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Quality Improvement of Catfish Floss (*Clarias gariaepenus*) Through Oil Reduction Technology with Spinner and Press Tools

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ABSTRACT

The nutritional content of catfish allows this freshwater fish to be processed into a variety of products, one of which is fish floss. Fish floss is a product that is popular among the community so it can be sold to increase the income. Unfortunately many fish floss products have poor quality, one of poor quality example is oil appeared in the packaging which makes fish floss product tends to get rancid quickly. The purpose of this study was to determine the optimum shelf life of best quality catfish floss. The experimental design of this study was divided into three treatments: spinnered, pressed, and spinnered-pressed. The quality of fish floss were observed every 12 days for 48 days.The results showed that there were significantly effect of floss catfish with different treatments of oil reduction. The best quality of catfish floss was achieved by spinnered-pressed treatment at 36 days storaging, with an average value of water content 4.99%, 28.39% of protein content, 9.15% of fat content, 4.99 meq kg^{-1} of peroxide value, and total plate count 6.9 x 10^{-3} cfu g^{-1}.

Keywords: *catfish, fish floss, oil reduction, quality*

ABSTRACT

Kandungan nutrisi ikan lele memungkinkan ikan air tawar ini diolah menjadi berbagai produk, salah satunya adalah abon ikan. Abon ikan adalah produk yang populer di kalangan masyarakat sehingga dapat dijual untuk menambah penghasilan. Sayangnya permasalahan banyak produk abon ikan memiliki kualitas buruk, salah satu contoh kualitas buruk adalah minyak muncul dalam kemasan yang membuat produk Abon ikan cenderung cepat tengik. Tujuan dari penelitian ini adalah untuk menentukan umur simpan optimal dari benang abon lele kualitas terbaik. Desain eksperimental dari penelitian ini dibagi menjadi tiga perlakuan: spinnered, pressed, dan spinnered-pressed. Kualitas Abon ikan diamati setiap 12 hari selama 48 hari. Hasil penelitian menunjukkan bahwa ada pengaruh yang signifikan dari abon ikan dengan perlakuan berbeda pengurangan minyak. Kualitas terbaik dari Abon ikan dicapai dengan perlakuan pemintalan pada penyimpanan 36 hari, dengan nilai rata-rata kadar air 4,99%, kadar protein 28,39%, kadar lemak 9,15%, kadar lemak 4,99 meq kg^{-1}, dan jumlah plat total 6,9 x 10-3 cfu g^{-1}.

Kata Kunci : *ikan lele, Abon ikan, penurunan minyak, kualitas*

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1. Introduction

Catfish is one type of freshwater fish that are quite economical and easily cultivated. Data from the Ministry of Maritime Affairs and Fisheries in 2017 states that in the year period of 2012 to 2016, fish consumption in Indonesia was relatively high at > 31.4 per Kg/capita. From the aquaculture sector, catfish occupies the second leading after Tilapia as the most popular fish in the community so that the level of consumption continues to rise (MMAF, 2017). The high nutrient content of catfish and the relatively low selling price make catfishes processed become more practical and popular, one like catfish floss. Catfish floss is one of processed fishery products by frying method. The frying method is a complex process of heat transfer and mass using cooking oil as a heat exchange medium (Dehghannya et. al., 2015; Vauvre et. al., 2015). The edible oil is also a source of energy and essential fatty acids (FAs) and serves as a carrier of fat-soluble vitamins (Choudhary and Grover, 2013; Prakash et al., 2015). Besides being fried, some fish floss processors also apply pressing techniques to reduce water content and speed up the frying time. The frying time will determine how much fat or oil content of product. Rosanag et al., (2009) stated that most of the oil was absorbed in the fried sample during first 180 s of frying, of which about 34% of the internal oil and 0.7% of the surface oil was absorbed during the first 20 s of frying. Diamante et al., (2012) observed that the oil content of vacuum-fried apricot slices decreased with the decrease of the frying time during frying. The problem is that fish floss products require a long enough frying time of approximately 30-40 minutes to be able to become dried and makes crispy texture of fish floss products. On the other hand, it will increase the level of cooking oil which has an effect on the shelf life of fish floss. The shelf life of catfish floss was generally 1-2 months depending on processing and packaging techniques (Diasa et. al., 2013). The purpose of this study was to determine the most optimal processing technique and storage time to obtain catfish floss with good quality. Khaksar et. al., (2019) stated that spinnering was reported to be a more effective approach to preserve the nutritional quality during storage and also to obtain optimal storage conditions.

2. Material and Methods

Sample preparation

Fresh catfish were collected from aquaculture pond at Klaseman, Salatiga, Central Java. After gilled and gutted off, catfish is processed into fish floss by boiled, shredded, added spices, fried and vacuum packed and also stored for 48 days. The treatment applied in making catfish floss after being fried were drained from cooking oil using a spinner with 400 rpm, then pressed, and the combination of spined and presses were shredded spinnered and pressed. Then the products were packaged in polyethylene (PE) plastic bag and stored at room temperature. The chemical characteristic of catfish floss (water content, protein content, fat content and peroxide value (PV)) and microbiological test were observed until the 48th days with every 12 days measurements.

Nutrition value: The chemical composition for water, protein, and fat content were determined according to the AOAC method (2016).

Food safety: Catfish floss was analyzed by the content of the Total Plate Count (TPC) through the Bacteriological Analytical Manual (BAM) (2001) method.

Peroxide value: Peroxide value measurement was performed according to AOCS Cd 8b-90 (2011) and expressed as mEq/kg (milliequivalents/kg) of fat. Briefly, 5 g of the oil sample were dissolved into 30 mL of acetic acid:chloroform (3:2) in a flask. The mixture was then subjected to an excess of iodide via a saturated solution of potassium iodide (0.5 mL). The flask was then swirled before the addition of saturated potassium iodide. The solution was swirled again for a minute. The peroxides present oxidized the iodide to iodine and the iodine was then titrated to a colorimetric endpoint (blue color disappeared) using 0.01 N sodium thiosulfate (Na_2S_2O) solution (standardized using potassium dichromate and potassium iodide) with starch (10%) as an indicator. The amount of iodine produced is directly proportional to the peroxide value.

Sensory evaluation: The 15 panelists from Department of Fish Product

Technology, Diponegoro University who were previously experienced in quality evaluation participated in sensory evaluation of treated catfish floss. The sensory characteristics that were evaluated include appearance, color, flavor, taste and texture of the product, using a 9 points hedonic scale (9 = like extremely; 1 = dislike extremely).

Statistical analysis: Data obtained were analyzed by using one-way Analysis of Variance (ANOVA) and followed by a post hoc Tukey-test at 0.05 level of significance. SPSS-package was used (SPSS, 1998).

3. Results and Discussion

Water content of catfish floss

The water content of catfish floss with 3 different treatments changed significantly for up to 48 days.

Table 1. Water content of catfish floss

Treatment	Water content (%) of Catfish Floss due storage (days)				
	0	12	24	36	48
Spinnered	0.74 ± 0.29[a]	2.17 ± 0.85[b]	4.18 ± 0.36[cd]	5.58 ± 0.69[e]	6.03 ± 1.00[f]
Pressed	0.6 ±0.6[a]	2.94 ± 0.19[b]	4.16 ± 0.56[d]	5.18 ± 0.65[e]	6.13 ± 0.73[f]
Spinnered+pressed	0.42 ±0.87[a]	1.94 ± 0.35b[c]	4.17 ± 0.23[d]	4.99 ± 0.52[e]	5.23 ± 0.66[f]

Table 1 showed that water content of catfish floss statistically significant ($P < 0.05$) increase along the length of storage. However, the water content did not change significantly due to treatment for 48 days. The addition of about 2% and 3% of initial water content were observed after 12 days of storage and so on for up to 48 days. The Indonesian National Standardization (2013) requires that the water content of fish floss should be lower than 7%. Based on treatments, the water contents of floss catfish followed a similar pattern, whereas tends to decreased, otherwise increased with a long storage.

The increasing of water content could mainly be due to the transfer of catfish floss water inside into surface along with outing of oil from product. However, the product quality was not negatively affected by the increasing of catfish floss water content. The water content of catfish floss in this study still lower than Mufti et. al. (2016) that prepared shredded fish with water content around 3.64-9.78%. The average of water content as seen as Table 1 still fulfil the requirement of Indonesian National Standardization and can prevent the product deterioration. It has been reported that the spoilage of meat floss is retarded when its water content falls below (Wang et al., 2016).

Protein Content of Catfish Floss

The protein content of catfish floss shown in Table 2.

Based on Table 2, we can seen that they were high level of catfish floss protein content, ranged between 25 – 32.29%. The treatment of processing statistically significant ($P<0.05$) increase the protein content, otherwise with time storage significantly impact ($P<0.05$) on decrease of catfish floss protein content.

Table 2. Protein content of catfish floss

Treatment	Protein content (%) of Catfish Floss due storage (days)				
	0	12	24	36	48
Spinnered	28.4 ± 0.55[d]	27.69 ± 0.77[c]	27.69 ± 0.3[c]	25.64 ± 0.18[b]	25.00 ± 1.54[a]
Pressed	30.32 ± 0.75[f]	29.57 ± 0.36[e]	28.12 ± 0.40[cd]	26.85 ± 0.9[bc]	25.42 ±1.05[b]
Spinnered+pressed	32.29 ± 0.92[g]	32.28 ± 0.20[g]	29.29 ± 0.45[e]	28.39 ± 0.54[cd]	26.25 ±1.52[bc]

Fat Content of Catfish Floss

Fat content of catfish floss in this study showed on Table 3.

Table 3. Fat content of catfish floss

Treatment	Fat content (%) of Catfish Floss due storage (days)				
	0	12	24	36	48
Spinnered	12.54 ± 0.62^{fg}	12.13 ± 0.24^{f}	11.96 ± 0.26^{ef}	10.08 ± 0.12^{bcd}	9.5 ± 0.37^{abc}
Pressed	15.26 ± 0.95^{h}	14.86 ± 0.51^{h}	13.98 ± 0.09^{gh}	11.46 ± 0.28^{def}	10.67 ± 0.17^{cde}
Spinnered+pressed	10.42 ± 0.87^{bcd}	10.51 ±0.41^{cd}	9.99 ± 0.54^{bcd}	9.15 ± 0.46^{ab}	8.59 ± 0.12^{a}

The total fat content of catfish floss varied between 8.59 and 15.26 g per 100 g of edible portion. Fat content of catfish floss decrease with increasing of time storage. The combination treatment between spinnered and pressed results the lowest fat content for 48 days. It is means that the processing of catfish floss could reduced more oil from catfish floss compared with simple/single processing. Albuqurque et al., (2016) stated that the applied cooking methods can change the nutritional quality and safety of foods.

Total Plate Count (TPC) of Catfish Floss

Microbiological quality of catfish floss can be seen from the calculation of bacterial colonies contained in it, as shown in Table 4.

Table 4 showed that overall treatment gave no significant influence (P >0.05) on the TPC value of catfish floss, in otherwise there were significantly different (P < 0.05) of catfish floss during storage of 0 day, 12 days, 24 days, 36 days and 48 days. The results showed that the TPC value catfish floss increase during storage. Spinnered and pressed catfish floss has a lowest TPC values than catfish floss made by only spinnered or pressed. This is indicated that the more processed carried out, the more it can suppress bacterial growth. However, the opposite happened in terms of shelf life, where catfish floss products are kept longer, the TPC content increases. TPC content resulted in this study still fulfil the requirements of Indonesian National Standardization (2013) minimum 5 x 10^5 cfu/g until day 48.

Table 4. TPC content of catfish floss

Treatment	TPC (cfu/g) of Catfish Floss due storage (days)				
	0	12	24	36	48
Spinnered	3.6 x 10^2 ± 0.39^{a}	6.8 x 10^2 ± 0.5^{b}	4.4 x 10^3 ± 0.26^{cd}	7.8 x 10^3 ± 0.78^{e}	2.9 x 10^4 ± 1.00^{f}
Pressed	3.4 x 10^2 ±0.7^{a}	6.7 x 10^2 ± 0.19^{b}	4.3 x 10^3 ± 0.37^{d}	7.6 x 10^3 ± 0.69^{e}	2.5 x 10^4 ± 0.84^{f}
Spinnered+pressed	3.04 x 10^2 ±0.8^{a}	6.6 x 10^2 ± 0.45b^{c}	4.1 x 10^3 ± 0.27^{d}	6.9 x 10^3 ± 0.5^{e}	2.0 x 10^4 ± 0.74^{f}

Table 5. Peroxide values (PV) of Cafish floss

Treatment	Peroxide values (meq/kg) of Catfish Floss due storage (days)				
	0	12	24	36	48
Spinnered	0.74 ± 0.29^{a}	2.17 ± 0.85^{b}	4.18 ± 0.36^{cd}	5.58 ± 0.69^{e}	6.03 ± 1.00^{f}
Pressed	0.6 ±0.6^{a}	2.94 ± 0.19^{b}	4.16 ± 0.56^{d}	5.18 ± 0.65^{e}	6.13 ± 0.73^{f}
Spinnered+pressed	0.42 ±0.87^{a}	1.94 ± 0.35b^{c}	4.17 ± 0.23^{d}	4.99 ± 0.52^{e}	5.23 ± 0.66^{f}

Peroxide Values of Catfish Floss

During storage of catfish floss, the extent of degradation can be determined using the peroxide value; it gives a measure of the extent to which a product has undergone primary oxidation.

The effect of processing on the peroxide values (PV) of the catfish floss during the 48 days of storage under light is shown in Table 5. The amount of primary lipid oxidation product (hydroperoxide) was evaluated during the storage period. There were no significant of the rate of formation of the hydroperoxides in the product with or without combination of spin and press. On the other hand, there were significantly different in the products during storages ($P < 0.05$).

The effect in catfish floss with the highest concentration (6.13 meq kg $^{-1}$) of pressed catfish and then stored for 48 days was considerably higher than that in the spinnered catfish and combination spinnered-pressed catfish during 48 days of storage. As the lenght of storage increased from 0 to 48 days, the peroxide values after 12 day of storage decreased in all treatments, especially in treatment spinnered and pressed combination from 0.42; 1.94; 4.17; 4.99 dan 5.23 meq kg^{-1}, respectively. The values in Table 5 also show that the treatment effect of spin and press on the oxidation of catfish floss was time-dependent. As the storage time increased, the disparity in the hydroperoxide formation between the products with and without combination, increased. The results obtained from the peroxide value analyses indicated that combination processing effectively inhibited oxidation in the catfish floss products. This is supported by a previous study on lipid quality of fried fish, whereas the peroxide value of deep fried samples was observed within the acceptable limit of 10-20 milliequivalents of O_2 kg $^{-1}$ sample (Dhanapal et al., 2016). The deep fried samples showed a peroxide value in the range of 0.42-5.23 meq kg $^{-1}$ still meets the peroxide value tolerance limit. Thus, oxidative changes in the different culinary fats are greatly affected by factors related to their chemical composition. As for the minor degradation compounds, it was observed that they varied depending on the frying time and oil type (Lee et.al., 2013; Park and Kim, 2016).

Sensory evaluation

The treatment in this study could describe the physical characteristic of catfish floss. Changes in frying food color depend on oil variety, duration of exposure to both light and heat and type of food fried (Choe and Min, 2007). The level of panelists' preference for catfish floss can be seen in Table 6.

Table 6. Sensory values of panelists on catfish foss with different treatments

Treatment	Panels Sensory Values			
	Appearance	Taste	Texture	Flavor
Spinnered	6.54^{a}	7.04^{b}	6.02^{a}	6.01^{a}
Pressed	7.04^{b}	7.10^{b}	6.21^{a}	7.02^{b}
Spinnered+pressed	8.19^{c}	8.20^{c}	8.04^{c}	8.22^{c}

Based on Table 6, it can seen that the preference value of appearance, taste, texture and flavor have a real impact. The more complete treatment applied, the higher preference value given by the panelists to catfish floss. The best appearance value on spinnered and pressed catfish floss treatment. Likewise with the taste, texture and aroma, catfish floss which are given spinnered and pressed treatments were preferred by panelists compare to catfish floss which are only spinnered or only pressed.

The value of catfish floss texture with combination treatment of spin and press rather smooth and crispy. This is caused by more water content being lost so the catfish floss visual becomes drier. Park and Kim (2016) stated that the quality of food fried depends on frying time and frying oil used for food.

4. Conclusion

From a nutritional and sensory point of view, it is possible to conclude that the applied simple or combination processing can significantly influence the nutritional quality, safety, and sensory of catfish floss. In this research, the combination between spined and pressed could extend the length storage of catfish floss until 48 days of storages. This study will contribute to important knowledge on how the applied cooking methods and time storage can change the nutritional quality and safety of foods, namely of catfish floss and can be very useful for dietary recommendations and nutritional assessment.

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