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Utilization of Patin Fish Oil as an Additional Ingredient in Making Shredded Cookies

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ABSTRACT

Shark catfish, a common freshwater species found in Koto Masjid village, is renowned for its high fat content which primarily consists of unsaturated fatty acids, such as linoleic acid, linolenic acid, eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA). In this research experiment, shark catfish oil was incorporated as an additional ingredient in shredded cookies. The objective was to evaluate organoleptic aspects such as taste, scent, texture, and color of shredded cookies using the hedonic quality test scale and hedonic test. Statistical analysis involved the Kruskal-Wallis test and the Mann-Whitney test. The study involved 25 examiners, including 10 trained and 15 moderate ones. Results revealed that the addition of heated shark catfish oil to shredded beef significantly influenced flavor, fragrance, texture, and color. The hedonic quality test indicated that incorporating 50% shark catfish oil resulted in the highest ratings for savory and sweet flavor, catfish scent, crunchy texture, and brownish-yellow color. The hedonic test findings suggested that the addition of 50% shark catfish oil improved color, scent, taste, and texture, suggesting the potential for this shredded cake to become a valuable commodity for the community.

I. Introduction

Koto Mesjid is a village situated in District XIII, Kampar Regency, Central Java, Indonesia. This village is famous for its shark catfish (known as patin fish in Indonesian) cultivation, earning it the nickname "Patin Village". Koto Mesjid is located in Kampar Regency, an area renowned for its fertile soil and abundant water sources, rendering it an ideal location for fish cultivation. The presence of this fishery has contributed to the economic welfare of local communities, providing employment opportunities and supporting the local food system. Of the total village area of 425.5 Ha, Koto Mesjid Village, also called Kampung Patin has a pool area of ± 230 Ha. The best fish in this hamlet include catfish whose production reaches 2,190 tons per year or ±6 tons per day. With a total area of 52 Ha and 776 ponds, this community produces around 2,190 tons of catfish every year (Ira Oktaviani Rz et al., 2021).

The introduction of catfish farming in the city provides opportunities for the development of new industries in the area, as evidenced by the village slogan "There is no house without a fish pond". PT. Telkom Pekanbaru helped establish a catfish farm in Kampung Patin Village in 2003 (Yanti et al., 2020). Over time, the science of cultivating catfish has evolved. It has progressed from the development of hatcheries and maintenance facilities to the establishment of fish feed factories and a processing facility in Patin Village, which has created employment opportunities for the local community.

The location of Koto Mesjid Village is strategic and profitable for business growth due to its proximity to the main transportation center, thus providing easy access to other provinces in Riau. This village is situated approximately 62.1 kilometers, or about two hours from Pekanbaru City. As an integrated catfish center in Riau Province, this village is home to a number of micro, small, and medium enterprises (MSMEs) that focus on the processing of catfish into various products, such as smoked catfish, pudding, nuggets, fillets, meatballs, shredded meat, *batagor* (fried fish dumplings),

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crackers, and so on. These products have been distributed to various regions in Riau. The processing of catfish results in a meat yield of between 33 and 38 percent, while the remaining parts become waste.

According to research conducted by (Hastarini et al., 2012) indicates that the stomach and entrails of catfish are the primary sources of fish oil. The fat content of catfish head is 11.2%, tail bone 13.10%, skin 7.90%, entrails 26.31%, remaining meat 6.63%, stomach cover 36.21%, and meat 2.72%.

Shark catfish, also known as Patin Hyphothalmus, belong to the same species as catfish. Consumption of this fish is likely to provide a series of health benefits due to its high content of vitamins, minerals, and omega-3 fatty acids (Mierke-Klemeyer et al., 2008). The omega-3 fatty acids offer a number of extraordinary benefits. One of the fish's principal advantages is its capacity to reduce cholesterol and fat levels in the blood, thereby preventing the accumulation of fat in the arteries (Pak & Bragadóttir, 2005).

Omega-3 fatty acids, especially EPA and DHA, are essential for brain development and function (McNamara & Carlson, 2006). These fatty acids are important for the structure and function of brain cells, and play a role in the formation of brain tissue (Chang et al., 2009). Conversely, the essential fatty acid omega-6 plays a role in maintaining the integrity of cell membranes, reducing the risk of blood clots, and maintaining cholesterol balance (von Schacky & Harris, 2007). On the other hand, the consumption of fatty acids, a type of omega-9 fatty acid, has been demonstrated to facilitate the reduction of low-density lipoprotein (LDL) cholesterol levels (Johnson, 2014) and increase high-density lipoprotein (HDL) cholesterol levels in the blood (Wang et al., 2016). Fish oil represents a superior nutritional alternative for the human body (Gasco et al., 2018). The objective of this study is to assess the impact of incorporating shark catfish oil into a shredded cookie formulation. The aim is to ascertain whether the quality of the resulting product is comparable to that of a traditional shredded cake, which relies solely on margarine. In addition, shark catfish floss has been employed in this research.

In this research, a reduction was carried out in the production of shredded catfish cookies. This was performed by lowering the margarine composition and incorporating catfish oil, which is rich in protein and nutrition. The acceptability of patin fish floss cake products containing fish oil additives among testers is yet to be determined. The testing of shredded cookie products with the additional ingredient of shark catfish oil includes an assessment of the product's taste, aroma, texture, and color. In light of the aforementioned background, this study also conducted a product study employing various methodologies utilizing catfish oil in the production of shredded cookies. This study selected catfish as the subject of this experiment due to the prevalence of catfish processing centers in the author's hometown of Koto Mesjid Village, which generates a considerable amount of catfish waste that has not been utilized effectively. Additionally, this study also aims to highlight the significant potential of the village of Koto Mesjid, which is situated within the author's homeland..

Following the preceding discussion, the following problems were investigated:

1) Did the experiment using catfish oil as an additional ingredient to make floss cookies produce a different taste, aroma, texture, and color?
2) How did the outcomes of experiments utilizing catfish oil as an additive in the production of floss cookies illustrate the testers' preferences for taste, aroma, texture, and color?

The ingestion of catfish oil is believed to confer a number of benefits, including the avoidance of cardiovascular issues, the reduction of elevated blood pressure, and the prevention of the adhesion of plaque to blood vessels, in addition to other salutary effects. A study conducted (K. T. Hwang, J. E. Kim, S. G. Kang, S. T. Jung, 2004) demonstrated that the levels of omega-3, omega-6, and omega-9 fatty acids in fish oil exhibited an increase.

II. Method

In this research, experimental methods were used to investigate the influence of one treatment on another in a controlled situation. Organoleptic properties, namely hedonic quality, taste, color, and texture of shredded cookies added with catfish oil, were tested. Moreover, the experimental method was employed with the objective of evaluating the veracity of the hypothesis that had been proposed.

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A. Determining the Time and Location of Research

This research was conducted in a village, precisely in Koto Mesjid Village in Riau Province, Indonesia, from October 2022 to February 2023. This location was chosen deliberately because it was the center of catfish production in Riau Province.

B. Data Types and Sources

The primary data was gathered from catfish farmers who provided information regarding catfish processing, the utilization of catfish waste, and the outcomes of experiments on the use of catfish oil. The primary data obtained from the experimental results was then followed by the distribution of questionnaires to examiners who assessed the level of feasibility of using catfish oil.

C. Method of collecting data

Organoleptic properties were tested through hedonic relationships and preferences for texture, taste, color, and aroma from shredded cookies with the addition of catfish oil at 0%, 50%, 75%, and 100%. The results of organoleptic properties are presented in Table 1.

Table 1. Research Design

Treatment	Repetition			
	A	**B**	**C**	**D**
P1	P1A	P1B	P1C	P1D
P2	P2A	P2B	P2C	P2D
P3	P3A	P38	P3C	P3D

P1:	Repetition 1	A:	Process without the addition of shark catfish oil
P2:	Repetition 2	B:	Process with the addition of shark catfish oil 50%
P3:	Repetition 3	C:	Process with the addition of shark catfish oil 75%
		D:	Process with the addition of shark catfish oil 100%

D. Research Variable

Research variables are attributes or values related to certain individuals, objects, or activities that researchers choose to examine and analyze (Sugiyono, 2018). In this research, there variables were used:

a. Independent variable (independent): addition of shark catfish oil. The variable that gives rise to the dependent variable is believed to be the cause.
b. Dependent variable: sensory quality of shredded cookies with the addition of shark catfish oil. Changes in the independent variable affect the variation of the variable.
c. Control variables: tools and materials that are of good quality. Factors are controlled so that external elements that are not examined do not influence the influence of the independent variable on the dependent variable.

E. Data Analysis Method

For data analysis, this research employed two types of hedonic taste tests, namely the Preference Hedonic Test and the Quality Hedonic Test, to determine consumer preferences and perceptions of various products. The hedonic test is a sensory organoleptic analysis test that assesses the level of liking of a product and assesses the quality differences between many similar items by assigning a score based on certain product attributes (Pimentel et al., 2016). A hedonic scale is used to describe this level of liking. This is done by assigning a score to the following categories: very like, like, somewhat like, somewhat dislike, dislike, really dislike, and so forth (Tarwendah, 2017). Table 2 summarizes the terms of scores and intervals for hedonic and organoleptic tests.

Table 2. Scoring and Interval Terms

Criteria	Score	Intervals
Really like	5	≥ 4,1 - 5,0
Like	4	≥ 3,1 - 4,0
Kinda like it	3	≥ 2,1 - 3,0
Do not like	2	≥ 1,1 - 2,0
Very dislike	1	≥ 0 - 1,0

Source: (Suyono, 2018)

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In this study, the relationship between the percentage of correct answers (P) and the frequency of answering (f) in a sample of N participants was explored. Specifically, the correlation between P and f was tested, while controlling for the total number of samples (N) was used in the analysis. Our findings show a positive and significant correlation between P and f, indicating that as the frequency of answering increases, the percentage of correct answers also tends to increase. These results imply the presence of a positive relationship between the two variables. In other words, the more often participants are exposed to a particular concept or task, the more likely they are to demonstrate mastery of that concept or task. These findings present significant implications for educators and instructional designers, as they highlight the importance of providing frequent opportunities for practice and reinforcement to promote learning and retention of information.

Interpretation and evaluation of research findings were performed based on the level of response of respondents. Interpretive methodology was employed to analyze data collected from respondents, to gain a deeper understanding of their perspectives and experiences (Arikunto, 1998), as presented in Table 3.

Table 3. Percentage Value Category

No	Interval Limit Percentage	Assessment Category
1.	0-20 %	Very low
2.	21-40 %	Low
3.	41-60 %	Currently
4.	61-80 %	Tall
5.	81-100 %	Very high

Source: (Arikunto, 1998)

Hedonic quality tests are designed to convey more specific impressions of quality than simply impressions of likes and dislikes. Impressions of hedonic quality range from general, good, or bad, to more specific ones, such as tender meat, soft rice, and crunchy cucumber (Setyaningsih et al., 2010). Table 4 presents the category for hedonic quality test scores.

Table 4. Percentage Value Category

Color	Aroma	Texture	Taste	Score	Interval
Deep brown	It doesn't have the typical catfish aroma	Not very crunchy	Tasteless	1	>0-1
Brown	It doesn't have the distinctive smell of catfish	Not crunchy	Savory a little sweet	2	>1-2
Light brown	Slightly smells like catfish	A bit crunchy	Savory quite sweet	3	>2-3
Brownish-yellow	Has a typical catfish smell	Crispy	Savory and sweet	4	>3-4
Golden Yellow	Has a strong typical catfish smell	Very crunchy	Very tasty and		

In this research, SPSS 2.0 software was employed to analyze data descriptively and associatively. In the event that the data does not follow a normal distribution, it is possible to employ parametric analysis, the Kruskal-Wallis test, or non-one-way ANOVA. This nonparametric analysis does not require normally distributed data (Priyatno, 2013). Following the Kruskal-Wallis test, which yielded significant results ($0.00 \leq 0.05$), the Mann-Whitney test was employed for further analysis. The Mann-Whitney test is a non-parametric analysis, meaning it does not require a specific data distribution. This is in contrast to other statistical tests, which typically follow a specific distribution, such as the normal distribution or t distribution. Additionally, the Mann-Whitney test does not require data that is normally distributed (Priyatno, 2013).

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III. Results and Discussion

The trained panelists' perceptions of the hedonic attributes (color, aroma, texture, and taste) of the product are presented in Table 5.

Table 5. Hedonic Quality Test Results for Taste, Aroma, Texture and Color

	Taste	**Aroma**	**Texture**	**Color**
Chi-square	12,459	19,441	20,738	9,006
Df	3	3	3	3
Asymp. Sig.	0,006	0,000	0,000	0,029

The findings of the analysis demonstrate that the addition of Patshark catfish fish oil to shredded cookies results in a discernible difference in their taste, texture, and aroma. A value above 0.00 indicates that there are significant variations in the taste, texture, and aroma of cotton candy cookies when catfish oil is added under different processing conditions in this study. This implies that the research findings indicate notable differences, which can be quantified using the Mann-Whitney test to determine the extent of the differences for each treatment. The results of the Mann-Whitney test are presented in Tables 6 to 9.

Table 6. Mann Whitney Test Results on Shredded Cookies with the Addition of Shark Catfish Oil

Treatment	**A - B**	**A - C**	**A - D**	**B – C**	**B – D**	**C - D**
Mann-Whitney U	33,000	23,000	15,000	40,500	24,500	31,500
WILCOXON W	88,000	78,000	70,000	95,500	79,500	86,500
Z	- 1,491	- 2,368	- 2,809	- 1,028	- 2,187	- 1,595
Asymp. Sig. (2-tailed)	0,136	0,018	0,005	0,304	0,029	0,111

Table 7. Mann Whitney Test Results on the Aroma of Shredded Cookies with the Addition of Shark Catfish Oil

Treatment	**A - B**	**A - C**	**A - D**	**B – C**	**B – D**	**C - D**
Mann-Whitney U	20,000	15,500	5,000	38,500	14,000	22,500
WILCOXON W	75,000	70,500	60,000	93,500	69,000	77,500
Z	- 2,462	- 2,770	- 3,516	-,965	- 2,887	- 2,202
Asymp. Sig. (2-tailed)	0,014	0,006	0,000	0,335	0,004	0,028

Table 8. Mann Whitney Test Results on the Texture of Shredded Cookies with the Addition of Shark Catfish Oil

Treatment	**A - B**	**A - C**	**A - D**	**B – C**	**B – D**	**C - D**
Mann-Whitney U	31,500	12,000	5,500	29,500	10,500	20,500
WILCOXON W	86,500	67,000	60,500	84,500	65,500	75,500
Z	-1,532	-3,086	-3,537	- 1,829	-3,136	-2,428
Asymp. Sig. (2-tailed)	0,125	0,002	0,000	0,067	0,002	0,015

Table 9. Mann Whitney Test Results on the Color of Shredded Cookies the Addition of Shark Catfish Oil

Treatment	**A - B**	**A - C**	**A - D**	**B – C**	**B – D**	**C - D**
Mann-Whitney U	41,500	38,000	19,500	46,500	23,500	23,000
WILCOXON W	96,500	93,000	74,500	101,500	78,500	78,000
Z	-,794	-1,076	- 2,496	-,294	-2,108	-2,161
Asymp. Sig. (2-tailed)	0,427	0,282	0,013	0,768	0,035	0,031

The results of the treatments A-B, A-C, A-D, B-C, B-D, and C-D indicate that the taste, aroma, texture, and color of shredded cookies with the addition of catfish oil have a probability value of Asymp. sig. (2-tailed), which indicates that the probability values are different.

a. For treatment A-B, there were no significant differences in the taste, aroma, texture, or color of the crushed biscuits with 0% and 50% catfish oil added (1-2). This is indicated by the probability value of Asymp. sig. (Both sides) > 0.05.

b. Treatment A-C demonstrated that the shredded cookies with the addition of 75% and 0% catfish oil (1-3) exhibited a probability value of Asymp. sig. (2-tailed) > 0.05. The results of the two-sided asymptotic significance test ($\alpha = 0.05$) indicated that there were no significant differences between the groups studied. This finding suggests that the observed differences had no practical relevance to texture, color, flavor, and aroma. However, the texture value of 0.02 < 0.05 yielded different results, indicating that significant differences were observed in texture.

c. In terms of taste, aroma, texture, and color, treatments A to D exhibited Asymp. sig probability values of 0.13 > 0.05 when 0% and 100% catfish oil (1 to 4) were added to the crushed biscuits (both sides), indicating uniformity in color. Nevertheless, the outcomes may diverge with regard to taste, aroma, and texture. A p-value of less than 0.05 signifies a notable distinction in taste, aroma, and texture.

d. Treatments B and C demonstrated no discernible alterations in the flavor, texture, aroma, or color of the crumb cake upon the addition of 50% and 75% catfish oil (2-3). This is evidenced by the expected value of Asymp. sig. (Both sides) > 0.05.

e. A value of <0.05 indicates a significant difference in taste and texture. Treatments B-D were found to improve the taste of mashed cookies treated with 50% and 100% catfish oil (2-4). The probability value is Asymp. .sig. (Two-sided) > 0.05, indicating a similarity in taste and color

f. Treatment C-D demonstrated that the taste, aroma, texture, and color (3-4) of the crumb cake after the addition of 75% and 100% catfish oil had probability values of Asymp. sig. (both sides) > 0.05, indicating that there were significant changes in these aspects.

IV. Conclusion

The results of the hedonic quality test, coupled with the findings of the subsequent Mann-Whitney test, yielded the following insights into the utilization of catfish oil as an additional ingredient in crushed biscuits across the 0%, 50%, 75%, and 100% treatments. The findings of the hedonic quality test can be summarized as follows: The trained testers reported that the taste, aroma, texture, and color of the shredded cake with the addition of catfish oil had undergone significant changes. The trained testers reported that the addition of catfish oil did not significantly alter the color or taste of the cookies, but did significantly affect the texture and aroma. The combined assessment of taste, aroma, texture, and color by joint testers indicated that the addition of catfish oil resulted in notable alterations to the aforementioned attributes. The results of the hedonic or liking test yielded the following conclusions: The hedonic test results indicated that the testers preferred the shredded cakes with the addition of 50% shark catfish oil compared to the dry cakes with the addition of 0%, 75%, and 100% shark catfish oil. The hedonic test also revealed that the taste, aroma, texture, and color of the cakes were enhanced by the addition of fish oil.

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