Characteristic and shell life of the surimi by-product from patin fillet, for fishball use

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Abstract. Catfish (*Pangasius hypopthalmus*) is widely cultivated in Riau province, especially in the Kampar area, so that in this area there are many catfish processing industries, producing fish fillets and smoked fish. The catfish processing industry (fillet and smoking) produces about 20-67% solid waste (by-product) in the form of tetelan meat, bones, belly fat, and entrails (offal). This study aimed to utilize the waste of tetelan meat into fishball products with various formulations. The method used was the experimental method with one treatment factor, namely the formulation of fishball processing with 2 treatment levels, and each treatment was repeated 2 times. The experimental results of this study compared various formulations based on organoleptic consumer acceptance. The results showed that fishball FB1 and FB2 were not different regarding the organoleptic value, proximate, micorbial test, and shell life time. Fishball FB2 products are more appreciated than FB1 products because of the tapioca and corn flour addition. Furthemore, the by-product raw material in the form of tetelan meat can be processed into surimi with an organoleptic quality that meets the Indonesian standards.
Key Words: *Pangasius hypopthalmus*, solid waste, fishball products .

Introduction. Catfish is one of the freshwater fish species highly available, especially in the center of the catfish production in Riau province, namely the Kampar district. 70% of Riau's total catfish production of 22,369.02 tons comes from the Kampar district 1 (DKP 2019). In Riau province, especially in the Kampar district, products from catfish are still traditionally processed, for instance as salai fish. The fat content in catfish meat is very high, causing a slightly yellowish color and inhibiting the gel formation, so that products processed from catfish have a non-spongy texture (Dewita & Syahrul 2014, 2015). According to Dewita et al (2021), forgetting a good gelation of the products made from catfish, leaching of the catfish meat can be used to remove the fat. The leaching product of the catfish meat is called surimi. The surimi is processed from groundfish meat and it is extracted with water treated with an anti-denaturing agent, then frozen (Asikin et al 2020). Surimi is an intermediate product or basic raw material in the manufacture of kamaboko (fish gel products), sausages, fish nuggets, otak-otak and fishballs. The utilization of catfish (*Pangasius hypopthalmus*) surimi into ready-to-eat products such as fishball has not been maximized, because information about its nutritional content and innovation is still limited, so people are not interested in using catfish surimi as a value-added product. Fishballs are included in one form of ready-to-eat products that are favored by the public because they have a long shelf life and high selling value.

Fishballs are processed from mashed meat (surimi) which is added with spices, then molded like a ball and then covered with breadcrumbs on the surface. At this point, they are ready to be fried (Asikin et al 2019). In today's modern era, the lifestyle of this society has changed from static to dynamic. In this case, time has a very important role, especially for urban communities who have a busy life and high mobility. To support these activities, they need instant or ready-to-eat foods that have high nutritional value or are rich in protein.

Fish raw materials are not only popular and consumed both in fresh and processed forms, they can also be processed into products with good nutritional and economic value, such as ready-to-eat fish-based processed products, namely fishballs. These processed fishery products are currently popular on the market for meeting protein needs for the community (Nurjanah et al 2019). This is due to the demands of modern life, requiring ready-to-eat foods that have high nutritional value. Apart from practical reasons, the popularity of fish is also supported by its delicious taste, low price and easy availability in various places. Currently, meatballs are processed from beef and chicken pulverized mea, which are relatively expensive raw materials, limiting the profits iof the industry. This study aimed to examine the utilization of waste by-products of processing catfish fillets into fishball products. In the fishball processing process, in addition to fish raw materials, additional ingredients are needed such as spices that affect the taste, aroma, color and texture of fishballs.

Material and Method

Materials and tools. The material used in this study, namely tetelan meat waste (by-product) was obtained from processing catfish fillets. Other materials were binders and spices as well as packaging materials (aluminum paper). In addition, materials used for the analysis of proximate compositions such as distilled water, selenium catalyst, H_2SO_4 (Merck KGa), H_3BO_3 (Merck) 2%, filter paper, cotton fat-free, HCl (Merck) 0.1 (Merck) N, NaOH (Merck) 40 mL, solvent hexane (Sigma Aldrich), bromcresol green(Sigma) 0.1%, and methyl red 0.1% (Sigma), aquades, Pa. chloroform, and Pa. methanol, NaOH (Merck) 0.5 N in methanol, BF3 (Merck), saturated NaCl (Merck), n-hexane (Merck), and anhydrous Na_2SO_4 (Merck). The tools needed in this research are used for fishball processing and quality analysis. This research was carried out using trial and error formulation technology by mixing crushed fish raw materials, binders and spices. The method used is an experimental method with one treatment factor, namely the formulation of fishball processing with 2 treatment levels, and each treatment was repeated 2 times.

Research procedure. The main raw material used in making surimi is tetelan meat which comes from leftover meat that is still attached to the bones from the fish milling process. The minced meat obtained is mashed using a food processor to produce mashed meat. Furthermore, this mashed meat is used as the raw material for surimi.

The procedure for making catfish surimi was implemented according to Lestari (2011) and it was modified, as follows:

1. The mashed meat was washed using ice water (cold water) at a temperature of 5-10ºC. The ratio of fish to cold water was 1-3; the washing process was carried out 2 times, then the result was pressed using a gauze.
2. After that, the leaching process was carried out, namely the process of immersion in cold salt water (0.3%), with a ratio of 1:4 for 15 minutes, while stirring, then the result was pressed using a gauze.
3. Then the pressed minced meat was added with 0.3% sorbitol and 0.2% sodium tri polyphosphate, so that the catfish surimi was obtained.
4. Furthermore, the raw material for surimi is added to the fishball formulation (Table 1), then the dough is made, molded into small rounds, then soaked in boiling water to form fishballs.

The formulation and processing of surimi and fishball products can be seen in Table 1 and Figure 1.

Table 1

Fishball formulation

Ingredients	*F1*	*F2*
Meat	250 g	250 g
Garlic	3	3
Salt	2	2
Monosodium glutamate	10 g	10 g
White peppers	1	1
Egg	1	1
Carrot	1	1
Cheese	100 g	100 g
Tapioca	0	4
Wheat	2	0
Corn starch	0	2
Sago starch	4	0
Bread starch	2	2
Water	500 mL	500 mL

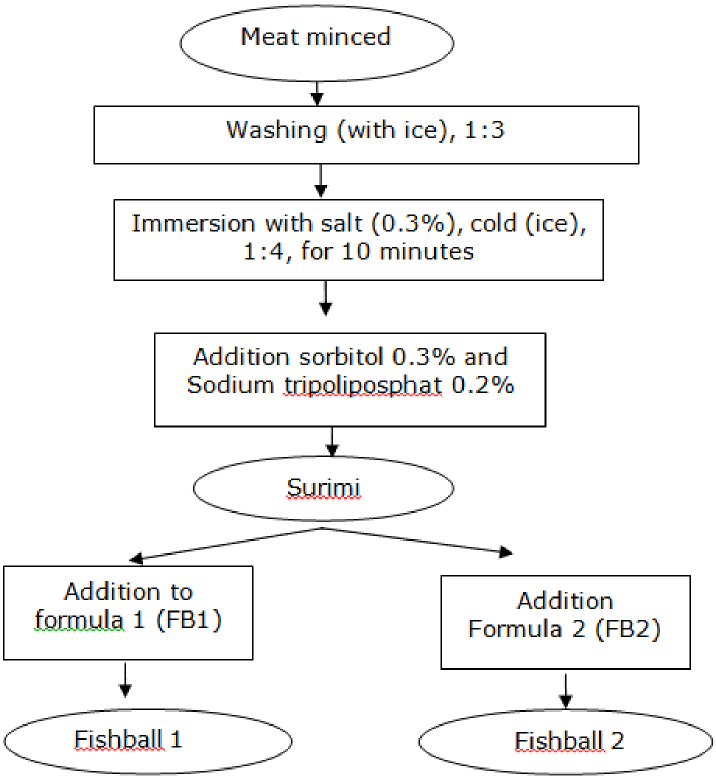

Figure 1. Flowchart of making surimi and fishball.

Data analysis. The data obtained was processed, tabulated and graphed, then the processed data was analyzed descriptively, as simple statistics.

Results. According to SNI 01-2649-1992 (BSN 1992), the organoleptic freshness characteristics of surimi raw materials are at least (a) appearance and color (clean, meat color specific for each fish species), (b) aroma (freshness specific for fish species), (c) meat (elastic, dense and compact) and (d) taste (neutral to slightly sweet). 25 moderately trained panelists performed a surimi organoleptic quality assessment, using the parameters of appearance, aroma, taste and texture. In addition, proximate and microbiological tests were also carried out. The results of the quality test of surimi can be seen in Table 2.

Table 2

Catfish surimi analysis and SNI 01-2694-1992 (BSN 1992)

Parameters	*Result*	*SNI Standard*	*Unit*
Organoleptic	7	7	
	Microbial contamination		
Total bacteria max.	1 x 10^4	5 x 10^5	Colony g^{-1}
Escherichia coli max.	1 x 10^2	<3	Colony 25 g^{-1}
Staphylococcus max.	1 x 10^2	<3	Colony 25 g^{-1}
Salmonella	Negative	Negative	
	Chemical contamination		
Ash max.	0.75	1	% Dry based
Fat (max.)	0.35	0.5	% Dry based
Protein (min.)	16.27	15	% Dry based

Organoleptic assessment. The results of the organoleptic quality analysis of catfishball fish with different formulations can be seen in Table 3.

Table 3

Characteristics of catfishball fish with different formulations

Products	*Parameter*			
	Appearance	*Odor*	*Texture*	*Taste*
Fishball 1	7.46	7.25	7.52	7.42
Fishball 2	7.80	7.56	7.64	7.58

In Table 3 it can be seen that the organoleptic characteristics of fishballs with different formulations also show different values for each fishball. This is presumably due to the use of different formulation materials and it turns out that the panelists gave a higher rating on Fishball 2 products.

Proximate. The results of the analysis of the proximate quality of catfishball meat with different formulations can be seen in Table 4.

Table 4

Characteristics of catfishball fish with different formulations

Proximate (%)	*FB1*	*FB2*
Moisture	55.24±0.5	54.38±0.4
Protein	8.06±0.6	8.86±0.7
Fat	9.90±0.2	8.27±0.6
Ash	1.99±0.25	1.56±0.4

Based on Table 3, the proximate composition of Fishball 1 and Fishball 2 is relatively similar, which indicates that the formulation has no effect on the proximate composition.

Discussion. In the business of processing catfish fillets, the size of the fish needed is 700–1,000 g per head, and usually produces around 50-60% fillet meat and 10-20% tetelan meat (peeled from the bones). This by-product is used in this study to produce catfish surimi because this raw material is abundant and underutilized. The surimi produced from catfish is yellowish, due to the high-fat content of catfish. According to Suparmi et al (2021), the appearance or appearance of a food product is influenced by several factors, including ingredients for food processing, such as the use of tapioca and cornstarch binders, which make the fishball more compact and attractive. Aroma differences case different tastes of the fishballs; for instance, Fishball 2 products are more appreciated than Fishball 1 products. According to Alhanansir et al (2017), this is thought to be due to the aroma of Fishball 2 coming from the surimi, the binders, such as tapioca flour and cornstarch, and other added spices. Furthermore, the results showed that the addition of tapioca flour and cornstarch can improve the texture characteristics of Fishball 2. It is suspected that the binding material and fish surimi are sources of myofibril proteins that form a gel, so that Fishball 2 has a chewy, compact and non-sticky texture (Hardoko 1994). The results of the study (Table 4) showed that the use of different formulations has an effect on the organoleptic assessment of catfish fishballs. According to Lewles & Heyman (2010), the taste of a food comes from the ingredients; when processed, the taste is influenced by the ingredients added in the processing and also by the proximate composition. The aggregated quality test results (organoleptic, proximate and microbiological) can be seen in Table 5.

Table 5

Fishbal analysis results

Parameters	*FB 1*	*FB2*	*SNI standard*	*Unit*
Organoleptic	7	7	7	
Microbial contamination				
ALT max.	1×10^4	1×10^4	1×10^5	Colony g^{-1}
Escherichia coli max.	1×10^2	1×10^2	<3	Colony 25 g^{-1}
Staphylococus max.	1×10^2	1×10^2	<3	Colony 25 g^{-1}
Salmonella	Negative	Negative	Negative	
Chemical contamination				
Ash total max.	1.99±0.3	1.56±0.32	2	% Dry based
Protein min.	8.06±0.46	8.86±0.456	7	% Dry based
Moisture max.	55.24±0.60	54.38±0.68	65	% Dry based

In Table 5 it can be seen that the different formulations of the fishballs met the standard SNI 7266 (BSN 2014). It means that the formulation treatment has no effect on the quality of the resulting fishball. To determine changes in quality and shelf life of fishball, the product was stored for 0, 15, 30 and 45 days at cold temperatures (-50°C). Changes in product quality during the storage, based on proximate values and peroxide values, can be seen in Table 6.

Table 6

Changes in the proximate value of fishball products with different formulations during the cold storage (-50°C)

Product	*Shell life (days)*	*Moisture (%)*	*Protein (%)*	*Fat (%)*	*Ash (%)*	*Peroxide (Meq g^{-1})*
Fishball 1	0	55.24	8.35	9.90	1.99	5.27
	15	56.64	8.08	9.82	1.86	5.86
	30	62.12	7.62	8.86	1.82	6.48
	45	63.76	6.56	8.27	1.76	8.56
Fishball 2	0	53.96	8.96	13.76	1.71	6.41
	15	54.74	8.60	12.84	1.55	6.80
	30	55.90	7.18	11.92	1.46	7.42
	45	56.44	7.09	10.56	1.12	9.36

In Table 6 above, it can be seen that the product storage for 45 days has a proximate value that still meets the SNI standard, with a peroxide value which has not exceeded the rejection threshold, which is <10 meq g^{-1}. This means that all fishball products made from raw materials from the by-products of processing catfish, especially fillet processing, are still fit for consumption. This is presumably due to the influence of the packaging used, which is a combination of aluminum foil with HDPE packaging, and to the cold temperature (-50^{0}C), inhibiting the deterioration of quality during the storage. According to Dewita et al (2020) and Soraya & Hidayat (2021), the Al-HDPE packaging has a lower permeability to O_2, so the respiration process is slower. Furthermore, the analysis of the product shelf-life quality (Table 6) uses several parameters, including the water content and peroxide number. According to Anandita et al (2017), the water content in food ingredients also determines the level of acceptance and durability of the food itself. Furthermore, the microbiological analysis of the product at the end of the shelf life (45 days) was also carried out and it can be seen in Table 7.

Table 7

Microbiological value of fishball products with different formulations during 45 days storage

Parameter	*Fishball 1*	*Fishball 2*	*SNI Standard*
Microbs total	1×10^4	1×10^4	1×10^4
E. coli	Negative	Negative	Negative
Salmonella	Negative	Negative	Negative
Staphylococcus	<10	<10	1×10^2

In Table 7 above, it can be seen that all fishball products, with different formulations, during a storage of 45 days at cold temperatures (-50ºC) in packaging combining aluminum foil and HDPE, still meet SNI standards.

Conclusions. Based on the results of the research that has been carried out, the following can be concluded: the by-product raw material in the form of tetelan meat can be processed into surimi with an organoleptic quality that meets the 01-2649-1992 SNI standard. The utilization of surimi to produce fishballs with different formulations can meet the 01-2649-1992 SNI standard organoleptically, proximately and microbiologically, with a shelf life of 45 days at cold temperatures (-50ºC).

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Conflict of interest. The authors declare no conflict of interest.

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