (b/b)	0	6	8	10
Water	mL	150	150	150	150

2.3 Procedure analysis

2.3. 1. Organolpetic test (SNI 01-6683-2002)

The organoleptic test was carried out by 25 moderately trained panelists to test the quality of sago noodles fortified with lead fish meal. The organoleptic test usually aims to determine the panelists' response to the general quality properties of color, aroma, texture, and taste by using a score sheet on a scale of 1 as the lowest value and 9 for the highest value.

2.3.2 Proximate Analysis (AOAC 2005)

Proximate analysis includes moisture, ash, protein, fat, and carbohydrate content.

2.3.2.6 Analysis of calcium levels (Ratnawati et al., 2014)

Calcium level testing The determination of calcium levels was carried out by measuring the wet digested sample using an Atomic Absorption Spectrophotometer (AAS) at a wavelength of 420 nm. The calcium content was tested referring to the modified method. Analysis of the calcium content of the sample was carried out by weighing 0.1 g of the fine sample and transferring it to a 100 mL volume Kjeldahl flask. Sample destruction was carried out by fortifying 15 mL of hydrochloric acid (HCl). The solution was digested until it became clear and then cooled. The filtered volume is calibrated to 100 mL and ready to be measured on AAS.

2.3.2.7 Analysis of phosphorus levels (Ratnawati *et al*., 2014)

Phosphorus content was detected using a U-VIS spectrophotometer, in which the test method referred to was modified. The sample was weighed as much as 5 g, added 20 mL of concentrated HNO_3, then boiled for 5 minutes and cooled, then added 5 mL of concentrated sulfuric acid (H_2SO_4). The solution was heated and refined (digestion) with HNO_3 fortification drop by drop until the solution was colorless, followed by heating until white smoke appeared and cooled. Add 15 mL of distilled water to the beaker and boil again for 10 minutes. A total of 10 ml of the sample solution was put into a 100 mL volumetric flask. Then 40 mL of distilled water and 25 mL of vanadate molybdate reagent were added to the measuring flask and diluted to the mark. The absorbance value of the solution was measured by a spectrophotometer at a wavelength of 400 nm.

2.4 Analysis Data

The experimental design used was a non-factorial Completely Randomized Design (CRD) with 4 levels, namely M0; (without fish meal), M1 (6% fish meal), M2 (8% fish meal), M3 (10% fish meal) Then, each treatment was repeated 3 times. Organoleptice tes with kruskal wallis test with 30 untrained panelist.

3. RESULT AND DISCUSSION

3.1 Characteristics of Mi sago fortified with Fish Flour.

The results of the assessment of the characteristics of sago noodles fortified with fish meal from organoleptic parameters, proximate, mineral content and amino acid content can be seen in the following description.

3.1.1 Sensory Evaluation.

The results of the organoleptic test analysis of the fortified sago noodles of starter fish meal can be seen in Table 3.

Table 3. The average organoleptic value of fortified sago noodles from fish meal

Treatment	Parameters

	Appearances	Odor	Taste	Texture
M_0	5.03[d]	5.16[c]	5.83[a]	5.24[c]
M_1	5.99[c]	5.99[b]	7.93[c]	5.99[b]
M_2	8.19[b]	8.45[b]	8.48[c]	8.35[b]
M_3	6.96[a]	5.09[a]	6.67[b]	6.61[a]

Description: M0 (control), M1 (fish meal 6%), M2 (fish meal 8%), M3 (fish flour 10%)

Mean values; the different letters within the same column represent significantly different values ($p<0.05$)

In Table 3, the average value of the appearance of sago noodles with the fortification of starter fish meal ranged from 5.03-8.19. The highest average appearance value was found in sago noodles without fortification of lead fish meal M2 (8.19) with intact, attractive characteristics, bright white color, and the lowest M0 (5.03) with characteristics of being easily broken cracked, less attractive, and dull white. M1 (5.99) with intact characteristics, somewhat attractive, slightly bright white color, and M3 (6.96) with intact characteristics, easy to break, slightly attractive, slightly bright white color.

The results showed that there was an effect of fortification of the lead fish meal on the organoleptic quality characteristics (appearance, smell, taste, and texture) of sago noodles. Sago noodles fortified with 8% fish meal had the best appearance, taste, aroma, and texture values from all treatments. This is the opinion of Rumapar (2015), which states that the limit on the amount of fortification of scad fish meal if the amount is > 8% causes the low organoleptic value of noodles. According to Suparmi *et al*., (2020) the higher the fortification of fish meal on sago noodles will produce an appearance that makes the sago noodles pale and not bright so that the visual value of fish meal fortified sago noodles shows differences, where the appearance of each treatment will become paler. and not bright.

The phenomenon of change in organoleptic value is caused by a non-enzymatic reaction (Maillard reaction). Maillard reactions can be triggered by heating at high temperatures, such as roasting, frying, roasting, and cooking processes (Kusnandar, 2010).

3.1.2 Proximate

The data from the proximate analysis of sago noodles fortified with fish meal can be seen in Table 4.

Table 4. The results of proximate analysis of sago noodles fortified with Biang fish meal

Proximate	M_0 (0%)	M_1 (6%)	M_2 (8%)	M_3 (10%)

Moisture	22.65±0.1	22.35±0.4	21.72±0.3	21.04±0.15
Ash	0.72 ±0.3	1.69±0.21	2.15±0.4	2.43±0.25
Protein	0.45 ±0.4	5.58±0.2	6.34±0.26	7.49±0.34
Fat	0.33 ±0.2	1.45±0.22	1.5±0.13	1.69±0.13
Carbohydrate	75.85±0.3	68.93±0.4	68.29±0.21	67.35±0.23

Description: M0 (control), M1 (fish meal 6%), M2 (fish meal 8%), M3 (fish flour 10%)

Table 4 shows that the average protein content of sago noodles fortified with the prickly fish meal with different concentrations ranges from 0.45-7.49%. The highest average protein content was found in sago noodles with 10% lead fish meal fortification (M3) which was 7.49% and the lowest protein was found in treatment (M0) which was 0.45%. The results of the analysis of variance showed that the fortification of the lead fish meal had a significant effect on the protein content of sago noodles, where Fcount (610.42) > Ftable (4.07) at the 95% confidence level. M0 (0.45%) was significantly different from the treatment M1 (5.58%), M2 (6.34%), and M3 (7.49).

The results showed that the fortification of lead fish meal in sago noodles had a significant effect on the average value of protein content in sago noodles. The higher the amount of fish meal fortified in sago noodles, the higher the average protein content, because the protein content of the fish meal reaches 73.0% (Sumarto *et al*., 2018). Furthermore, Asikin *et al*., (2019), stated that fish contains high protein and is composed of amino acids that the body needs for growth. Fish protein is very easy to digest and absorb by the body. The protein content of sago noodles fortified with Biang fish meal in the M1, M2, and M3 treatments had met the SNI requirements of 3% (SNI 01-2987-1992).

Based on the results of the water content test in Table 4, shows that the average value of the water content of sago noodles fortified with different concentrations of fish meal is between 21.04-22.65%. The highest water content was found in sago noodles without fortification of 0% fish meal (M0), which was 22.65%, the lowest was found in sago noodles with the fortification of 10% fish meal (M3), which was 21.04%. The results of the analysis of variance showed that the fortification of the lead fish meal had a significant effect on the water content of sago noodles, where Fcount (5.59) > Ftable (4.07) at the 95% confidence level. The results of the further BNJ test showed that each treatment had a significantly different water content. The results of this study indicate that the greater the concentration of fortified starter fish meal in sago noodles, the lower the water content of sago noodles. According to Dewita *et al*., (2014), this is due to the hygroscopic fortification of fish meal which is a binder used by the food industry to bind/absorb the water content in the dough. However, the average water content value of sago noodles is still acceptable because based on the maximum standard it is still in accordance with the standard SNI 01-2987-1992, the moisture content of semi-wet noodles is 20-35% (SNI, 1992).

Based on Table 4, it shows that the average fat content of fortified sago noodles with different concentrations of starter fish meal is between 0.36-1.69%. The highest average fat content was found in sago noodles with 10% (M3) fortification of starter fish meal. Meanwhile, the lowest average fat content was found in sago noodles without fortification of M0 starter fish meal (0%).

The results of the analysis of variance showed that the fortification of the lead fish meal had a significant effect on the fat content of sago noodles, where Fcount (87.94) > Ftable (4.07) at a 95% confidence level, further BNJ test found that the treatment M0 (0.33 %) was significantly different from the treatment of M1 (1.45%), M2 (1.59%) and M3 (1.69%). M1 (1.45) was not significantly different from M2 (1.59%), and M2 (1.59%) was also not significantly different from M3 (1.69%).

The results showed that the fortification of the root fish meal in sago noodles had a significant effect on the average value of fat content in sago noodles. The higher the amount of fish meal fortified in sago noodles, the higher the average value of the fat content, because the fat content of the fish meal is between 5.96-6.69% (Suparmi *et al.*, 2021[b]). Fat content is very influential on the durability of the material, if the fat content of the material is high it will accelerate rancidity due to fat oxidation (Ketaren, 2005). The fat content of sago noodles fortified with fish meal in all treatments had met the SNI requirements of <7% (SNI 01-298730 1992).

Based on Table 4, it shows that the average value of ash content of sago noodles fortified with different concentrations of fish meal is between 0.72-2.43%. The highest average ash content was found in sago noodles with the fortification of lead fish meal 10% (M3), which was 2.43%. Meanwhile, the lowest average ash content was found in sago noodles without fortification of lead fish meal (M0), which was 0.72%.

The results of the analysis of variance showed that the fortification of the lead fish meal had a significant effect on the ash content of sago noodles, where Fcount (290.89) > Ftable (4.07) at a 95% confidence level, the results of the BNJ follow-up test showed that the treatment was M0 (0.72%) was significantly different from the treatment of M1 (1.69%), M2 (2.15%), and M3 (2.43%). While the treatment M2 (2.15%) was not significantly different from P3 (2.43%). The results showed that there was an effect of fortification of lead fish meal on the average value of ash content in sago noodles. The higher the amount of fortified fish meal, the higher the average ash content. This is because the mineral content in the lead fish meal reaches 2.94bb% (Nurjanah *et al*., 2019). According to Winarno (2002), most foodstuffs (96%) consist of organic and water. In the process of processing (burning) organic matter burns but inorganic substances do not, therefore higher levels of mineral elements are detected. The results showed that the ash content produced was in accordance with the quality standard of semi-wet noodles, namely a maximum of 3% (SNI 01-2987-1992).

Based on Table 4, it shows that the average value of carbohydrate content of sago noodles fortified with different concentrations of fish meal is between 67.35-75.85%. The highest average carbohydrate content was found in sago noodles with the fortification of 0% lead fish meal (M0), which was 75.85%. While the lowest average is (M3), which is 67.35%. The results of the analysis of variance showed that the fortification of lead fish meal had a significant effect on the carbohydrate value of sago noodles, where F count (202267.53) > Ftable (4.07) at a 95% confidence level.

From the results of the study, it was known that the fortification of the root fish meal in sago noodles had a significant effect on the average value of carbohydrate content in sago noodles. The higher the amount of fermented fish meal fortified in sago noodles, the lower the average value of the carbohydrate content, due to the reduced product constituent components which are a source of carbohydrates. carbohydrates that are high in sago starch (Lawalata, 2004). The carbohydrate content of fortified sago noodles from the starter fish meal in all treatments had met the SNI requirements, which was 86.9% (SNI 01-3451-1992).

Based on the characteristics of the organoleptic and proximate parameters, it can be seen that the M2 treatment, namely the formulation of 8% fortification of lead fish meal in sago noodles, was a treatment that met the standards and was continued to analyze the parameters of mineral content, fatty acids, and amino acids.

3.1.3 Mineral Content of Fortified Sago Noodles Starfish Flour 8%

Based on the mineral analysis that has been carried out on sago noodles with the fortification of 8% lead fish meal, the average results of the mineral analysis are shown in Table 5.

Table 5. Mineral Content of 8% Fortified Sago Noodles Fish Flour

Minerals	Mo(%)	M_2(%)
Calsium (mg/kg)	1131±0.8	8402±0,65
Phosfore (%)	111.14±0,2	183±0,34
Iodium (I)	118±0,5	190.16±0,56
Magnesium (mg/kg)	20.4±0,7	141.88±0,4
Zinc (Zn) (mg/kg)	102.6±0,13	153.02±0,24
Iron (Fe) (mg/kg)	10.4±0,25	15.93±0,21

Based on Table 5, shows that the mineral is Ca.P. I, Mg, Zn, and Fe sago noodles fortified with the lead fish meal with a concentration of 8%. The results showed that the fortification of lead fish meal in sago noodles had a significant effect on the average value of calcium levels in sago noodles. The higher the amount of fish meal fortified in sago noodles, the higher the average calcium content, because the calcium content of the fish meal reaches 8397 mg/kg (Hidayat *et al*., 2013).

3.1.4 Amino Acid Content of Fortified Sago Noodles Starfish Flour 8%

The results of the amino acid analysis of sago noodles fortified with 8% Biang fish meal can be seen in Table 6.

Table 6. Amino acid profile of Sago Noodles Fortification of prickly fish meal

Amino acids	M_0(%)	M_2(%)
1 Aspartic acid	0.15±0.1	0.50±0.3
1. Threonine*	0.07±0.3	0.24±0.1
2. Serine	0.06±0.4	0.20±0.2
3. Glutamate	0.00±0.6	0.88±0.13
4. Glysine	0.08±0.3	0.26±0.2
5. Alanine	0.10±0.2	0.32±0.3
6. Valine*	0.10±0.4	0.32±0.5
7. Methione*	0.24±0.1	0.72±0.56
8. Ileusine*	0.07±0.3	0.24±0.4
9. Leusine*	0.12±0.34	0.40±0.3
10. Tyrosine	0.02±0.25	0.08±0.2
11. Phenylalanine*	0.05±0.2	0.18±0.34
12. Histidine*	0.18±0.15	0.60±0.2
13. Lysine*	0.12±0.4	0.58±0.2
14. Arginine	0.06±0..3	0.66±0.6
15. Total amino acids (%)	1.275±0.24	6.18±0.3
AA essensial (%)	0.95±0.27	3.60±0.2
AA non essensial (%)	0.325±0.35	2.58±0.15

*amino acids essential

In Table 6 it can be seen that the types of amino acids for fortified sago noodles from fish meal consist of 8 types of essential amino acids, namely histidine, arginine, threonine, valine, alanine, methionine, isoleucine, leucine, phenylalanine. There are 7 types of non-essential amino acids, namely aspartic acid, glutamic acid, serine, glycine, and tyrosine. In accordance with the results of Suparmi *et al.*, (2021[b]) research, most of these amino acids were detected in fishery commodities. Based on the amount of amino acid content, 8% fortified sago noodles can be classified as nutritious food because it contains complete amino acids.

According to Nurjanah *et al*., (2015), each essential amino acid has a special function, namely as a cell-forming and can also be useful as a flavor giver. In line with the opinion of Abdullah *et al.*,(2017) that the use of amino acids can be seen from the characteristics of the taste, some amino acids have a sweet taste, a bitter taste, and some have no taste. Glycine, proline, alanine, hydroxyproline, valine, and serine have a sweet taste. Isoleucine and arginine have a bitter taste, a savory taste caused by glutamic acid, and leucine is tasteless.

3.1.5 Fatty Acid Content of Fortified Sago Noodles Starfish Flour 8%

Table 7 shows that the fatty acid profile in fortified sago noodles from 8% fish meal shows a balanced portion of unsaturated and saturated fatty acids. The content of fatty acids in 8% fortified sago noodles from prickly fish flour has 13 components of unsaturated fatty acids while saturated fatty acids have 17 components. The results of the analysis show that the fatty acid profile shows a balanced portion between unsaturated fatty acids and saturated fatty acids.

Table 7. The fatty acid content of sago noodles fortified with 8% fish meal

Fatty acids	M_0 (%)	M_2 (%)
1. Caprylic Acid, C8:0	0.061±0.1	0.189±0.3
2. Lauric Acid, C12:0	0.008±0.2	0.024±0.4
3. Tridecanoic Acid, C13:0	0.00±0.3	0
4. Myristic Acid, C14:0	0.15±0.23	0.51±0.12
5. Myristoleic Acid, C14:1	0.004±0.4	0.0156±0.1
6. Pentadecanoic Acid, C15:0	0.06±0.56	0.27±0.1
7. Palmitic Acid, C16:0	0.59±0.2	2.97±0.3
8. Palmitoleic Acid, C16:1	0.13±0.14	0.42±0.2
9. Heptadecanoic Acid, C17:0	0.07±0.45	0.21±0.25
10. Cis-10-Heptadecanoic Acid, C17:1	0.03±0.3	0.09±0.3
11. Stearic Acid, C18:0	0.50±0.27	1.8±0.6
12. Elaidic Acid, C18:1n9t	0	0
13. Oleic Acid, C18:1n9c	0.75±0.3	0.46±0.5
14. Linolelaidic Acid, C18:2n9t	0.02±0.1	0.06±0.6
15. Linoleic Acid, C18:2n6c	0.06±0.5	0.18±0.3
16. Arachidic Acid, C20:0	0.02±0.4	0.06±0.2
17. y-Linolenic Acid, C18:3n6	0.00±0.3	0
18. Cis-11-Eicosenoic Acid, C20:1	0.04±0.2	0.03±0.1
19. Linolenic Acid, C18:3n3	0.011±0.25	0.039±0.4
20. Heneicosanoic Acid, C21:0	0.008±0,4	0.024±0.5
21. Cis-11,14-Eicosedienoic Acid, C20:2	0.022±0.3	0.066±0.34
22. Behenic Acid, C22:0	0.025±0.25	0.081±0.1
23. Cis-8,11,14-Eiosetrienoic Acid, C20:3n6	0	0
24. Cis-11,14,17-Eicosatrienoic Acid Methyl Ester, C20:3n3	0	0
25. Arachidonic Acid, C20:4n6	0.026±0.1	0.093±0.4
26. Tricosanoic Acid, C23:0	0.	0
27. Cis-5,8,11,14,17-Eicosapentaenoic Acid, C20:5n3	0.24±0.1	1.14±0.46
28. Lignoceric Acid, C24:0	0.015±0.2	0.045±0.3
29. Nervonic Acid, C24:1	0,011±0.1	0.033±0.21
30. Cis-4,7,10,13,16,19-Docosahexaenoid Acid, C22:6n3	0,41.23±0.25	1.26±0.1
Total fatty acids (%)	2.8015±0.2	9.845±0.32

4. Conclusion

Based on the results of the study, it can be concluded that the fortified sago noodles of sago fish meal had a significant effect on the organoleptic characteristics and its proximate content, the best treatment was fortified sago fish meal 8%. Hedonic test with a taste value of 8.9, aroma 8.6, the visual value of 8.9, and texture value of 8.8. The mineral content is Ca.P. I, Mg, Zn, and Fe. Essential amino acids hight content were methionine and non essential amino acids high content were glutamate acid. Beside that, sago noodles high content to EPA and DHA which is good for health.

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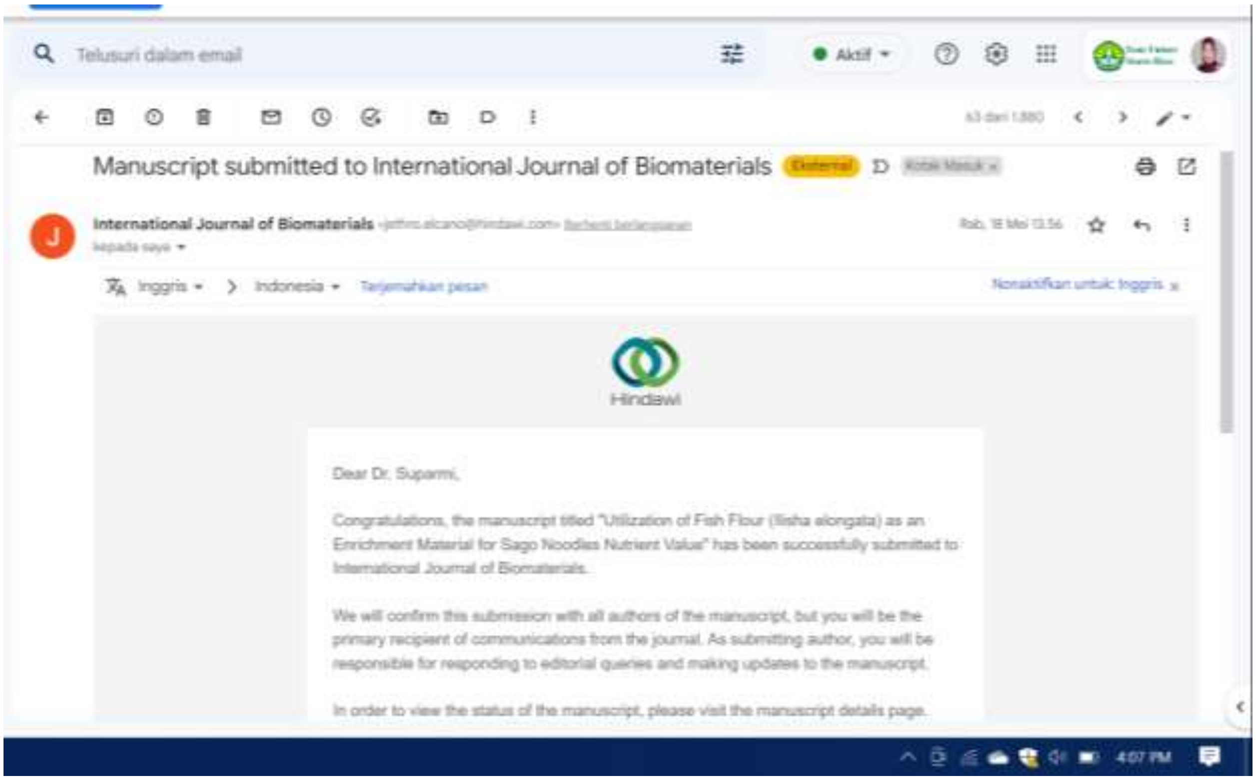
2. Manuscript Submitted (Rabu, 18 Mei 2022)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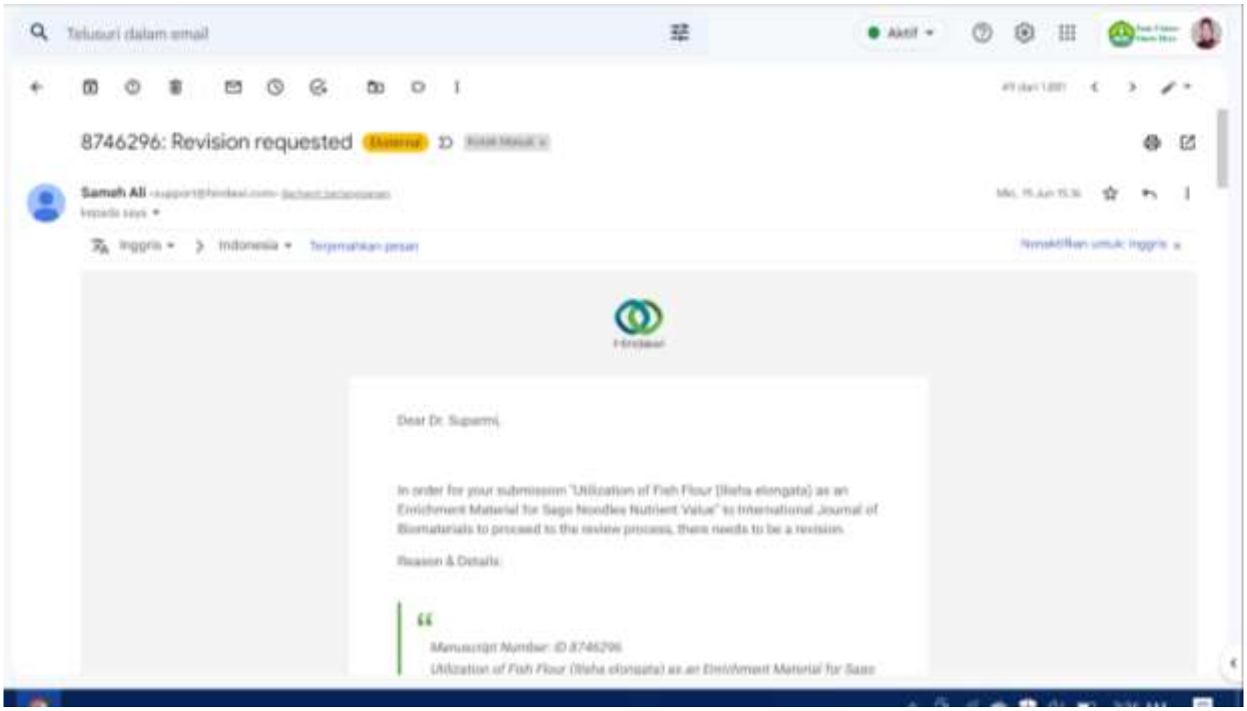

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In order for your submission "Utilization of Fish Flour (Ilisha elongata) as an Enrichment Material for Sago Noodles Nutrient Value" to International Journal of Biomaterials to proceed to the review process, there needs to be a revision.

Reason & Details:

“

Manuscript Number: ID 8746296 Utilization of Fish Flour (Ilisha elongata) as an Enrichment Material for Sago Noodles Nutrient Value Dear Dr Suparmi Suparmi, We have received reviewer reports on your above manuscript. They indicated that it is not acceptable for publication in its present form. However, if you can suitably address the reviewers' comments (included below), I invite you to revise and resubmit your manuscript within July 18, 2022. If you are submitting a revised manuscript, please show the *changes made in the text, either with a different color font or by highlighting the changes (please do not use the Track Changes feature in Microsoft Word) in the revised version. I look forward to receiving your revised manuscript. Yours sincerely, Sameh Ali, Ph.D. Academic Editor International Journal of Biomaterials Editor and Reviewer comments: Reviewer #1: I reviewed this manuscript and it seems this manuscript needed major revision on References list and text. some references in list not available in text, all check of references needed. discussion is poor and it is necessary that more discussion do. author should use some articles published at 2020, 2021 in this field for discussion. overall check of manuscript from point of English language needed. Reviewer #2: General: The English of the manuscript need to improve with the help of professional English editor. Title: Need to state the English name of fish used (Chinese Herring?) Fortification term more suitable than enrichment term. Enrichment term refer to the addition of micronutrients to a food which are lost during processing. Abstract: Need to update and re-arrange for the better appearance of the abstract. Need to highlight statistical analysis of the result, whether any significant difference exists among the samples? Line 16: Need to state the list of analysis conducted. Line 17: Final conclusion need to state at the end of the abstract. Line 30: change the keywords of organoleptic to acceptability Introduction: Line 44: Need to delete the symbol of " ..... " Need to update some old references to updated related references. (Sugiyono et al., 2010). Fish meal generally refer as a low-quality fish powder/flour product for animal consumption. Please refer to the references on high quality fish powder for human consumption (surimi powder). Need to come with global scenario on the fish powder (flour) technology and the need of noodle fortification. Additional references for Introduction: Santana, P. Huda, N., and T. A. Yang. 2012. Technology for production of surimi powder and potential of applications: A review. International Food Research Journal. 19 (4): 1313-1323. Chin, C. K., N. Huda and Yang, T. A. 2012. Incorporation of surimi powder in wet yellow noodles and its effects on the physicochemical and sensory properties. International Food Research Journal. 19(2):701-707. Materials and Methods Line 68: Need to state the dimension of fish used (average individual weight and length). Line 83: 2.2.1 Fish flour preparation. Gizzard normally refer to internal organ of poultry. Please use proper term of removing internal organ of fish. What is the objective of 60 mnts pressing on washed fish (eviscerated fish?) Line 91: Table 2. Biang fish flour? Please* *provide detail formulation for noodle preparation. Line 95: Noodle preparation? Please provide reference(s) for noodle preparation. Line 111: Organoleptic test. Please revise with updated suitable reference(s) on sensory evaluation Affective test. Line 112: Need to provide details information on how the training conducted to the panellist? Need to stated whether sample permutation and three digit sample code applied during the sensory test? Line 118-198. Proximate analysis. No need to provide details step by step process for proximate analysis. By referring to the AOAC methods, understandable enough for the readers. Line 200: and Line 211: Please check whether the methods of Calcium and Phosphorous analysis was developed by Ratnawati et al., 2014 or by other party as cited by Ratnawati et al., 2014. Need to provide Method of Statistical Analysis conducted. Result and Discussion. Line 232: Table 3. Need to provide Standard Deviation of each treatment. Please use proper symbol for the resulted daya (change 5,03 to 5.03 – applied for all data). Please carefully check the proper sequence of statistical notifications (a, b, c and d). Please check the statistic notification for texture. If 5.99b no difference than 8.35b, also suppose no difference for 6.61a which is between 5.99 – 8.35. Line 260: Table 4. Need to provide Standard Deviation of each treatment. Please provide statistical analysis notification for each resulted data whether any significant difference exist among the treatment? Line 370. Please provide additional one paragraph for discussion of Table 5 result. No evidence that the fortification with fish flour increase the mineral Ca, P, I, Mg, Zn and Fe content of the noodle since the data of mineral content sample M0 was not presented. Statement had a significant effect on…. Need to delete. Line 380: Please check Biang fish meal? Biang stand for? Line 384: prickly fish meat? Please check. Data will meaningful if the data of amino acid composition of the sample M0 was presented and compared with M2 at 8% fortification. Line 412: Table 7. Data will meaningful if the data of fatty acid composition of the sample M0 was presented and compared with M2 at 8% fortification. Conclusion Please limit the conclusion based on the result only. There is no resulted data mentioning the statement attractive, grayish-white sago noodles; has a distinctive aroma of sago noodles with a hint of fish; specific taste typical of sago noodles and fish prickly taste, delicious; slightly chewy texture. References: Need to check the format for References presentation. Need to add with some international publication related with fortification of fish protein on noodle preparation.*

For more information about what is required, please click the link below.

MANUSCRIPT DETAILS

Kind regards,
Sameh Ali

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4. Perbaikan Manuscript (27 Juni 2022)

Utilization of *Biang* Fish Flour (*Ilisha elongata*) as an Enrichment Material for Sago Noodles Nutrient Value

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ABSTRACT

This study aims to determine the appropriate concentration of lead fish meal for enriching the nutritional value of sago noodles favored by consumers. The method used is an experimental design using Completely Randomized (CRD) with 4 concentration levels of lead fish meal, namely 4% without a lead fish meal (M0), 6% (M1), 8% (M2), 10% (M3).The Analysis form sagoo noodles were rendement, proximate by AOAC method, amino acids by HPLC, fatty acids by GC, and minerals by HPLC. The results of the study getting the best treatment was a concentration of 8% (M2) with the characteristics of whole sago noodles appearance, attractive, grayish-white color; has a distinctive aroma of sago noodles with a hint of fish; specific taste typical of sago noodles and fish prickly taste, delicious; slightly chewy texture. Sensory evaluation with a taste value of 8.9, aroma 8.6, visual value of 8.9, and texture value 8.8. its nutritional content is 5.58% protein content; air 22.35%; ash 1.69%; fat 1.41%, carbohydrates 68.29%. The proximate values are protein 5.58%, water content 22.35%, ash 1.69%, fat content 1.41%, carbohydrates (different) 68.29% . The mineral content is Ca.P. I, Mg, Zn, and Fe. Amino acids consist of 8 types of essential amino acids namely histidine, arginine, threonine, valine, alanine, methionine, isoleucine, leucine, phenylalanine, and 7 types of nonessential amino acids namely aspartic acid, glutamic acid, serine, glycine, tyrosine. Its fatty acid profile has 13 components of unsaturated fatty acids and 17 components of saturated fatty acids.

Keywords : Fortification, lead fish meal, characteristics, sago noodles, acceptability

1. INTRODUCTION

Sago noodles as special food and in demand by the community, especially Kab. Meranti Islands, Riau Province, Indonesia, this is because noodles are easy to serve, durable, and relatively cheap [1]. Indonesian people have experienced changes in consumption patterns, namely by make noodles as a companion or substitute for rice. Sago noodles are made from sago flour which contains 84.7% high carbohydrate content, and 353 kcal energy, but has a low protein content of 0.7%, 0.2% fat content, and low mineral content. However, sago flour as the basic ingredient for making noodles has several advantages compared to other flours, namely, it contains undigested starch and is beneficial for digestive health, namely "resistant starch" (RS) which has effects such as dietary fiber and the use of fishery products in the form of fortification can increase the added value of the product [2].

Process production sago noodels can be produce with applicable technology and several raw material, example surimi powder and addition fish meal [3,4]. Efforts to increase the nutritional value of sago noodles are by fortifying using highly nutritious ingredients such as fish meal, which has a high nutritional content where the protein content reaches 73.0%, water content 7.12-7.88%, ash content 12.97>11.89% fat content is 8% and has minerals that are important for the growth and development of the body, among others, the fish meal contains calcium (Ca) 8397-8402 mg/kg, phosphorus (P) 169 -183 mg/kg, Iodine (I) 189.44-190.16 mg/kg, magnesium (Mg) 141.32-141.88 mg/kg, zinc (Zn) 152.07-153.02 mg/kg, and iron (Fe) 15.76-15.93 mg/kg, therefore this lead fish meal has the potential to be developed, as well as being able to act as a fortification of other food products based on the fish meal as an effort to increase the nutrition of protein-rich foods [5]. Fish meal from biang fish which is a endemic fish Riau Province that content high protein.

Addition of processed fish-based products is one of the efforts to increase fish consumption in the community. Processed fish products developed must lead to products that can be eaten immediately (ready to eat), are easy to carry, and do not take long to cook. Therefore, this study aimed to determine the concentration of the main flour in increasing the nutritional value of sago noodles.

2. MATERIALS AND METHOD

2.1 Material and Tools

The main ingredients used in this study were 50 kg of fresh pike fish size 77-95 g, water, and sago flour. The chemicals used for proximate analysis were methanol, sodium acetate, triethylamine, sulfuric acid, aquades, eluent, sodium acetate buffer, boric acid, sodium hydroxide, hydrochloric acid, PP indicator, diethyl ether, catalyst, and blue reagent.

The tools used in this research are oven, grinder, blender, jar, tray, 80 mesh sieve, basin, spoon, knife, presto, analytical scale, sago noodle ampia machine, sago noodle printing machine, frying pan, pan, basin, dough machine, sago noodles, plastic packaging, label paper, gas stove, stove, and press.

2.2 Research methods

The method used in this research is an experimental design. The research method includes Manufacture of lead fish meal and making sago noodles fortified fish flour.

2.2.1 Manufacture of lead fish meal (modification[5])

The whole gizzard was removed and washed thoroughly, then pressed for 60 minutes, then dried using an oven for 48 hours at 44.20C, and made flour using a blender. To obtain a uniform flour grain size, filtering is carried out using an 80 mesh sieve.

2.2.2 Making Sago Noodles Fortified Fish Flour (modification[5])

The gelatinization process of sago flour is done by adding a little water to the sago flour (the process of moisturizing the material) until smooth, then the flour is roasted/roasted for about 5-10 minutes. The process of mixing noodle dough ingredients (formulation of ingredients: sago flour 500 g, water 150 mL, a fish meal with treatment level For the M0 treatment, namely without a fish meal, M1 fish meal 6%, M2 fish meal 8%, M3 flour fish starter 10%. Stirred until perfect gelatinization is formed. Then the dough is in the form of small balls and placed in plastic to give a boundary. Printing of dough The dough is formed into small circles and delimited and then printed using amphia to form a sheet.

The results of the dough mold (in long plastic sheets), then a short boiling process is carried out by inserting the dough mold in a container filled with boiling water until cooked, marked with a brownish yellow color (1-2 minutes). The process of draining and aerating in a closed room for 12 minutes. o'clock. The formulation of the fortified sago noodles of the prickly fish flour can be seen in Table 2**.**

Table 2. The formula for making sago noodles

Material	Unit	Treatment			
		M_0	M_1	M_2	M_3
Sago flour	g	500	500	500	500
Biang fish flour	% (b/b)	0	6	8	10
Water	mL	150	150	150	150

2.3 Procedure analysis

2.3. 1. Organolpetic test [6]

The organoleptic test was carried out by 25 moderately trained panelists to test the quality of sago noodles fortified with lead fish meal. The organoleptic test usually aims to determine the panelists' response to the general quality properties of color, aroma, texture, and taste by using a score sheet on a scale of 1 as the lowest value and 9 for the highest value.

2.3.2 Proximate Analysis [7]

Proximate analysis includes moisture, ash, protein, fat, and carbohydrate content.

2.3.2.6 Analysis of calcium levels [8]

Calcium level testing The determination of calcium levels was carried out by measuring the wet digested sample using an Atomic Absorption Spectrophotometer (AAS) at a wavelength of 420 nm. The calcium content was tested referring to the modified method. Analysis of the calcium content of the sample was carried out by weighing 0.1 g of the fine sample and transferring it to a 100 mL volume Kjeldahl flask. Sample destruction was carried out by fortifying 15 mL of hydrochloric acid (HCl). The solution was digested until it became clear and then cooled. The filtered volume is calibrated to 100 mL and ready to be measured on AAS.

2.3.2.7 Analysis of phosphorus levels [8]

Phosphorus content was detected using a U-VIS spectrophotometer, in which the test method referred to was modified. The sample was weighed as much as 5 g, added 20 mL of concentrated HNO_3, then boiled for 5 minutes and cooled, then added 5 mL of concentrated sulfuric acid (H_2SO_4). The solution was heated and refined (digestion) with HNO_3 fortification drop by drop until the solution was colorless, followed by heating until white smoke appeared and cooled. Add 15 mL of distilled water to the beaker and boil again for 10 minutes. A total of 10 ml of the sample solution was put into a 100 mL volumetric flask. Then 40 mL of distilled water and 25 mL of vanadate molybdate reagent were added to the measuring flask and diluted to the mark. The absorbance value of the solution was measured by a spectrophotometer at a wavelength of 400 nm.

2.4 Analysis Data

The experimental design used was a non-factorial Completely Randomized Design (CRD) with 4 levels, namely M0; (without fish meal), M1 (6% fish meal), M2 (8% fish meal), M3 (10% fish meal) Then, each treatment was repeated 3 times. Organoleptice tes with kruskal wallis test with 30 untrained panelist.

3. RESULT AND DISCUSSION

3.1 Characteristics of Mi sago fortified with Fish Flour.

The results of the assessment of the characteristics of sago noodles fortified with fish meal from organoleptic parameters, proximate, mineral content and amino acid content can be seen in the following description.

3.1.1 Sensory Evaluation.

The results of the organoleptic test analysis of the fortified sago noodles of starter fish meal can be seen in Table 3.

Table 3. The average organoleptic value of fortified sago noodles from fish meal

Treatment	Parameters			
	Appearances	Odor	Taste	Texture
M_0	5.03^d	5.16^c	5.83^a	5.24^c
M_1	5.99^c	5.99^b	7.93^c	5.99^b
M_2	8.19^b	8.45^b	8.48^c	8.35^b
M_3	6.96^a	5.09^a	6.67^b	6.61^a

Description: M0 (control), M1 (fish meal 6%), M2 (fish meal 8%), M3 (fish flour 10%)

Mean values; the different letters within the same column represent significantly different values ($p<0.05$)

In Table 3, the average value of the appearance of sago noodles with the fortification of starter fish meal ranged from 5.03-8.19. The highest average appearance value was found in sago noodles without fortification of lead fish meal M2 (8.19) with intact, attractive characteristics, bright white color, and the lowest M0 (5.03) with characteristics of being easily broken cracked, less attractive, and dull white. M1 (5.99) with intact characteristics, somewhat attractive, slightly bright white color, and M3 (6.96) with intact characteristics, easy to break, slightly attractive, slightly bright white color (Figure 1).

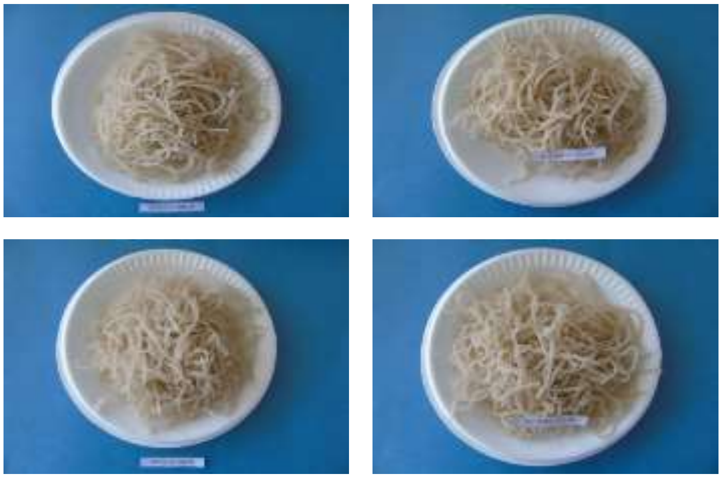

Figure 1. Photograph sago oodles (M_o,M_1,M_2,M_3)

The results showed that there was an effect of fortification of the lead fish meal on the organoleptic quality characteristics (appearance, smell, taste, and texture) of sago noodles. Sago noodles fortified with 8% fish meal had the best appearance, taste, aroma, and texture values from all treatments. This is the opinion of [9], which states that the limit on the amount of fortification of scad fish meal if the amount is > 8% causes the low organoleptic value of noodles. According to [10] the higher the fortification of fish meal on sago noodles will produce an appearance that makes the sago noodles pale and not bright so that the visual value of fish meal fortified sago noodles shows differences, where the appearance of each treatment will become paler. and not bright.

The phenomenon of change in organoleptic value is caused by a non-enzymatic reaction (Maillard reaction). Maillard reactions can be triggered by heating at high temperatures, such as roasting, frying, roasting, and cooking processes [11].

3.1.2 Proximate

The data from the proximate analysis of sago noodles fortified with fish meal can be seen in Table 4.

Table 4. The results of proximate analysis of sago noodles fortified with Biang fish meal

Proximate	M_0 (0%)	M_1 (6%)	M_2 (8%)	M_3 (10%)
Moisture	22.65±0.1	22.35±0.4	21.72±0.3	21.04±0.15
Ash	0.72 ±0.3	1.69±0.21	2.15±0.4	2.43±0.25
Protein	0.45 ±0.4	5.58±0.2	6.34±0.26	7.49±0.34
Fat	0.33 ±0.2	1.45±0.22	1.5±0.13	1.69±0.13
Carbohydrate	75.85±0.3	68.93±0.4	68.29±0.21	67.35±0.23

Description: M0 (control), M1 (fish meal 6%), M2 (fish meal 8%), M3 (fish flour 10%)

Table 4 shows that the average protein content of sago noodles fortified with the prickly fish meal with different concentrations ranges from 0.45-7.49%. The highest average protein content was found in sago noodles with 10% lead fish meal fortification (M3) which was 7.49% and the lowest protein was found in treatment (M0) which was 0.45%. The results of the analysis of variance showed that the fortification of the lead fish meal had a significant effect on the protein content of sago noodles, where Fcount (610.42) > Ftable (4.07) at the 95% confidence level. M0 (0.45%) was significantly different from the treatment M1 (5.58%), M2 (6.34%), and M3 (7.49).

The results showed that the fortification of lead fish meal in sago noodles had a significant effect on the average value of protein content in sago noodles. The higher the amount of fish meal fortified in sago noodles, the higher the average protein content, because the protein content of the fish meal reaches 73.0% [5]. Furthermore,[12] stated that fish contains high protein and is composed of amino acids that the body needs for growth. Fish protein is very easy to digest and absorb by the body. The protein content of sago noodles fortified with Biang fish meal in the M1, M2, and M3 treatments had met the SNI requirements of 3% [13].

Based on the results of the water content test in Table 4, shows that the average value of the water content of sago noodles fortified with different concentrations of fish meal is between 21.04-22.65%. The highest water content was found in sago noodles without fortification of 0% fish meal (M0), which was 22.65%, the lowest was found in sago noodles with the fortification of 10% fish meal (M3), which was 21.04%. The results of the analysis of variance showed that the fortification of the lead fish meal had a significant effect on the water content of sago noodles, where Fcount (5.59) > Ftable (4.07) at the 95% confidence level. The results of the further BNJ test showed that each treatment had a significantly different water content. The results of this study indicate that the greater the concentration of fortified starter fish meal in sago noodles, the lower the water content of sago noodles. According to [14], this is due to the hygroscopic fortification of fish meal which is a binder used by the food industry to bind/absorb the water content in the dough. However, the average water content value of sago noodles is still acceptable because based on the maximum standard it is still in accordance with the standard SNI 01-2987-1992, the moisture content of semi-wet noodles is 20-35%.

Based on Table 4, it shows that the average fat content of fortified sago noodles with different concentrations of starter fish meal is between 0.36-1.69%. The highest average fat content was found in sago noodles with 10% (M3) fortification of starter fish meal. Meanwhile, the lowest average fat content was found in sago noodles without fortification of M0 starter fish meal (0%).

The results of the analysis of variance showed that the fortification of the lead fish meal had a significant effect on the fat content of sago noodles, where Fcount (87.94) > Ftable (4.07) at a 95% confidence level, further BNJ test found that the treatment M0 (0.33 %) was significantly different from the treatment of M1 (1.45%), M2 (1.59%) and M3 (1.69%). M1 (1.45) was not significantly different from M2 (1.59%), and M2 (1.59%) was also not significantly different from M3 (1.69%).

The results showed that the fortification of the root fish meal in sago noodles had a significant effect on the average value of fat content in sago noodles. The higher the amount of fish meal fortified in sago noodles, the higher the average value of the fat content, because the fat content of the fish meal is between 5.96-6.69% [15]. Fat content is very influential on the durability of the material, if the fat content of the material is high it will accelerate rancidity due to fat oxidation [16]. The fat content of sago noodles fortified with fish meal in all treatments had met the SNI requirements of <7% [13]

Based on Table 4, it shows that the average value of ash content of sago noodles fortified with different concentrations of fish meal is between 0.72-2.43%. The highest average ash content was found in sago noodles with the fortification of lead fish meal 10% (M3), which was 2.43%. Meanwhile, the lowest average ash content was found in sago noodles without fortification of lead fish meal (M0), which was 0.72%.

The results of the analysis of variance showed that the fortification of the lead fish meal had a significant effect on the ash content of sago noodles, where Fcount (290.89) > Ftable (4.07) at a 95% confidence level, the results of the BNJ follow-up test showed that the treatment was M0 (0.72%) was significantly different from the treatment of M1 (1.69%), M2 (2.15%), and M3 (2.43%). While the treatment M2 (2.15%) was not significantly different from P3 (2.43%). The results showed that there was an effect of fortification of lead fish meal on the average value of ash content in sago noodles. The higher the amount of fortified fish meal, the higher the average ash content. This is because the mineral content in the lead fish meal reaches 2.94bb% [17]. According to [18], most foodstuffs (96%) consist of organic and water. In the process of processing (burning) organic matter burns but inorganic substances do not, therefore higher levels of mineral elements are detected. The results showed that the ash content produced was in accordance with the quality standard of semi-wet noodles, namely a maximum of 3% [19].

Based on Table 4, it shows that the average value of carbohydrate content of sago noodles fortified with different concentrations of fish meal is between 67.35-75.85%. The highest average carbohydrate content was found in sago noodles with the fortification of 0% lead fish meal (M0), which was 75.85%. While the lowest average is (M3), which is 67.35%. The results of the analysis of variance showed that the fortification of lead fish meal had a significant effect on the carbohydrate value of sago noodles, where F count (202267.53) > Ftable (4.07) at a 95% confidence level.

From the results of the study, it was known that the fortification of the root fish meal in sago noodles had a significant effect on the average value of carbohydrate content in sago noodles. The higher the amount of fermented fish meal fortified in sago noodles, the lower the average value of the carbohydrate content, due to the reduced product constituent components which are a source of carbohydrates. carbohydrates that are high in sago starch [20]. The carbohydrate content of fortified sago noodles from the starter fish meal in all treatments had met the SNI requirements, which was 86.9%

Based on the characteristics of the organoleptic and proximate parameters, it can be seen that the M2 treatment, namely the formulation of 8% fortification of lead fish meal in sago noodles, was a treatment that met the standards and was continued to analyze the parameters of mineral content, fatty acids, and amino acids.

3.1.3 Mineral Content of Fortified Sago Noodles Starfish Flour 8%

Based on the mineral analysis that has been carried out on sago noodles with the fortification of 8% lead fish meal, the average results of the mineral analysis are shown in Table 5.

Table 5. Mineral Content of 8% Fortified Sago Noodles Fish Flour

Minerals	Mo(%)	M_2(%)
Calsium (mg/kg)	1131±0.8	8402±0,65
Phosfore (%)	111.14±0,2	183±0,34
Iodium (I)	118±0,5	190.16±0,56
Magnesium (mg/kg)	20.4±0,7	141.88±0,4
Zinc (Zn) (mg/kg)	102.6±0,13	153.02±0,24
Iron (Fe) (mg/kg)	10.4±0,25	15.93±0,21

Based on Table 5, shows that the mineral is Ca.P. I, Mg, Zn, and Fe sago noodles fortified with the lead fish meal with a concentration of 8%. The results showed that the fortification of lead fish meal in sago noodles had a significant effect on the average value of calcium levels in sago noodles. The higher the amount of fish meal fortified in sago noodles, the higher the average calcium content, because the calcium content of the fish meal reaches 8397 mg/kg [21].

3.1.4 Amino Acid Content of Fortified Sago Noodles Starfish Flour 8%

The results of the amino acid analysis of sago noodles fortified with 8% Biang fish meal can be seen in Table 6.

Table 6. Amino acid profile of Sago Noodles Fortification of prickly fish meal

Amino acids	M_0(%)	M_2(%)
1 Aspartic acid	0.15±0.1	0.50±0.3
16. Threonine*	0.07±0.3	0.24±0.1
17. Serine	0.06±0.4	0.20±0.2
18. Glutamate	0.00±0.6	0.88±0.13
19. Glysine	0.08±0.3	0.26±0.2
20. Alanine	0.10±0.2	0.32±0.3
21. Valine*	0.10±0.4	0.32±0.5
22. Methione*	0.24±0.1	0.72±0.56
23. Ileusine*	0.07±0.3	0.24±0.4
24. Leusine*	0.12±0.34	0.40±0.3
25. Tyrosine	0.02±0.25	0.08±0.2
26. Phenylalanine*	0.05±0.2	0.18±0.34
27. Histidine*	0.18±0.15	0.60±0.2
28. Lysine*	0.12±0.4	0.58±0.2
29. Arginine	0.06±0..3	0.66±0.6
30. Total amino acids (%)	1.275±0.24	6.18±0.3
AA essensial (%)	0.95±0.27	3.60±0.2
AA non essensial (%)	0.325±0.35	2.58±0.15

*amino acids essential

In Table 6 it can be seen that the types of amino acids for fortified sago noodles from fish meal consist of 8 types of essential amino acids, namely histidine, arginine, threonine, valine, alanine, methionine, isoleucine, leucine, phenylalanine. There are 7 types of non-essential amino acids, namely aspartic acid, glutamic acid, serine, glycine, and tyrosine. In accordance with the results of [14] research, most of these amino acids were detected in fishery commodities. Based on the amount of amino acid content, 8% fortified sago noodles can be classified as nutritious food because it contains complete amino acids.

According to [22], each essential amino acid has a special function, namely as a cell-forming and can also be useful as a flavor giver. In line with the opinion of [23] that the use of amino acids can be seen from the characteristics of the taste, some amino acids have a sweet taste, a bitter taste, and some have no taste. Glycine, proline, alanine, hydroxyproline, valine, and serine have a sweet taste. Isoleucine and arginine have a bitter taste, a savory taste caused by glutamic acid, and leucine is tasteless.

3.1.5 Fatty Acid Content of Fortified Sago Noodles Starfish Flour 8%

Table 7 shows that the fatty acid profile in fortified sago noodles from 8% fish meal shows a balanced portion of unsaturated and saturated fatty acids. The content of fatty acids in 8% fortified sago noodles from prickly fish flour has 13 components of unsaturated fatty acids while saturated fatty acids have 17 components. The results of the analysis show that the fatty acid profile shows a balanced portion between unsaturated fatty acids and saturated fatty acids.

Table 7. The fatty acid content of sago noodles

Fatty acids	M_0 (%)	M_2 (%)
31. Caprylic Acid, C8:0	0.061±0.1	0.189±0.3
32. Lauric Acid, C12:0	0.008±0.2	0.024±0.4
33. Tridecanoic Acid, C13:0	0.00±0.3	0
34. Myristic Acid, C14:0	0.15±0.23	0.51±0.12
35. Myristoleic Acid, C14:1	0.004±0.4	0.0156±0.1
36. Pentadecanoic Acid, C15:0	0.06±0.56	0.27±0.1
37. Palmitic Acid, C16:0	0.59±0.2	2.97±0.3
38. Palmitoleic Acid, C16:1	0.13±0.14	0.42±0.2
39. Heptadecanoic Acid, C17:0	0.07±0.45	0.21±0.25
40. Cis-10-Heptadecanoic Acid, C17:1	0.03±0.3	0.09±0.3
41. Stearic Acid, C18:0	0.50±0.27	1.8±0.6
42. Elaidic Acid, C18:1n9t	0	0
43. Oleic Acid, C18:1n9c	0.75±0.3	0.46±0.5
44. Linolelaidic Acid, C18:2n9t	0.02±0.1	0.06±0.6
45. Linoleic Acid, C18:2n6c	0.06±0.5	0.18±0.3
46. Arachidic Acid, C20:0	0.02±0.4	0.06±0.2
47. y-Linolenic Acid, C18:3n6	0.00±0.3	0
48. Cis-11-Eicosenoic Acid, C20:1	0.04±0.2	0.03±0.1
49. Linolenic Acid, C18:3n3	0.011±0.25	0.039±0.4
50. Heneicosanoic Acid, C21:0	0.008±0,4	0.024±0.5
51. Cis-11,14-Eicosedienoic Acid, C20:2	0.022±0.3	0.066±0.34
52. Behenic Acid, C22:0	0.025±0.25	0.081±0.1
53. Cis-8,11,14-Eiosetrienoic Acid, C20:3n6	0	0
54. Cis-11,14,17-Eicosatrienoic Acid Methyl Ester, C20:3n3	0	0
55. Arachidonic Acid, C20:4n6	0.026±0.1	0.093±0.4
56. Tricosanoic Acid, C23:0	0.	0
57. Cis-5,8,11,14,17-Eicosapentaenoic Acid, C20:5n3	0.24±0.1	1.14±0.46
58. Lignoceric Acid, C24:0	0.015±0.2	0.045±0.3
59. Nervonic Acid, C24:1	0,011±0.1	0.033±0.21

60. Cis-4,7,10,13,16,19-Docosahexaenoid Acid, C22:6n3	0,41.23±0.25	1.26±0.1

The combination sago and biang fish flour of sago flour causes an increase in the fatty acid content of sago noodles. The highest content is found in palmitic acid. Palmitic acid can be a precursor to omega-3 which is very beneficial for human health. An increase also occurred in unsaturated fatty acids, especially for the fatty acids EPA and DHA. The increase in the fatty acid value is thought to be due to the fat content of the lead fish which reached 19% plus the fat content of sago which contributed 0.2% . Sago noodles with the addition of starter fish meal can potentially be a functional food for stunting prevention [24].

4. Conclusion

Based on the results of the study, it can be concluded that the fortified sago noodles of sago fish meal had a significant effect on the organoleptic characteristics and its proximate content, the best treatment was fortified sago fish meal 8%. Hedonic test with a taste value of 8.9, aroma 8.6, the visual value of 8.9, and texture value of 8.8. The mineral content is Ca.P. I, Mg, Zn, and Fe. Essential amino acids hight content were methionine and non essential amino acids high content were glutamate acid. Beside that, sago noodles high content to EPA and DHA which is good for health.

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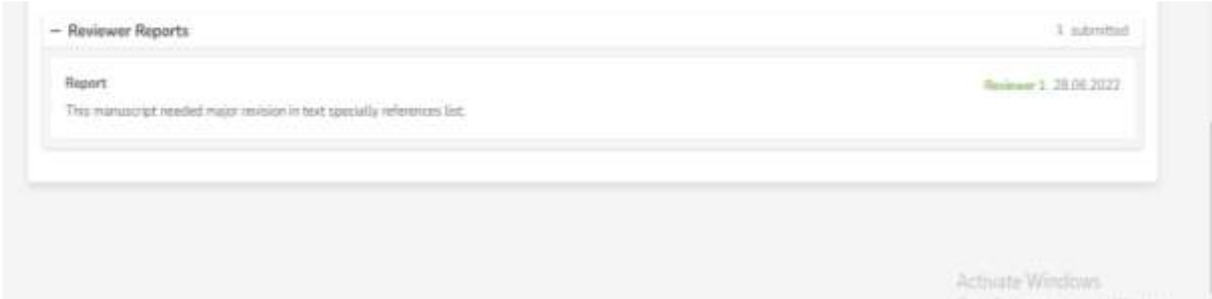
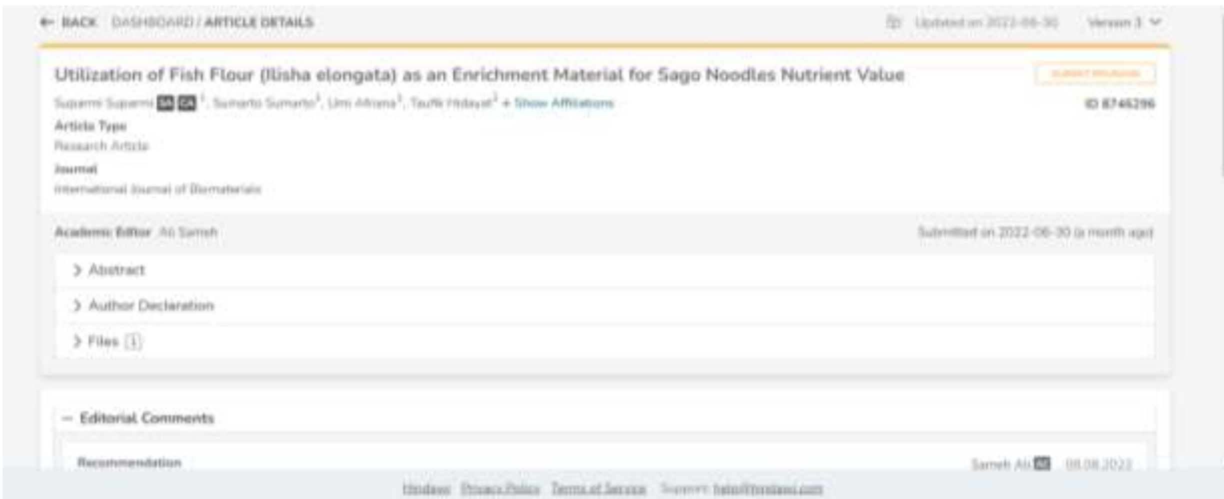
5. **Penilaian Manuscript (review)(28 Juni 2022)**



6. **Perbaikan Manuscript (30 Juni 2022)**



Utilization of *Biang* Fish Flour (*Ilisha elongata*) as an Enrichment Material for Sago Noodles Nutrient Value

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ABSTRACT

This study aims to determine the appropriate concentration of lead fish meal for enriching the nutritional value of sago noodles favored by consumers. The method used is an experimental design using Completely Randomized (CRD) with 4 concentration levels of lead fish meal, namely 4% without a lead fish meal (M0), 6% (M1), 8% (M2), 10% (M3).The Analysis form sagoo noodles were rendement, proximate by AOAC method, amino acids by HPLC, fatty acids by GC, and minerals by HPLC. The results of the study getting the best treatment was a concentration of 8% (M2) with the characteristics of whole sago noodles appearance, attractive, grayish-white color; has a distinctive aroma of sago noodles with a hint of fish; specific taste typical of sago noodles and fish prickly taste, delicious; slightly chewy texture. Sensory evaluation with a taste value of 8.9, aroma 8.6, visual value of 8.9, and texture value 8.8. its nutritional content is 5.58% protein content; air 22.35%; ash 1.69%; fat 1.41%, carbohydrates 68.29%. The proximate values are protein 5.58%, water content 22.35%, ash 1.69%, fat content 1.41%, carbohydrates (different) 68.29% . The mineral content is Ca.P. I, Mg, Zn, and Fe. Amino acids consist of 8 types of essential amino acids namely histidine, arginine, threonine, valine, alanine, methionine, isoleucine, leucine, phenylalanine, and 7 types of nonessential amino acids namely aspartic acid, glutamic acid, serine, glycine, tyrosine. Its fatty acid profile has 13 components of unsaturated fatty acids and 17 components of saturated fatty acids.

Keywords : Fortification, lead fish meal, characteristics, sago noodles, acceptability

1. INTRODUCTION

Sago noodles as special food and in demand by the community, especially Kab. Meranti Islands, Riau Province, Indonesia, this is because noodles are easy to serve, durable, and relatively cheap [1]. Indonesian people have experienced changes in consumption patterns, namely by make noodles as a companion or substitute for rice. Sago noodles are made from sago flour which contains 84.7% high carbohydrate content, and 353 kcal energy, but has a low protein content of 0.7%, 0.2% fat content, and low mineral content. However, sago flour as the basic ingredient for making noodles has several advantages compared to other flours, namely, it contains undigested starch and is beneficial for digestive health, namely "resistant starch" (RS) which has effects such as dietary fiber and the use of fishery products in the form of fortification can increase the added value of the product [2].

Process production sago noodels can be produce with applicable technology and several raw material, example surimi powder and addition fish meal [3,4]. Efforts to increase the nutritional value of sago noodles are by fortifying using highly nutritious ingredients such as fish meal, which has a high nutritional content where the protein content reaches 73.0%, water content 7.12-7.88%, ash content 12.97>11.89% fat content is 8% and has minerals that are important for the growth and development of the body, among others, the fish meal contains calcium (Ca) 8397-8402 mg/kg, phosphorus (P) 169 -183 mg/kg, Iodine (I) 189.44-190.16 mg/kg, magnesium (Mg) 141.32-141.88 mg/kg, zinc (Zn) 152.07-153.02 mg/kg, and iron (Fe) 15.76-15.93 mg/kg, therefore this lead fish meal has the potential to be developed, as well as being able to act as a fortification of other food products based on the fish meal as an effort to increase the nutrition of protein-rich foods [5]. Fish meal from biang fish which is a endemic fish Riau Province that content high protein.

Addition of processed fish-based products is one of the efforts to increase fish consumption in the community. Processed fish products developed must lead to products that can be eaten immediately (ready to eat), are easy to carry, and do not take long to cook. Therefore, this study aimed to determine the concentration of the main flour in increasing the nutritional value of sago noodles.

2. MATERIALS AND METHOD

2.1 Material and Tools

The main ingredients used in this study were 50 kg of fresh pike fish size 77-95 g, water, and sago flour. The chemicals used for proximate analysis were methanol, sodium acetate, triethylamine, sulfuric acid, aquades, eluent, sodium acetate buffer, boric acid, sodium hydroxide, hydrochloric acid, PP indicator, diethyl ether, catalyst, and blue reagent.

The tools used in this research are oven, grinder, blender, jar, tray, 80 mesh sieve, basin, spoon, knife, presto, analytical scale, sago noodle ampia machine, sago noodle printing machine, frying pan, pan, basin, dough machine, sago noodles, plastic packaging, label paper, gas stove, stove, and press.

2.2 Research methods

The method used in this research is an experimental design. The research method includes Manufacture of lead fish meal and making sago noodles fortified fish flour.

2.2.1 Manufacture of lead fish meal (modification[5])

The whole gizzard was removed and washed thoroughly, then pressed for 60 minutes, then dried using an oven for 48 hours at 44.20C, and made flour using a blender. To obtain a uniform flour grain size, filtering is carried out using an 80 mesh sieve.

2.2.2 Making Sago Noodles Fortified Fish Flour (modification[5])

The gelatinization process of sago flour is done by adding a little water to the sago flour (the process of moisturizing the material) until smooth, then the flour is roasted/roasted for about 5-10 minutes. The process of mixing noodle dough ingredients (formulation of ingredients: sago flour 500 g, water 150 mL, a fish meal with treatment level For the M0 treatment, namely without a fish meal, M1 fish meal 6%, M2 fish meal 8%, M3 flour fish starter 10%. Stirred until perfect gelatinization is formed. Then the dough is in the form of small balls and placed in plastic to give a boundary. Printing of dough The dough is formed into small circles and delimited and then printed using amphia to form a sheet.

The results of the dough mold (in long plastic sheets), then a short boiling process is carried out by inserting the dough mold in a container filled with boiling water until cooked, marked with a brownish yellow color (1-2 minutes). The process of draining and aerating in a closed room for 12 minutes. o'clock. The formulation of the fortified sago noodles of the prickly fish flour can be seen in Table 2**.**

Table 2. The formula for making sago noodles

Material	Unit	Treatment			
		M_0	M_1	M_2	M_3
Sago flour	g	500	500	500	500
Biang fish flour	% (b/b)	0	6	8	10
Water	mL	150	150	150	150

2.3 Procedure analysis

2.3. 1. Organolpetic test [6]

The organoleptic test was carried out by 25 moderately trained panelists to test the quality of sago noodles fortified with lead fish meal. The organoleptic test usually aims to determine the panelists' response to the general quality properties of color, aroma, texture, and taste by using a score sheet on a scale of 1 as the lowest value and 9 for the highest value.

2.3.2 Proximate Analysis [7]

Proximate analysis includes moisture, ash, protein, fat, and carbohydrate content.

2.3.2.6 Analysis of calcium levels [8]

Calcium level testing The determination of calcium levels was carried out by measuring the wet digested sample using an Atomic Absorption Spectrophotometer (AAS) at a wavelength of 420 nm. The calcium content was tested referring to the modified method. Analysis of the calcium content of the sample was carried out by weighing 0.1 g of the fine sample and transferring it to a 100 mL volume Kjeldahl flask. Sample destruction was carried out by fortifying 15 mL of hydrochloric acid (HCl). The solution was digested until it became clear and then cooled. The filtered volume is calibrated to 100 mL and ready to be measured on AAS.

2.3.2.7 Analysis of phosphorus levels [8]

Phosphorus content was detected using a U-VIS spectrophotometer, in which the test method referred to was modified. The sample was weighed as much as 5 g, added 20 mL of concentrated HNO_3, then boiled for 5 minutes and cooled, then added 5 mL of concentrated sulfuric acid (H_2SO_4). The solution was heated and refined (digestion) with HNO_3 fortification drop by drop until the solution was colorless, followed by heating until white smoke appeared and cooled. Add 15 mL of distilled water to the beaker and boil again for 10 minutes. A total of 10 ml of the sample solution was put into a 100 mL volumetric flask. Then 40 mL of distilled water and 25 mL of vanadate molybdate reagent were added to the measuring flask and diluted to the mark. The absorbance value of the solution was measured by a spectrophotometer at a wavelength of 400 nm.

2.4 Analysis Data

The experimental design used was a non-factorial Completely Randomized Design (CRD) with 4 levels, namely M0; (without fish meal), M1 (6% fish meal), M2 (8% fish meal), M3 (10% fish meal) Then, each treatment was repeated 3 times. Organoleptice tes with kruskal wallis test with 30 untrained panelist.

3. RESULT AND DISCUSSION

3.1 Characteristics of Mi sago fortified with Fish Flour.

The results of the assessment of the characteristics of sago noodles fortified with fish meal from organoleptic parameters, proximate, mineral content and amino acid content can be seen in the following description.

3.1.1 Sensory Evaluation.

The results of the organoleptic test analysis of the fortified sago noodles of starter fish meal can be seen in Table 3.

Table 3. The average organoleptic value of fortified sago noodles from fish meal

Treatment	Parameters			
	Appearances	Odor	Taste	Texture
M_0	5.03[d]	5.16[c]	5.83[a]	5.24[c]
M_1	5.99[c]	5.99[b]	7.93[c]	5.99[b]
M_2	8.19[b]	8.45[b]	8.48[c]	8.35[b]
M_3	6.96[a]	5.09[a]	6.67[b]	6.61[a]

Description: M0 (control), M1 (fish meal 6%), M2 (fish meal 8%), M3 (fish flour 10%)

Mean values; the different letters within the same column represent significantly different values ($p<0.05$)

In Table 3, the average value of the appearance of sago noodles with the fortification of starter fish meal ranged from 5.03-8.19. The highest average appearance value was found in sago noodles without fortification of lead fish meal M2 (8.19) with intact, attractive characteristics, bright white color, and the lowest M0 (5.03) with characteristics of being easily broken cracked, less attractive, and dull white. M1 (5.99) with intact characteristics, somewhat attractive, slightly bright white color, and M3 (6.96) with intact characteristics, easy to break, slightly attractive, slightly bright white color (Figure 1).

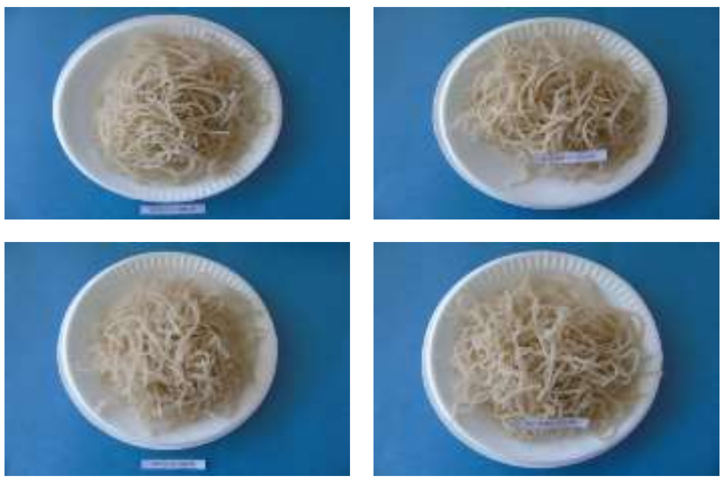

Figure 1. Photograph sago noodles (M_o,M_1,M_2,M_3)

The results showed that there was an effect of fortification of the lead fish meal on the organoleptic quality characteristics (appearance, smell, taste, and texture) of sago noodles. Sago noodles fortified with 8% fish meal had the best appearance, taste, aroma, and texture values from all treatments. This is the opinion of [9], which states that the limit on the amount of fortification of scad fish meal if the amount is > 8% causes the low organoleptic value of noodles. According to [10] the higher the fortification of fish meal on sago noodles will produce an appearance that makes the sago noodles pale and not bright so that the visual value of fish meal fortified sago noodles shows differences, where the appearance of each treatment will become paler. and not bright.

The phenomenon of change in organoleptic value is caused by a non-enzymatic reaction (Maillard reaction). Maillard reactions can be triggered by heating at high temperatures, such as roasting, frying, roasting, and cooking processes [11].

3.1.2 Proximate

The data from the proximate analysis of sago noodles fortified with fish meal can be seen in Table 4.

Table 4. The results of proximate analysis of sago noodles fortified with Biang fish meal

Proximate	M_0 (0%)	M_1 (6%)	M_2 (8%)	M_3 (10%)
Moisture	22.65±0.1	22.35±0.4	21.72±0.3	21.04±0.15
Ash	0.72 ±0.3	1.69±0.21	2.15±0.4	2.43±0.25
Protein	0.45 ±0.4	5.58±0.2	6.34±0.26	7.49±0.34
Fat	0.33 ±0.2	1.45±0.22	1.5±0.13	1.69±0.13
Carbohydrate	75.85±0.3	68.93±0.4	68.29±0.21	67.35±0.23

Description: M0 (control), M1 (fish meal 6%), M2 (fish meal 8%), M3 (fish flour 10%)

Table 4 shows that the average protein content of sago noodles fortified with the prickly fish meal with different concentrations ranges from 0.45-7.49%. The highest average protein content was found in sago noodles with 10% lead fish meal fortification (M3) which was 7.49% and the lowest protein was found in treatment (M0) which was 0.45%. The results of the analysis of variance showed that the fortification of the lead fish meal had a significant effect on the protein content of sago noodles, where Fcount (610.42) > Ftable (4.07) at the 95% confidence level. M0 (0.45%) was significantly different from the treatment M1 (5.58%), M2 (6.34%), and M3 (7.49).

The results showed that the fortification of lead fish meal in sago noodles had a significant effect on the average value of protein content in sago noodles. The higher the amount of fish meal fortified in sago noodles, the higher the average protein content, because the protein content of the fish meal reaches 73.0% [5]. Furthermore,[12] stated that fish contains high protein and is composed of amino acids that the body needs for growth. Fish protein is very easy to digest and absorb by the body. The protein content of sago noodles fortified with Biang fish meal in the M1, M2, and M3 treatments had met the SNI requirements of 3% [13].

Based on the results of the water content test in Table 4, shows that the average value of the water content of sago noodles fortified with different concentrations of fish meal is between 21.04-22.65%. The highest water content was found in sago noodles without fortification of 0% fish meal (M0), which was 22.65%, the lowest was found in sago noodles with the fortification of 10% fish meal (M3), which was 21.04%. The results of the analysis of variance showed that the fortification of the lead fish meal had a significant effect on the water content of sago noodles, where Fcount (5.59) > Ftable (4.07) at the 95% confidence level. The results of the further BNJ test showed that each treatment had a significantly different water content. The results of this study indicate that the greater the concentration of fortified starter fish meal in sago noodles, the lower the water content of sago noodles. According to [14], this is due to the hygroscopic fortification of fish meal which is a binder used by the food industry to bind/absorb the water content in the dough. However, the average water content value of sago noodles is still acceptable because based on the maximum standard it is still in accordance with the standard SNI 01-2987-1992, the moisture content of semi-wet noodles is 20-35%.

Based on Table 4, it shows that the average fat content of fortified sago noodles with different concentrations of starter fish meal is between 0.36-1.69%. The highest average fat content was found in sago noodles with 10% (M3) fortification of starter fish meal. Meanwhile, the lowest average fat content was found in sago noodles without fortification of M0 starter fish meal (0%).

The results of the analysis of variance showed that the fortification of the lead fish meal had a significant effect on the fat content of sago noodles, where Fcount (87.94) > Ftable (4.07) at a 95% confidence level, further BNJ test found that the treatment M0 (0.33 %) was significantly different from the treatment of M1 (1.45%), M2 (1.59%) and M3 (1.69%). M1 (1.45) was not significantly different from M2 (1.59%), and M2 (1.59%) was also not significantly different from M3 (1.69%).

The results showed that the fortification of the root fish meal in sago noodles had a significant effect on the average value of fat content in sago noodles. The higher the amount of fish meal fortified in sago noodles, the higher the average value of the fat content, because the fat content of the fish meal is between 5.96-6.69% [15]. Fat content is very influential on the durability of the material, if the fat content of the material is high it will accelerate rancidity due to fat oxidation [16]. The fat content of sago noodles fortified with fish meal in all treatments had met the SNI requirements of <7% [13]

Based on Table 4, it shows that the average value of ash content of sago noodles fortified with different concentrations of fish meal is between 0.72-2.43%. The highest average ash content was found in sago noodles with the fortification of lead fish meal 10% (M3), which was 2.43%. Meanwhile, the lowest average ash content was found in sago noodles without fortification of lead fish meal (M0), which was 0.72%.

The results of the analysis of variance showed that the fortification of the lead fish meal had a significant effect on the ash content of sago noodles, where Fcount (290.89) > Ftable (4.07) at a 95% confidence level, the results of the BNJ follow-up test showed that the treatment was M0 (0.72%) was significantly different from the treatment of M1 (1.69%), M2 (2.15%), and M3 (2.43%). While the treatment M2 (2.15%) was not significantly different from P3 (2.43%). The results showed that there was an effect of fortification of lead fish meal on the average value of ash content in sago noodles. The higher the amount of fortified fish meal, the higher the average ash content. This is because the mineral content in the lead fish meal reaches 2.94bb% [17]. According to [18], most foodstuffs (96%) consist of organic and water. In the process of processing (burning) organic matter burns but inorganic substances do not, therefore higher levels of mineral elements are detected. The results showed that the ash content produced was in accordance with the quality standard of semi-wet noodles, namely a maximum of 3% [19].

Based on Table 4, it shows that the average value of carbohydrate content of sago noodles fortified with different concentrations of fish meal is between 67.35-75.85%. The highest average carbohydrate content was found in sago noodles with the fortification of 0% lead fish meal (M0), which was 75.85%. While the lowest average is (M3), which is 67.35%. The results of the analysis of variance showed that the fortification of lead fish meal had a significant effect on the carbohydrate value of sago noodles, where F count (202267.53) > Ftable (4.07) at a 95% confidence level.

From the results of the study, it was known that the fortification of the root fish meal in sago noodles had a significant effect on the average value of carbohydrate content in sago noodles. The higher the amount of fermented fish meal fortified in sago noodles, the lower the average value of the carbohydrate content, due to the reduced product constituent components which are a source of carbohydrates. carbohydrates that are high in sago starch [20]. The carbohydrate content of fortified sago noodles from the starter fish meal in all treatments had met the SNI requirements, which was 86.9%

Based on the characteristics of the organoleptic and proximate parameters, it can be seen that the M2 treatment, namely the formulation of 8% fortification of lead fish meal in sago noodles, was a treatment that met the standards and was continued to analyze the parameters of mineral content, fatty acids, and amino acids.

3.1.3 Mineral Content of Fortified Sago Noodles Starfish Flour 8%

Based on the mineral analysis that has been carried out on sago noodles with the fortification of 8% lead fish meal, the average results of the mineral analysis are shown in Table 5.

Table 5. Mineral Content of 8% Fortified Sago Noodles Fish Flour

Minerals	Mo(%)	M_2(%)
Calsium (mg/kg)	1131±0.8	8402±0.65
Phosfore (%)	111.14±0.2	183±0.34
Iodium (I)	118±0.5	190.16±0.56
Magnesium (mg/kg)	20.4±0.7	141.88±0.4
Zinc (Zn) (mg/kg)	102.6±0.13	153.02±0.24
Iron (Fe) (mg/kg)	10.4±0.25	15.93±0.21

Based on Table 5, shows that the mineral is Ca.P. I, Mg, Zn, and Fe sago noodles fortified with the lead fish meal with a concentration of 8%. The results showed that the fortification of lead fish meal in sago noodles had a significant effect on the average value of calcium levels in sago noodles. The higher the amount of fish meal fortified in sago noodles, the higher the average calcium content, because the calcium content of the fish meal reaches 8397 mg/kg [21].

3.1.4 Amino Acid Content of Fortified Sago Noodles Starfish Flour 8%

The results of the amino acid analysis of sago noodles fortified with 8% Biang fish meal can be seen in Table 6.

Table 6. Amino acid profile of Sago Noodles Fortification of prickly fish meal

Amino acids	M_0(%)	M_2(%)
1 Aspartic acid	0.15±0.1	0.50±0.3
31. Threonine*	0.07±0.3	0.24±0.1
32. Serine	0.06±0.4	0.20±0.2
33. Glutamate	0.00±0.6	0.88±0.13
34. Glysine	0.08±0.3	0.26±0.2
35. Alanine	0.10±0.2	0.32±0.3
36. Valine*	0.10±0.4	0.32±0.5
37. Methione*	0.24±0.1	0.72±0.56
38. Ileusine*	0.07±0.3	0.24±0.4
39. Leusine*	0.12±0.34	0.40±0.3
40. Tyrosine	0.02±0.25	0.08±0.2
41. Phenylalanine*	0.05±0.2	0.18±0.34
42. Histidine*	0.18±0.15	0.60±0.2
43. Lysine*	0.12±0.4	0.58±0.2
44. Arginine	0.06±0..3	0.66±0.6
45. Total amino acids (%)	1.275±0.24	6.18±0.3
AA essensial (%)	0.95±0.27	3.60±0.2
AA non essensial (%)	0.325±0.35	2.58±0.15

*amino acids essential

In Table 6 it can be seen that the types of amino acids for fortified sago noodles from fish meal consist of 8 types of essential amino acids, namely histidine, arginine, threonine, valine, alanine, methionine, isoleucine, leucine, phenylalanine. There are 7 types of non-essential amino acids, namely aspartic acid, glutamic acid, serine, glycine, and tyrosine. In accordance with the results of [14] research, most of these amino acids were detected in fishery commodities. Based on the amount of amino acid content, 8% fortified sago noodles can be classified as nutritious food because it contains complete amino acids.

According to [22], each essential amino acid has a special function, namely as a cell-forming and can also be useful as a flavor giver. In line with the opinion of [23] that the use of amino acids can be seen from the characteristics of the taste, some amino acids have a sweet taste, a bitter taste, and some have no taste. Glycine, proline, alanine, hydroxyproline, valine, and serine have a sweet taste. Isoleucine and arginine have a bitter taste, a savory taste caused by glutamic acid, and leucine is tasteless.

3.1.5 Fatty Acid Content of Fortified Sago Noodles Starfish Flour 8%

Table 7 shows that the fatty acid profile in fortified sago noodles from 8% fish meal shows a balanced portion of unsaturated and saturated fatty acids. The content of fatty acids in 8% fortified sago noodles from prickly fish flour has 13 components of unsaturated fatty acids while saturated fatty acids have 17 components. The results of the analysis show that the fatty acid profile shows a balanced portion between unsaturated fatty acids and saturated fatty acids.

Table 7. The fatty acid content of sago noodles

Fatty acids	M_0 (%)	M_2 (%)
61. Caprylic Acid, C8:0	0.061±0.1	0.189±0.3
62. Lauric Acid, C12:0	0.008±0.2	0.024±0.4
63. Tridecanoic Acid, C13:0	0.00±0.3	0
64. Myristic Acid, C14:0	0.15±0.23	0.51±0.12
65. Myristoleic Acid, C14:1	0.004±0.4	0.0156±0.1
66. Pentadecanoic Acid, C15:0	0.06±0.56	0.27±0.1
67. Palmitic Acid, C16:0	0.59±0.2	2.97±0.3
68. Palmitoleic Acid, C16:1	0.13±0.14	0.42±0.2
69. Heptadecanoic Acid, C17:0	0.07±0.45	0.21±0.25
70. Cis-10-Heptadecanoic Acid, C17:1	0.03±0.3	0.09±0.3
71. Stearic Acid, C18:0	0.50±0.27	1.8±0.6
72. Elaidic Acid, C18:1n9t	0	0
73. Oleic Acid, C18:1n9c	0.75±0.3	0.46±0.5
74. Linolelaidic Acid, C18:2n9t	0.02±0.1	0.06±0.6
75. Linoleic Acid, C18:2n6c	0.06±0.5	0.18±0.3
76. Arachidic Acid, C20:0	0.02±0.4	0.06±0.2
77. y-Linolenic Acid, C18:3n6	0.00±0.3	0
78. Cis-11-Eicosenoic Acid, C20:1	0.04±0.2	0.03±0.1
79. Linolenic Acid, C18:3n3	0.011±0.25	0.039±0.4
80. Heneicosanoic Acid, C21:0	0.008±0.4	0.024±0.5
81. Cis-11,14-Eicosedienoic Acid, C20:2	0.022±0.3	0.066±0.34
82. Behenic Acid, C22:0	0.025±0.25	0.081±0.1
83. Cis-8,11,14-Eiosetrienoic Acid, C20:3n6	0	0
84. Cis-11,14,17-Eicosatrienoic Acid Methyl Ester, C20:3n3	0	0
85. Arachidonic Acid, C20:4n6	0.026±0.1	0.093±0.4
86. Tricosanoic Acid, C23:0	0.	0
87. Cis-5,8,11,14,17-Eicosapentaenoic Acid, C20:5n3	0.24±0.1	1.14±0.46
88. Lignoceric Acid, C24:0	0.015±0.2	0.045±0.3
89. Nervonic Acid, C24:1	0.011±0.1	0.033±0.21
90. Cis-4,7,10,13,16,19-Docosahexaenoid Acid, C22:6n3	0.41.23±0.25	1.26±0.1

The combination sago and biang fish flour of sago flour causes an increase in the fatty acid content of sago noodles. The highest content is found in palmitic acid. Palmitic acid can be a precursor to omega-3 which is very beneficial for human health. An increase also occurred in unsaturated fatty acids, especially for the fatty acids EPA and DHA. The increase in the fatty acid value is thought to be due to the fat content of the lead fish which reached 19% plus the fat content of sago which contributed 0.2% . Sago noodles with the addition of starter fish meal can potentially be a functional food for stunting prevention [24].

4. Conclusion

Based on the results of the study, it can be concluded that the fortified sago noodles of sago fish meal had a significant effect on the organoleptic characteristics and its proximate content, the best treatment was fortified sago fish meal 8%. Hedonic test with a taste value of 8.9, aroma 8.6, the visual value of 8.9, and texture value of 8.8. The mineral content is Ca.P. I, Mg, Zn, and Fe. Essential amino acids hight content were methionine and non essential amino acids high content were glutamate acid. Beside that, sago noodles high content to EPA and DHA which is good for health.

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7. Review Manuscript (8 Agustus 2022)

Hindawi

Suparmi

Recommendation

Sameh Ali AS 08.08.2022

Minor Revision Requested

Message for Author

Manuscript Number: ID 8746296
Utilization of Fish Flour (Bisha elongata) as an Enrichment Material for Sago Noodles Nutrient Value

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I look forward to receiving your revised manuscript.

Yours sincerely,
Sameh Ali, Ph.D.
Academic Editor
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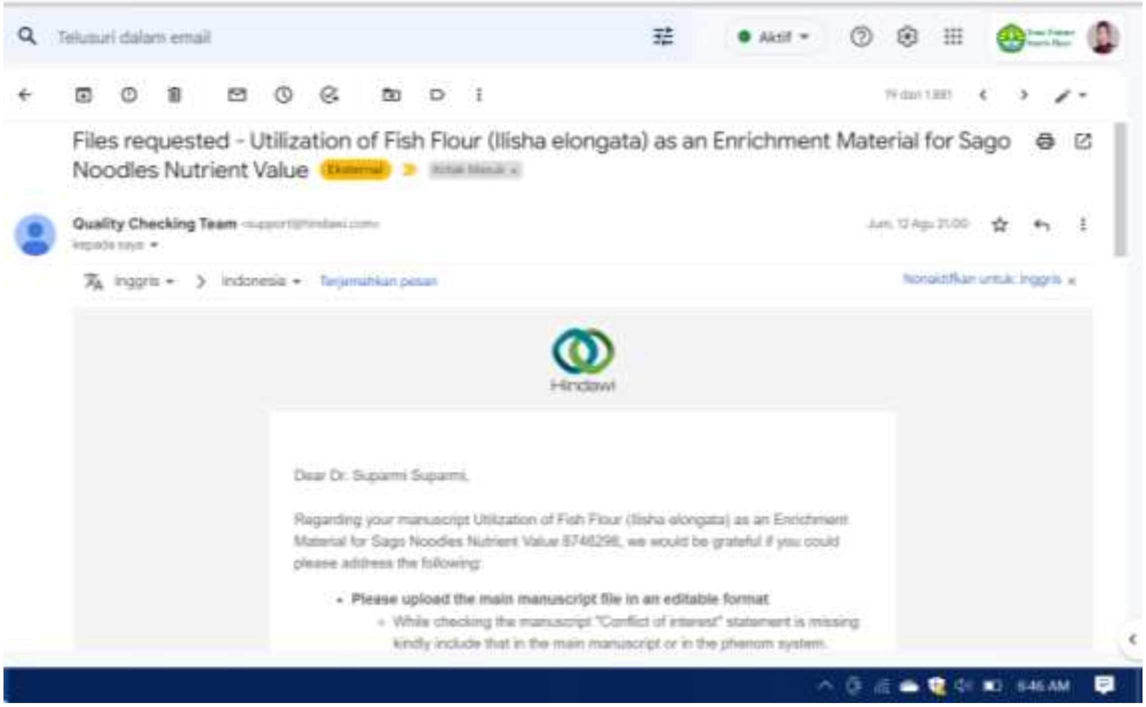

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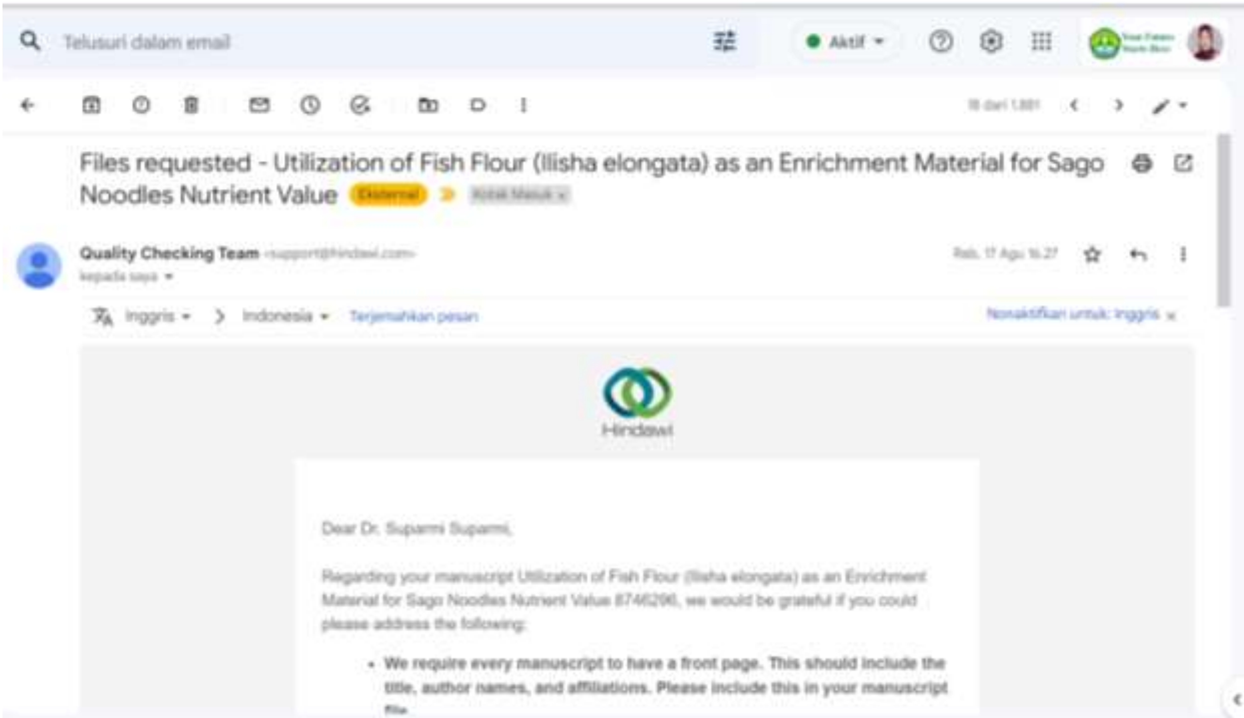

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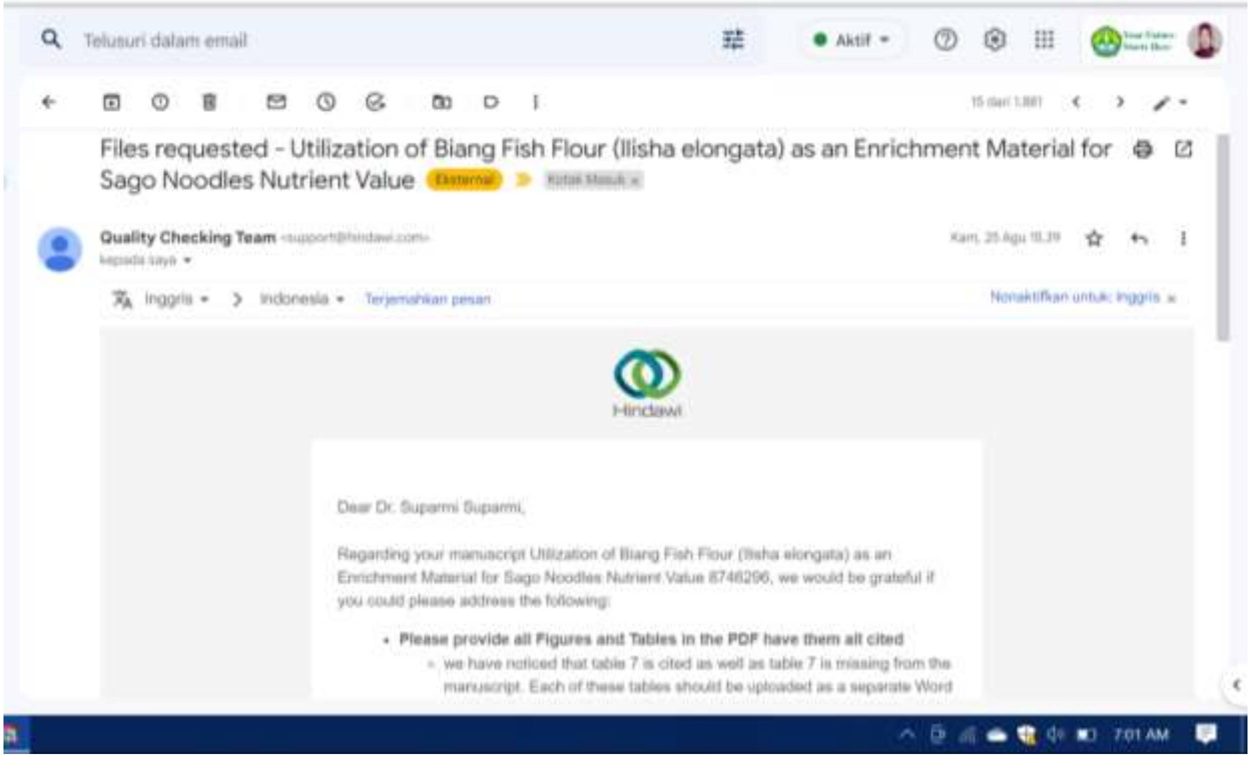

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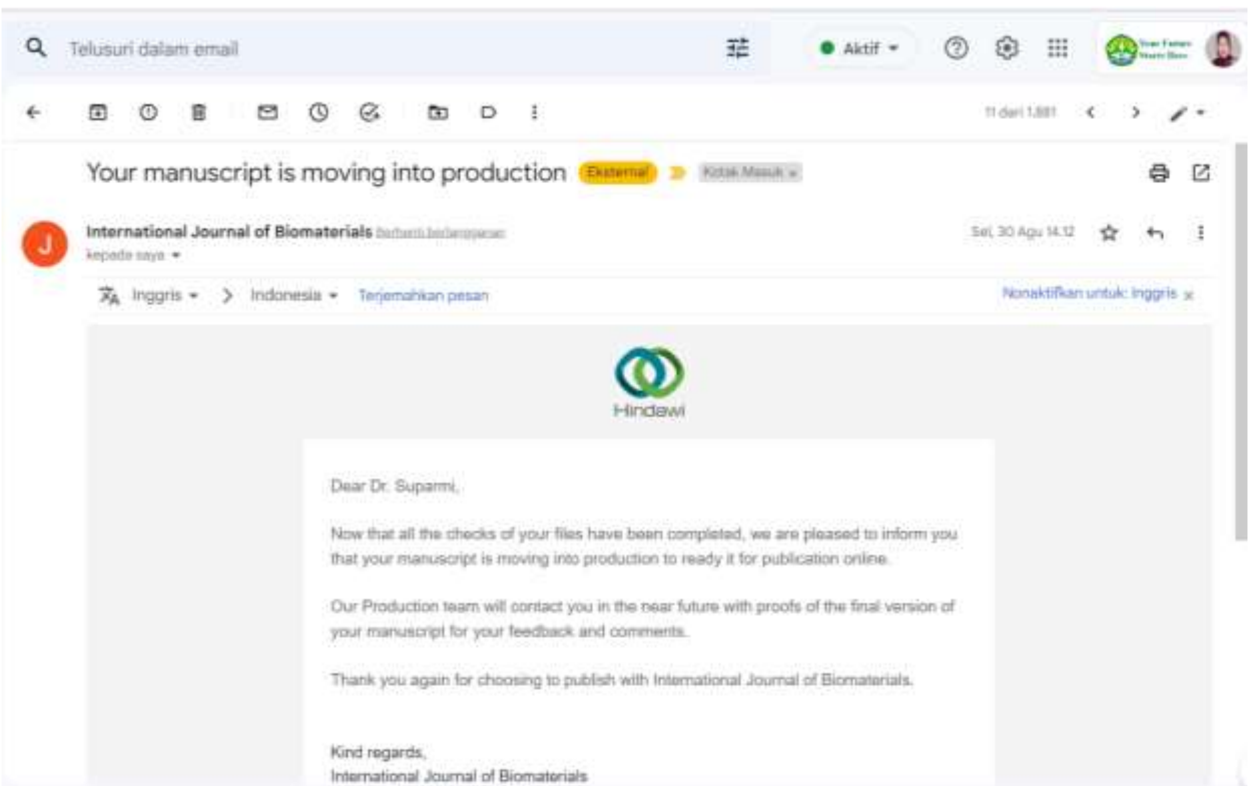
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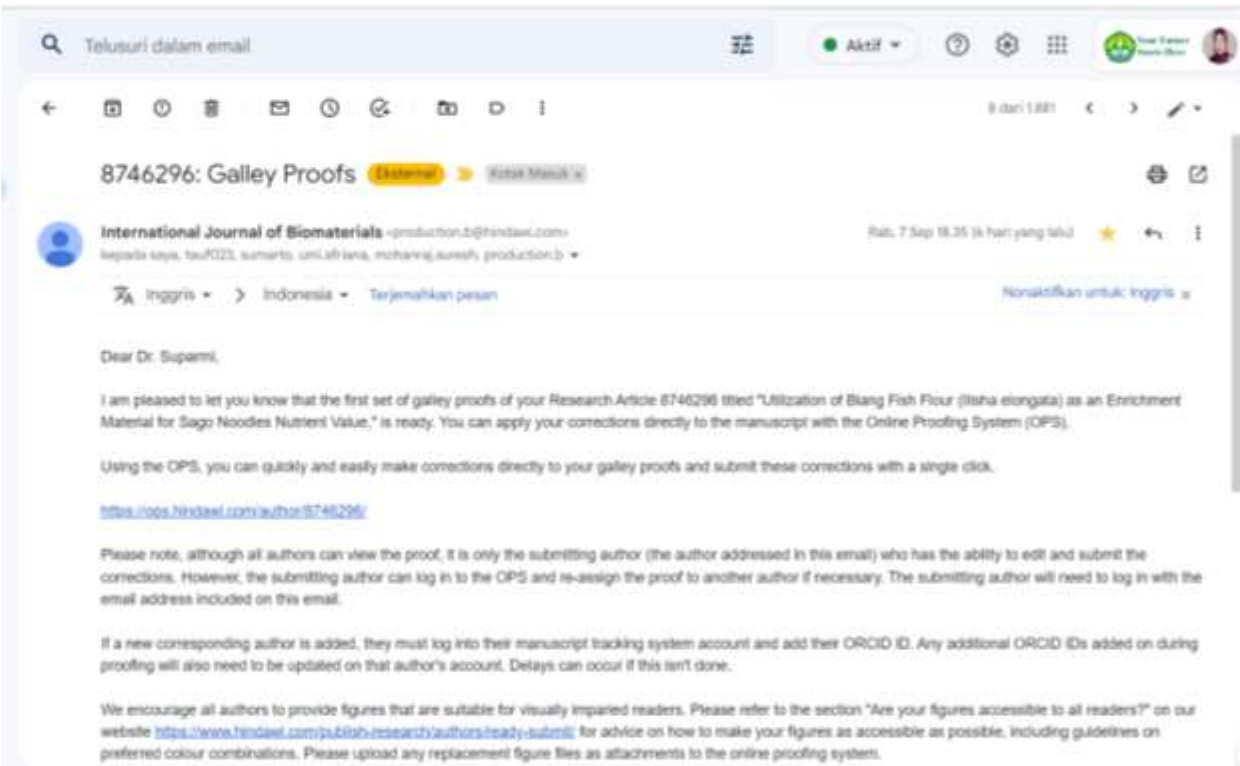
12. Galley Proofs (Rabu, 7 September 2022)



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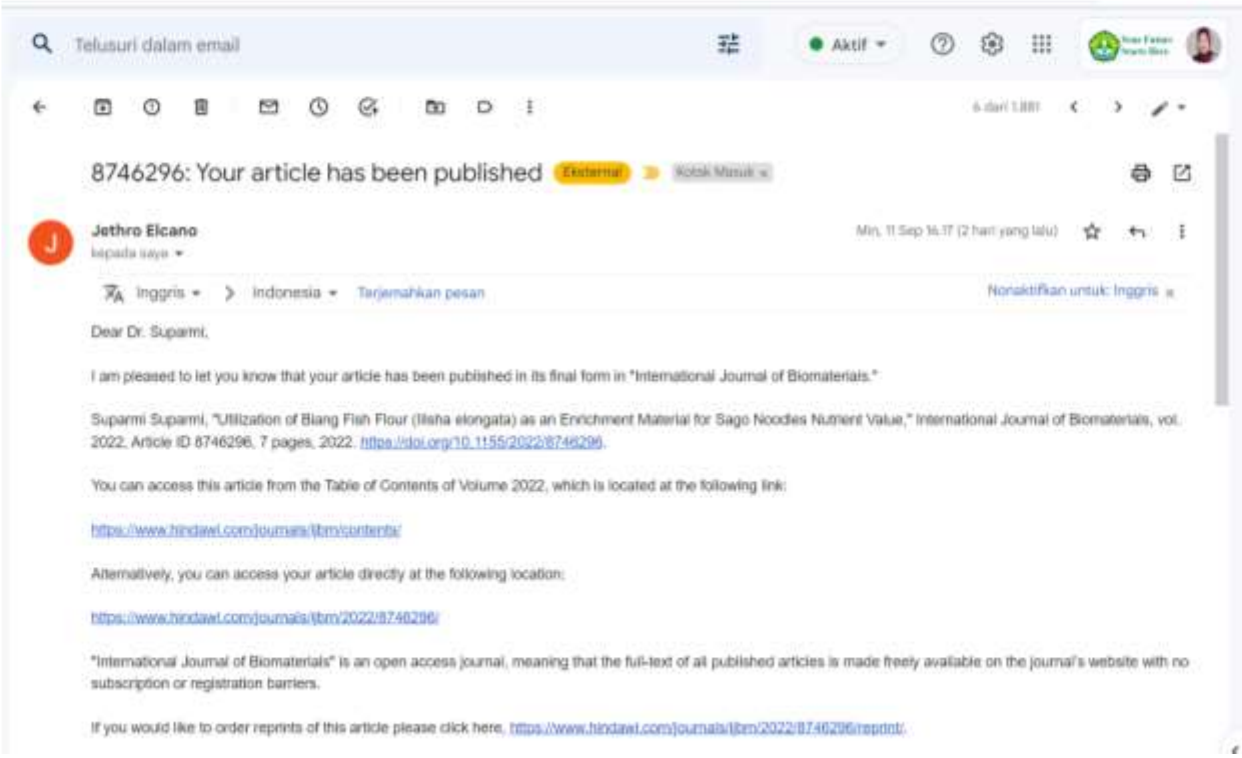
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Jethro Elcano

kepada saya

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Suparmi Suparmi, "Utilization of Biang Fish Flour (Ilisha elongata) as an Enrichment Material for Sago Noodles Nutrient Value," International Journal of Biomaterials, vol. 2022, Article ID 8746296, 7 pages, 2022. https://doi.org/10.1155/2022/8746296.

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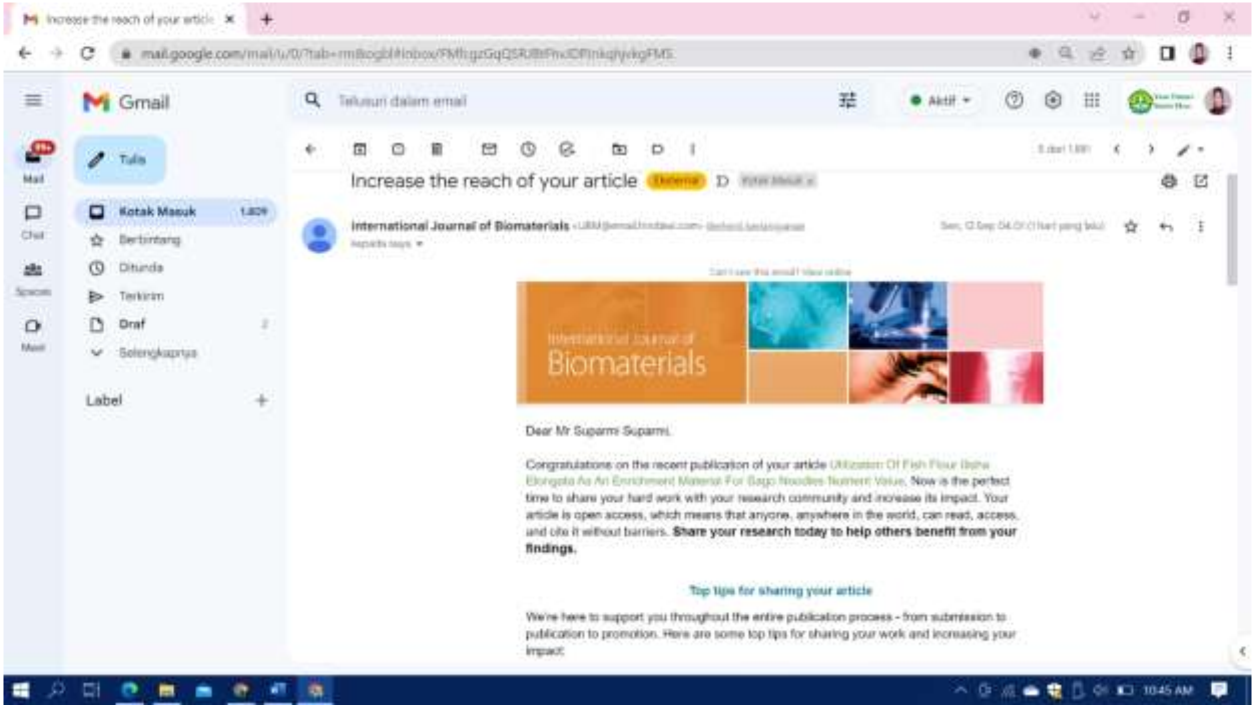
14. Increase the reach of your article (Senin, 12 September 2022)



Dear Mr Suparmi Suparmi,

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