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APPLICATION OF CATFISH FLOUR ON TEXTURE AND HEDONIC PROFILES OF PEMPEK LENJER

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ABSTRACT

African catfish flour can be used for making pempek from premix flour. The objective was to study the effect of the catfish flour and compare tapioca and wheat flour to the texture and hedonic profiles of pempek lenjer from premix flour. The methods consisted of making catfish flour and pempek from premix flour. The treatments were catfish flours of 15%, 20%, and 25% and a comparison of tapioca and wheat flours of 1:1, 2:1, and 3:1, respectively. Analysis on catfish flour was yield and proximate characteristics, as well as analysis on pempek lenjer, were texture profiles of hardness, springiness, and stickiness, and hedonic profiles of color, aroma, taste, and springiness texture. A complete two-factor random design and Duncan's post hoc analysis were used in the research. The results showed that catfish flour has a yield of 20%, moisture of 6,6%, ash of 1,54%, protein of 50,94%, fat of 16,75%, and carbohydrate of 24,17%. In addition, the more the catfish flour and the less the tapioca used led to the lower the hardness and the higher the springiness of pempek lenjer. However, it did not significantly affect the stickiness. The hedonic analysis showed that this pempek has a high preference value on all parameters. The texture profiles and hedonic test produced a combination of catfish flour of 20% and a comparison of tapioca and wheat flour of 2:1 as the chosen product in this research.

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INTRODUCTION

The catfish production in Bogor Regency always increases, where during 2014-2018, the average increase in fish production in Bogor Regency was around 16.77% (DISNAKAN 2019). Dumbo catfish is a type of freshwater fish that has 16.80% protein and 1.00% minerals (Rosa et al. 2007) and contains sufficient amounts of all essential amino acids; however, it has high moisture content. High moisture content and body pH close to neutral cause fish meat to be easily damaged, so it is necessary to be processed to reduce its moisture content but has better nutritional value, smell, taste, shape, and durability. Fish flour is a fish product obtained by removing part of the water, amount of the fat, or entirely in fish or fish residue (Tawali et al. 2018). Catfish flour with other flours can be used as a raw material for making traditional food of pempek. Nofitasari et al. (2015) reported that catfish pempek has an excellent chewy texture with a savory taste.

Alhanannasir et al. (2018) and Saparudin and Murtado (2017) dried their pempek using a dryer to extend the shelf life, as well as Pratama et al. (2016), used vacuum packaging in maintaining the quality of pempek products. In addition, improvement in shelf life of pempek can be converted as premix flour. Hakiki and Afifah (2019) explained premix flour is made to instant something so that it provided convenience, saved time in the manufacturing process, and had adequate storage capacity. There were several researches on premix flour of pempek, such as Zuly et al. (2019) used protein hydrolysate of rebon shrimp as well as Tawali et al. (2019), and Manggabarani (2017) used mackerel fish flour. The choice of catfish flour as a substitute for fresh fish in making pempek can facilitate the process of mixing or adding to other ingredients; however, the characteristics of fish meat in dry conditions are different from the characteristics of fresh fish meat can affect the pempek texture. One of them is wheat flour (gluten) to improve the pempek texture from premix flour. Sugito and Hayati (2006) improved in their pempek by using gluten to improve the texture. Tawali et al. (2019) also used wheat flour to enhance the texture in their pempek premix flour. While, Manggabarani (2017) utilized sago flour as texture improver of instant pempek. The texture is an essential factor in determining the quality of pempek (Ririsanti et

al., 2017). Oksilia and Pratama (2018) reported the hardness of pempek from type III resistant starch tapioca. In addition, Aminullah et al. (2020) studied the pempek texture profile of fresh African catfish with a mixture of tapioca and taro flour on parameters of hardness, chewiness and stickiness. Research on the texture profile of pempek products made from premix flour and based on African catfish has not been reported.

Research on the innovation of making pempek from premix flour based on African catfish has the aim to study the texture characteristics such as hardness, chewiness, and contortion profiles, as well as the preference profile of the panellists to the resulting pempek lenjer.

METHODS

The research consisted of preparing catfish flour, making pempek lenjer from premix flour, and analyzing physicochemical properties of catfish flour as well as texture and preference of pempek lenjer.

Materials and Tools

The materials in this research included African catfish obtained from Gadog Catfish Farm, Bogor Regency; tapioca from PT. Boga Jaya Flour; medium protein flour from PT. Bogasari; and additional ingredients in the form of seasonings, including salt from PT. Susanti Megah, garlic powder from CV. Citra Karya Mandiri, pepper from PT. Motasa Indonesia, and flavorings from PT. Sasa Inti. The tools included steamers, electric food dehydrator type MKS-DR10 (PT Toko Mesin Maksindo, Indonesia), blenders, digital scales, stirrers, and supporting tools for chemical analysis and texture analyzer type TexturePro CT V1.2 Build 9.

The Process of Making African Catfish Flour

This stage was the preparation stage of the ingredients needed in making premix flour, including starting with the manufacture of catfish meat flour. The process of making catfish flour followed Nandhani and Yuniarta (2015) method. The head, offal, skin, and bones of the catfish were removed so that only the meat was obtained. The fish meat was then washed with water and then immersed in lime juice with a ratio of 1:5 (lime: water) for 30 minutes. The fish that has been soaked was then steamed at 100 °C for 30 minutes. The fish meat that has been cooked and soft was

pressed by wrapping the fish with a calico cloth and then pressed manually. Then dried using a food dehydrator at 40 °C for 13 hours until the fish meat was dry, then the dried fish meat was weighed to determine the yield, then mashed and then sieved with a 90 mesh sieve.

Making Pempek Lenjer from Premix Flour

This stage consisted of making premix flour and traditional pempek lenjer. The method of making premix flour followed Tawali et al. (2018), namely mixing the ingredients according to the treatment. The formulation for making instant premix flour of pempek based on Putera (2005), namely 1 part fresh fish: 1 part tapioca, but in this study, the added portion of catfish flour refers to 1 part of fresh fish meat that has been dried, with the addition of a mixture of tapioca and wheat flour used to make pempek dos (pempek without fish). Pempek was made with a diameter of 2 cm and a length of 6 cm. It was boiled in boiling water (100 °C) for 15 minutes.

Experimental Design

The research design used was a completely randomized design using two factors. The first factor is the use of catfish meat meal (A), and the second factor is the ratio of the amount of tapioca to the wheat flour used (B). The treatment levels used for the first factor were A1 (15% of the weight of the flour mixture as much as 300 grams), A2 (20%), and A3 (25%). While, the level of treatment used in the second factor, namely the ratio of tapioca flour to wheat flour, is B1 (1: 1), B2 (2: 1), and B3 (3: 1). Other additives in the form of spices include salt (2% of the weight of the flour mixture+fish flour), garlic powder (5%), pepper (1%), and flavorings (1%) as well as warm water (45-50 °C) of 70% (by weight of fix premix flour). The detailed formulation of pempek premix flour can be seen at Table 1.

Catfish Flour Analysis

Yield (AOAC 2005)

Yield (%) = (weight of flour obtained (grams)) / (weight of wet fish meat (grams)) X 100%

Moisture content (AOAC 2005)

Analysis of moisture content in the product was carried out using the oven method. A sample of 2 grams was put on the dried porcelain plate, dried in an oven at 105 °C for 3 hours. The dried sample was cooled in a desiccator and weighed.

The work was repeated until constant weight. Calculation of moisture content:

$$\% \text{ Moisture Content} = (A-C) / B \times 100\%$$

where A = weight of plate + sample before drying (g), B = weight of initial sample (g), and C = weight of plate + sample after drying (g).

Ash content (AOAC 2005)

Porcelain plate was dried in an oven at 100 °C for 30 minutes (a). A sample of 2 grams (b) was weighed in a known weight porcelain plate. Sample was burned on a Bunsen until it did not smoke. The burned sample was put in a furnace with a temperature gradually up to 550 °C and held for 2 hours until the sample was light gray. The sample was cooled in a desiccator and then weighed (c).

$$\text{Ash content (\%)} = (c-a) / b \times 100\%$$

Protein content (AOAC 2005)

0.2 grams of the sample were weighed and put into a 30 ml kjeldahl flask. Then 3 ml of concentrated H₂SO₄ and 1 gram of catalyst were added. The sample was digested until the solution was clear green. The liquid was cooled, then 20 ml of 40% NaOH was added slowly into the distillation tool. Under the condenser of the distillation tool, an erlenmeyer was placed which contained 25 ml of 4% boric acid solution and 2 drops of the BCG-MR indicator. The end of the condenser hose must be immersed in the solution to accommodate the distillation output. The distillation process was carried out until the container solution was dark blue and the volume was approximately 50 ml. The distillate was titrated with 0.1 N HCl until a pink color. The same procedure was carried out for blanks (without samples). The number of sample titrations (a) and titration blank (b) were expressed in mL of 0.1 N HCl.

$$\text{N content (\%)} = ((a-b) \times \text{N HCl} \times 14,007) / (\text{sample (mg)}) \times 100\%$$

$$\text{Protein content (\%)} = \text{N content (\%)} \times 6.25$$

Fat content (soxhlet) (AOAC 2005)

The fat flask was oven dried for 30 minutes and weighed. The sample was weighed as much as 2 grams, wrapped in filter paper, and covered with fat-free cotton. The filter paper containing the sample was placed in a Soxhlet extraction device connected to a condenser attached to a fat flask.

The hexane solvent was put into a fat flask with a volume of 11/2 the volume of the Soxhlet and refluxed for 3 hours. The remaining solvent in the fat flask was removed by heating in the oven, and then the fat flask was weighed.

Carbohydrate content

Carbohydrate content measurement using the by difference method, which was calculated using the following calculations:

Carbohydrate content (%) = 100% - (moisture + ash + protein + fat contents)

Pempek Lenjer Analysis

Texture profile (TexturePro CT V1.2 Build 9)

Cooked pempek lenjer, which has been steamed for 3-5 minutes for conditioning the texture, then cut into dimensions of length, width, and height of 1.5 cm; and then placed on the plate of the texture analyzer and under the probe. Measurement of the pempek lenjer texture profile was conducted using a texture analyzer type TexturePro CT V1.2 Build 9. The probe set used was TA4/1000 with a probe diameter of 38.1 mm. The texture analyzer settings used were as follows:

Dimensions:		
Shape:	Block	
Length:	14,86	mm
Width:	0	mm
Depth:	0	mm
Test Method		
Test Type:	TPA	
Target:	15	%
Hold Time:	0	s
Trigger Load:	4,5	g
Test Speed:	0,5	mm/s
Return Speed:	0,5	mm/s
# of Cycles:	2	
Recovery Time:	0 s	
Same Trigger:	True	
Pretest Speed:	2	mm/s
Data Rate:	10	points/sec
Probe:	TA4/1000	
Fixture:	TA-BT-KI	
Load Cell:	4500g	

Table 2 shows the moisture content of the African catfish flour is 6.6%. This is in line with the provisions of FAO, which stated that the moisture content standard of fish flour for food was a maximum of 10% (Buckle et al. 1985). In addition, this value is also in accordance with

Mervina et al. (2012), who reported the moisture content of African catfish flour was 7.99%, and Fatmawati and Mardiana (2014) who reported moisture content of snakehead fish flour of 8.22%. This moisture content is closely related to the growth of microorganisms, where microbes can grow at a moisture content of 14-15%. The ash content in the African catfish flour is 1.54%. This is lower than Mervina et al. (2012), which is 4.83%. The low level of ash in the fish flour is made due to the raw materials used. According to Rosa et al. (2007), fresh African catfish has an ash content only of 1.00%.

The protein content of African catfish flour is 50.94% (Table 2). This result is close to the protein content of catfish flour from the research of Nandhani and Yunianta (2015), which was 56%. However, it is lower than the FAO standard, which is 60% (Buckle et al. 1985). Gokce et al. (2004) explained that the chemical composition of fish meat was influenced by internal factors such as fish species and external factors such as fish-eating habits. In addition, Fatmawati and Mardiana (2014) reported that the chemical composition of fish flour was also determined by the processing method. According to Rosa et al. (2007), the protein content of fresh African catfish was 16.80%, which was lower than that of snakehead fish of 19.71% (Chasanah et al. 2015) and mackerel fish of 20.20% (Purwaningsih 2010).

In addition, the fat content of the African catfish flour is 16.75%. This is higher than Nandhani and Yunianta (2015), which showed a fat content value of 10.73%, and Mervina et al. (2012), which was 10.83%. The high-fat content is closely related to the raw materials used. According to Rosa et al. (2007), fresh catfish contained a fat content of 5.70%. Apart from raw materials, the process of making fish flour also affects the final fat content. The mechanical pressing process is not carried out in this study so that the fat contained in the meat is not reduced completely. The carbohydrate content in Table 2 shows a value of 24%. This result is higher than that of African catfish flour in Mervina et al. (2012), which showed a carbohydrate content of 20.51%.

Texture Profile of Pempek Lenjer from Premix Flour

The texture is an important factor in determining the quality of food products, including pempek (Ririsanti et al., 2017). The physical characteristics of pempek products can be measured by physical analysis using a Texture Analyzer, which can measure the texture profile of a product, including hardness, chewiness, and stickiness. The measurement of the hardness, chewiness, and stickiness of pempek lenjer from premix flour can be seen in Table 3.

Hardness Texture

Table 3 shows that the hardness of pempek with African catfish flour tends to decrease its hardness. This is in accordance with Aminullah et al. (2020), who reported that the addition of fish in making pempek could reduce pempek hardness. This is related to protein content, where the more protein is used, the lower the hardness of the pempek product. This is explained by Oksilia and Pratama (2018) that protein has the ability to bind water so that with more protein, the more water is bound, which has implications for decreasing the hardness of a product.

Table 3 also shows that the addition of more tapioca can increase the hardness of the pempek product. Aminullah et al. (2020) reported that

more tapioca additions tend to increase the hardness of the pempek product produced. According to Guo et al. (2003), tapioca has amylose content, which plays a role in forming the hardness texture of a product. Amylose plays a role in increasing hardness compared to amylopectin, where after undergoing gelatinization, amylopectin will form a soft gel, while amylose will form a hard gel (Luna et al. 2015; Supriyadi 2012). This is also supported by Sunarlim and Triyantini (2003), who stated that the increasing concentration of tapioca resulted in harder products because of the higher amount of starch. This is in line with Lin et al. (2016), who reported that high amylose flour has a tougher powdery gel, adhesive, and compact than medium and low amylose flour. The more amylose in the sample will limit the development of the granule and maintain the integrity of the granule, and the stronger the bonds between the molecules led to the higher the consistency of hardness (Luna et al. 2015).

The Duncan's post-test in Table 3 shows an interaction, namely that there is a tendency for the combination of less African catfish flour and more tapioca produces harder pempek than the combination of more African catfish flour and less tapioca.

Table 1 Formulation of Pempek Premix Flour (based on 300 g of tapioca and wheat flour)

Code	Materials (gram)						
	Catfish flour	Tapioca	Wheat flour	Garlic powder	Salt	Pepper	Flavourings
A1B1	45	150	150	17.25	6.9	3.45	6.9
A1B2	45	200	100	17.25	6.9	3.45	6.9
A1B3	45	225	75	17.25	6.9	3.45	6.9
A2B1	60	150	150	18	7.2	3.6	7.2
A2B2	60	200	100	18	7.2	3.6	7.2
A2B3	60	225	75	18	7.2	3.6	7.2
A3B1	75	150	150	18.75	7.5	3.75	7.5
A3B2	75	200	100	18.75	7.5	3.75	7.5
A3B3	75	225	75	18.75	7.5	3.75	7.5

Note: A1B1 = African catfish flour as much as 15% of the weight of flour with ratio of tapioca: wheat flour 1: 1
 A1B2 = African catfish flour as much as 15% of the weight of flour with ratio of tapioca: wheat flour 2: 1
 A1B3 = African catfish flour as much as 15% of the weight of flour with ratio of tapioca: wheat flour 3: 1
 A2B1 = African catfish flour as much as 20% of the weight of flour with ratio of tapioca: wheat flour 1: 1
 A2B2 = African catfish flour as much as 20% of the weight of flour with ratio of tapioca: wheat flour 2: 1
 A2B3 = African catfish flour as much as 20% of the weight of flour with ratio of tapioca: wheat flour 3: 1
 A3B1 = African catfish flour as much as 25% of the weight of flour with ratio of tapioca: wheat flour 1: 1
 A3B2 = African catfish flour as much as 25% of the weight of flour with ratio of tapioca: wheat flour 2: 1
 A3B3 = African catfish flour as much as 25% of the weight of flour with ratio of tapioca: wheat flour 3: 1

Table 2 Chemical Composition of African Catfish Flour

Content	Percentage
Moisture (%)	6.6
Ash (%)	1.54
Protein (%)	50.94
Fat (%)	16.75
Carbohydrate (%)	24.17

Table 3 Hardness, Chewiness, and Stickiness of Pempek made from Premix Flour

Treatment	Hardness (gF)	Chewiness (mm)	Stickiness (mJ)
Effect of catfish flour addition			
A1	3706.750 ^x	1.865 ^x	0.015 ^x
A2	2800.917 ^y	1.890 ^x	0.025 ^x
A3	2214.667 ^z	1.917 ^x	0.021 ^x
Effect of tapioca : wheat flour ratio			
B1	2454.500 ^q	1.777 ^q	0.018 ^p
B2	2457.083 ^q	1.961 ^p	0.027 ^p
B3	3810.750 ^p	1.933 ^p	0.017 ^p
Interaction of catfish flour addition and ratio of tapioca : wheat flour			
A1B1	2674.500 ^{cd}	1.600 ^a	0.025 ^a
A1B2	3652.250 ^b	1.970 ^a	0.015 ^a
A1B3	4793.500 ^a	2.025 ^a	0.005 ^a
A2B1	2564.500 ^{cd}	1.875 ^a	0.010 ^a
A2B2	1988.000 ^{de}	1.920 ^a	0.040 ^a
A2B3	3850.250 ^b	1.875 ^a	0.025 ^a
A3B1	2124.500 ^{cde}	1.855 ^a	0.020 ^a
A3B2	1731.000 ^e	1.995 ^a	0.025 ^a
A3B3	2788.500 ^c	1.900 ^a	0.020 ^a

Note: A1 = African catfish flour as much as 15% of the weight of flour

A2 = African catfish flour as much as 20% of the weight of flour

A3 = African catfish flour as much as 25% of the weight of flour

B1 = Ratio of tapioca: wheat flour 1: 1

B2 = Ratio of tapioca: wheat flour 2: 1

B3 = Ratio of tapioca: wheat flour 3: 1

The different superscript letter at one column states that it is significantly different at $\alpha = 0.05$

Chewiness texture

Table 3 shows the chewiness value of pempek with the use of African catfish flour. Although it is not statistically significant, it can be seen that on average, there is an effect of using fish flour on the resulting chewiness. The resulting pempek tends to be chewier with the use of more fish flour. This result is in line with Aminullah et al. (2020), who reported that the addition of fish could increase the chewiness of the pempek. The protein in fish can bind water, and the more fish flour used, the more protein is contained so that more water is bound. Tanikawa (2000) explained that protein molecules would bind with hydrogen and disulfide bonds to form a mesh construction that binds to form a gel with a chewy texture. The

resulting chewiness value of pempek is lower than Aminullah et al. (2020), which is made from fresh African catfish. The heating process during the manufacture of fish flour can decrease the ability of protein to give a gel texture to the product.

The results of Duncan's post hoc test in Table 3 show that the ratio of tapioca to wheat flour 2: 1 can increase the chewiness significantly. This is because tapioca contains high enough amylopectin, which can affect the chewiness of the product. According to Pangesthi (2009), starch with high amylopectin content and strong stickiness has the potential to form chewiness. The presence of protein from flour, namely gluten, causes the dough to become solid and gives it chewiness. Pramudya et al. (2014) stated that gluten was a flour protein with a chewy texture so

that the higher the use of flour in the manufacture of analog meatballs, the more chewy the texture will be. There is no interaction between the treatment of using African catfish flour and the ratio of tapioca and wheat flour to the chewiness of pempek with a range of values from 1.600-2.025 mm.

Stickiness Texture

Table 3 shows that the stickiness obtained is not much different from the stickiness of pempek made from fresh African catfish in the study of Aminullah et al. (2020), with a value range of 0.000-0.075 mJ. This is because the African catfish flour has a high-fat content (Utomo et al. 2013), where high-fat fish has low gel ability and stickiness.

Table 3 also shows that the comparative treatment of tapioca flour and wheat did not affect the stickiness level of the pempek produced. This is because the mixed flour contains high amylose from tapioca and flour and contains relatively low gluten from wheat flour so that the resulting product is not sticky. According to Indrianti et al. (2013), high amylose levels reduce the stickiness of noodle products. This is supported by Luna et al. (2015), who stated that rice with low amylose or high amylopectin causes the texture of rice to be not hard and high stickiness. The high amylopectin causes a more compact granule structure, the air space between the granules, and the larger size of the granules. There is no interaction between the treatment of using African catfish meat flour and the ratio of tapioca and flour to pempek stickiness.

Hedonic Profile of Pempek Lenjer from Premix Flour

The preference test or also known as the hedonic test, was an assessment method using the five human senses to determine consumer acceptance of the products and to show which treatment was the most preferred (Erungan et al. 2005). The test includes an assessment of color, aroma, taste, and chewiness texture parameters on a scale of 0-10 cm horizontal. The results of the preference test can be seen in Table 4.

Color

Table 4 shows the level of preference for the use of African catfish meat flour, although it is not statistically significant. However, panellists tend to like the pempek color on the use of less African

catfish flour. The use of catfish flour causes the pempek to have a brownish color. This color comes from the fish flour, which undergoes a non-enzymatic browning reaction during the fish flour production process. This mechanism was a Maillard reaction in food products containing protein occurred. In hot conditions, the amino acids from the protein react with reducing sugars from carbohydrates. Table 4 shows that pempek with more or less proportion of tapioca tends to be preferred with a tendency that is not significantly different. This is because tapioca can give a brighter color; however, according to Tawali et al. (2018), too much tapioca can cause a paler color. Although the product has a brownish color, it is still acceptable by the panelists. On the assessment scoresheet, comments from panellists are obtained that pempek has a light brownish color, so the color is somewhat favored by the panelists.

Aroma

Table 4 shows that pempek with the use of fish flour tends to be favored by panelists. This is because the fish flour has a distinctive fish aroma. According to Liu et al. (2009), the flavors contained in fish were the aldehyde, alcohol, ketone, acid, and hydrocarbon groups. Besides, more or less proportion of tapioca tends to be preferred with a tendency not to be significantly different between treatments. Tapioca has no taste and aroma, so that the use of tapioca flour on aroma parameters has no significant effect; this is reinforced by Indra et al. (2014), who stated that the use of tapioca in the manufacture of African catfish surimi meatballs did not affect significantly to aroma parameters. In addition, Munawaroh and Indrawati (2014) stated that the use of wheat flour had no significant effect on the preference for the aroma of crackers. On the assessment scoresheet, comments from the panelists that the pempek has a distinctive fish aroma so that the panelists like the pempek aroma.

Taste

The results of Duncan's post hoc test in Table 4 show that the use of catfish flour by 20% significantly increases the panelists' preference for the taste of pempek; however, the more catfish flour, namely 25%, lead to the lower the panelists' preference for pempek tastes. Using too much fish flour can make the fish taste more pronounced and relatively sharper. This is in line with Tawali et al. (2018), who reported that 30% mackerel fish flour reduced the panellists' preference for the taste of

fried pempek because the fish flavor was too sharp. Table 4 also shows that the proportion of tapioca has no significant effect on the pempek taste. Tapioca has no taste and aroma, so that the use of tapioca flour on taste parameters has no significant effect. On the assessment scoresheet, the panelists comment that pempek has a distinctive taste of fish, but it is not the typical muddy taste of catfish. This is due to the flour processing, which causes the unique muddy taste in catfish to disappear, so the pempek taste tends to be favored by panelists.

Chewiness

Table 4 shows the somewhat preferred chewiness value even though it is not statistically significant, but on average, there is an effect. the panelists' asses that the more the catfish flour tends to decrease panelists' preference for pempek chewiness. The use of fish flour as much as 15% (in a reasonably small amount) tends to be preferred. This is related to the protein from the fish flour, which can affect the elasticity of the

pempek. The more catfish flour used the more elasticity of the pempek. The results of Duncan's continued test in Table 4 show that the ratio of tapioca and flour to 2: 1 increased the panelists' preference for the elasticity of pempek significantly and significantly decreased the panelists' preference for the increasing use of tapioca (in a comparison of tapioca: 3: 1 flour); however, the use of less tapioca (in the ratio of tapioca: 1: 1 flour) tends to be preferred. Aprilianingtyas (2009), Ririsanti et al. (2017), and Rifani et al. (2015) explained that pempek with not too chewy texture was the most preferred pempek. This is explained by research that elasticity is influenced by high levels of amylopectin in starch (Pangesthi 2009) as well as by gluten. In the assessment scoresheet, comments from panelists are obtained that the texture of the pempek is chewy but not too chewy. The combination of using 20% catfish flour and a 2: 1 ratio of tapioca to flour is the most preferred combination of chewiness parameters.

Table 4 Preference profile on parameters of color, aroma, taste, and chewiness of pempek lenjer made from premix flour

Treatment	Color	Aroma	Taste	Chewiness
Effect of catfish flour addition				
A1	6.6 ^x	6.2 ^x	7.0 ^y	5.8 ^x
A2	6.4 ^x	6.2 ^x	7.5 ^x	6.0 ^x
A3	6.2 ^x	6.3 ^x	7.1 ^y	5.7 ^x
Effect of tapioca : wheat flour ratio				
B1	6.5 ^p	6.2 ^p	7.2 ^p	5.6 ^q
B2	6.5 ^p	6.3 ^p	7.2 ^p	6.4 ^p
B3	6.2 ^p	6.3 ^p	7.3 ^p	5.5 ^q
Interaction of catfish flour addition and ratio of tapioca : wheat flour				
A1B1	6.7 ^a	6.2 ^a	7.0 ^a	5.7 ^a
A1B2	6.8 ^a	6.2 ^a	7.0 ^a	6.2 ^a
A1B3	6.2 ^a	6.2 ^a	7.0 ^a	5.5 ^a
A2B1	6.5 ^a	6.2 ^a	7.4 ^a	5.8 ^a
A2B2	6.6 ^a	6.2 ^a	7.5 ^a	6.6 ^a
A2B3	6.2 ^a	6.2 ^a	7.6 ^a	5.5 ^a
A3B1	6.4 ^a	6.2 ^a	7.1 ^a	5.3 ^a
A3B2	6.0 ^a	6.4 ^a	7.1 ^a	6.3 ^a
A3B3	6.2 ^a	6.4 ^a	7.2 ^a	5.6 ^a

Note: A1 = African catfish flour as much as 15% of the weight of flour

A2 = African catfish flour as much as 20% of the weight of flour

A3 = African catfish flour as much as 25% of the weight of flour

B1 = Ratio of tapioca: wheat flour 1: 1

B2 = Ratio of tapioca: wheat flour 2: 1

B3 = Ratio of tapioca: wheat flour 3: 1

The different superscript letter at one coloumn states that it is significantly different at $\alpha = 0.05$

Based on the results of the hardness test, the combination of 20% African catfish flour and a 2:1 ratio of tapioca and wheat flour (A2B2) is a formula combination that produces a hardness value in line with Aminullah et al. (2020) in the treatment without the use of taro flour that has a hardness of 1914.25 gF. Also, Manggabarani (2017) reported that 20% of fish flour was the chosen formula based on the organoleptic tests. In addition, the panelists' preference test on the parameters of color, aroma, taste, and chewiness texture, although not statistically significant, shows that the level of preference tends to be higher in this formulation compared to other formulations.

CONCLUSION

The African catfish flour in this study has a yield of about 20%, moisture content of 6.6%, ash content of 1.54%, protein content of 50.94%, fat content of 16.75%, and carbohydrate content of 24.17%. The main research results showed that the different proportions of African catfish flour in premix flour have a significant effect on hardness, where the more fish flour used tended to the lower the hardness and has a significant effect on preference in taste parameters. Premix flour with the ratio of tapioca and wheat flour has a significant effect on the hardness and chewiness, where the ratio of more tapioca tended to the higher the hardness and chewiness of the pempek and had a significant effect on the chewiness parameter. Based on these results, the combination of catfish flour as much as 20%, and the ratio of tapioca and flour 2: 1 was selected as the chosen combination for producing good pempek lenjer product from premix flour.

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