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Proximate Levels, Physical Characteristics, and Sensory Characteristics of Brownies with the Addition of Snakehead Fish

Jurnal 23

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Proximate Levels, Physical Characteristics, and Sensory Characteristics of Brownies with the Addition of Snakehead Fish

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ABSTRAK

Latar Belakang: Pola makan anak memegang peranan penting yang dapat mencegah terjadinya kekurangan gizi dan mengurangi risiko penyakit tidak menular (PTM), seperti diabetes, penyakit jantung, stroke, dan kanker. Pola konsumsi snack merupakan bagian dari pola makan. Brownies merupakan makanan tinggi energi yang popular karena mempunyai rasa yang lezat dan manis. Brownies adalah sejenis kue coklat yang mempunyai tekstur padat, tidak berongga, dan tidak begitu empuk karena brownies tidak membutuhkan pengembang atau gluten. Oleh karena itu brownies dapat dibuat dari tepung mocaf.
Tujuan: Penelitian ini bertujuan untuk menganalisis kadar proksimat, karakteristik fisik, dan karakteristik sensori brownies dengan penambahan ikan gabus.
Metode: Penelitian eksperimen yang menggunakan desain pengamatan laboratorium untuk mengkaji kadar proksimat, karakteristik fisik, dan karakteristik sensori. Konsentrasi daging ikan gabus terdiri dari 4 taraf perlakuan (0%, 60%, 80%, dan 100%).
Hasil: Hasil penelitian menunjukkan bahwa penambahan ikan gabus berpengaruh terhadap kadar air dan protein serta sifat sensoris warna, rasa, aroma, dan tekstur.
Kesimpulan: Penambahan yang paling bagus adalah pada penambahan 60 gram ikan gabus dengan nilai gizi kadar air 6,212%, kadar protein 4,039%, kadar abu 0,14%, kadar lemak 0,503%, dan kadar karbohidrat 2,662% serta memiliki sifat sensoris cokelat tua, tidak terasa ikan, tidak beraroma ikan, dan tidak lembut.

KATA KUNCI: *Brownies; Ikan Gabus; Mocaf; Pangan Lokal; PMT-AS*

ABSTRACT

Background: *Children's diet plays a vital role in preventing malnutrition and reducing the risk of Non-Communicable Diseases (NCDs), such as diabetes, heart disease, stroke, and cancer. A snack diet is part of a child's diet. Brownies are a popular high-energy food because they taste delicious and sweet. Brownies are chocolate cakes with a dense texture, not hollow, and not very soft because brownies do not require a leavening agent or gluten. Therefore, brownies can be made from mocaf flour.*
Objectives: *This research aims to analyze the proximate levels, physical characteristics, and sensory characteristics of brownies with the addition of snakehead fish.*
Methods: *Experimental research uses laboratory observation design to examine proximate levels and physical and sensory characteristics. The concentration of snakehead fish consists of 4 treatment levels (0%, 60%, 80%, and 100%).*
Results: *The results showed that adding snakehead fish affected the water and protein content and the sensory properties of colour, taste, aroma, and texture.*
Conclusions: *The best addition is the addition of 60 grams of snakehead fish with a nutritional value of 6.212% water content, 4.039% protein content, 0.14% ash content, 0.503% fat content, and 2.662% carbohydrate content. This addition has dark brown sensory properties, no fishy taste or fishy aroma, and is not tender.*

KEYWORD: *Brownies; Channa striata; Mocaf; Mocal food; PMT-AS*

Article info:
Article submitted on Month Date, Year
Articles revised on Month Date, Year
Articles received on Month Date, Year

INTRODUCTION

Children's diet plays a vital role in preventing malnutrition and reducing the risk of Non-Communicable Diseases (NCDs), such as diabetes, heart disease, stroke, and cancer. A snack diet is part of a child's diet. Snacks are foods consumed between two main meals. In general, snacks contribute 5-15% of a child's daily energy intake (Potter et al., 2018). Snack consumption significantly influences macronutrient intake, especially energy and fat, but has a low significant influence on micronutrient intake. Children often buy and consume snacks at school in large quantities during school breaks (Sekiyama et al., 2012). School-aged children are one of the nutritionally vulnerable groups who need attention because if they suffer from malnutrition, it can have a negative impact. Nutrition plays a vital role in the human life cycle. Efforts to improve nutritional status in society will contribute to the achievement of national development goals, especially in reducing the prevalence of malnutrition among elementary schoolchildren, so that, ultimately, it can improve the quality of human resources. One effort that can be made to meet nutritional needs from daily food consumption is by providing nutritional supplementation. One

of the supplementation programs currently being implemented by the government is the Provision of Supplementary Food for School Children Program (PMT-AS). PMT-AS is a snack with an energy content of 144-216 calories, 3.96-5.76 grams of protein, and 5.04-7.56 grams of fat (Ministry of Health, 2018). Snack products can be developed using staple foods that contain energy with the addition of various other food sources so they can complement each other when combined to produce products with better nutritional value.

Brownies are a popular high-energy food because they taste delicious and sweet. Brownies are a type of chocolate cake with a dense texture, are not hollow, and are not soft because brownies do not require a leavening agent or gluten (Fadhilah & Sari, 2020; Sumartini et al., 2020). Therefore, brownies can be made from mocaf flour. Mocaf flour has a higher starch content compared to wheat flour. Mocaf flour also has a lower water content compared to wheat flour, so it is more resistant to microbial damage and has a long shelf life (Putri et al., 2015). The disadvantage of mocaf flour in food processing applications is the low protein content of around 1.77% (L et al., 2020). Snakehead fish flour is an alternative ingredient with a high protein content that has a highlevel of productivity and is available in Indonesia (Fadhillah & Sari, 2020).

Research by Tri et al. in 2020 about the optimization of snakehead fish brownies production showed that there was a difference in albumin levels between the addition of steamed snakehead fish and raw snakehead fish. Brownies with 100 grams of raw snakehead fish contain 459.29% albumin, while 100 grams of steamed snakehead fish contain 447.14%. From the aspects of taste, colour, aroma, and texture, the addition of 100 grams of steamed snakehead fish was 81.09% liked by the panellists (Fadhilah & Sri, 2020). Therefore, making mocaf brownies with the addition of snakehead fish can be an alternative to developing PMT-AS based on local food, which can increase the malnutrition status of school-aged children.

MATERIALS AND METHODS

Material

The materials used in this research are 120 grams of mocaf flour, 35 grams of cocoa powder, 100 grams of dark cooking chocolate, 125 grams of melted butter, 3 chicken egg yolks, 6 chicken egg whites. 100 Grams of granulated sugar, 10 grams of vanilla, 5 grams of baking powder, and snakehead fish (0 grams, 60 grams, 80 grams,

and 100 grams. The equipment used during this research is a pan, saucer, frying pan, blender oven, mixer, basin, stove, strainer, measuring cup, and spoon.

Methods

The experimental research, meticuously designed to examine proximate levels, physical characteristics, and sensory characteristics. The research was conducted from October 2022 – January 2023. The process of making mocaf brownies with the addition of snakehead fish was carried out with utmost care and precision in the food technology laboratory of the Faculty of Nursing and Health Sciences, University of Muhammadiyah Semarang. Testing for proximate levels and sensory characteristics was conducted at the Cendekia Nanotech Hutama (CNH) laboratory, Semarang, while testing for sensory traits was carried out at the organoleptic laboratory at the Faculty of Nursing and Health Sciences, University of Muhammadiyah Semarang.

Process of making mocaf brownies with the addition of snakehead fish

Snakehead fish filets are washed until clean. The snakehead fish is then marinated in lime to avoid a fishy smell. After that, the fish is mashed using a blender until smooth and set aside. Mocaf flour and cocoa powder are roasted briefly in low heat until warm, and then it is filtered. Then melt the margarine and dark cooking chocolate in low heat and set it aside. White and yellow eggs are mixed, and sugar and baking powder are added until mixed, then the ingredients that have been roasted and melted are added and stirred until evenly mixed. Finally, stir the delicate snakehead fish meat until it is evenly mixed. Next, the baking sheet is lined with baking paper, then smeared with margarine, and the dough is put into the pan and baked in the oven at 80ºC for 15 minutes.

Procedures for Testing Proximate Levels, Physical Characteristics, and Sensory Characteristics

The water content test was measured using the AOAC method (1990), while the ash content was measured using the oven method. The protein content of the samples was measured using the Micro Kjeldahl method, the fat content using the Soxhlet method, and the carbohydrate content was measured using *the difference* method. The physical characteristics of mocaf brownies with the addition of snakehead fish were assessed using hedonic quality and a hedonic scale. The hedonic scale components

tested by the panellists include colour, aroma, taste, and texture using four hedonic scales, namely (1) really bad, (2) bad, (3) good, and (4) really good.

Statistic Analysis

Data was analyzed using a computer program. The normality test used is Shapiro Wilk. Data on proximate levels, physical characteristics, and sensory characteristics were normally distributed, so they were analyzed using the one-way ANOVA test to see the differences between treatments, then continued with the *Least Significant Difference (LSD) test*.

RESULTS AND DISCUSSIONS

Proximate Content of Mocaf Brownies with the Addition of Snakehead Fish

The result of the analysis of proximate levels shows that the more snakehead fish are used, the nutrient levels produced also vary (Table 1).

Table 1. Proximate Levels In Brownies With The Addition Of Snakehead Fish

Proximate Levels	Control	Snakehead Fish Addition		
		60 grams	80 grams	100 grams
Water content (%)	42,52 ± 7,18	48,72 ± 3,33	40,77 ± 1,71	39,20 ± 2,27
Ash content (%)	1,46 ± 0,08	1,45 ±0,08	1,41 ± 0,27	1,39 ± 0,25
Protein content (%)	5,46 ± 3,29	1,42 ± 1,91	1,14 ± 0,82	4,42 ± 5,41
Fat content (%)	32,99 ± 2,33	33,50 ± 3,23	35.34 ± 5,34	32,89 ± 2,20
Carbohydrate content (%)	17,54 ± 9,37	14,88 ± 6,44	21, 44 ± 6.57	22, 17 ± 2.49

The average water content of brownies with the addition of snakehead fish ranges from 39,20% - to 48,72%. The highest water content was obtained from the treatment of the addition of snakehead fish at 60 grams, while the lowest level was found at an addition of 100 grams. The water content in food ingredients determines acceptability, freshness, durability of ingredients, chemical reactions, enzyme activity, and growth of microorganisms. The amount of water content in brownie products with the addition of snakehead fish will affect the texture and taste (Muhammad et al., 2019; Karimuna, 2018). Until now, no Indonesian National Standard (SNI) regulates brownie quality standards, so the determination of water content uses bread quality standards. The maximum water content in breading, according to SNI 01-3840-1995, is 40% (Muhammad et al., 2019). Therefore, mocaf brownies with the addition of 100 grams of

snakehead fish have met the quality standards determined by SNI. The water content in brownies with the addition of snakehead fish is influenced by the initial water content of the raw material, cooking method, shape, size, time, temperature, and water that evaporates during the baking process, as well as the amount of starch and fibre contained in the brownies (Sumartini et al., 2021).

The average ash content of brownies with the addition of snakehead fish ranged from 1,39% - 1,46% (Table 1). The highest ash content was obtained from the treatment without the addition of snakehead fish, while the lowest ash content was found in the treatment with the addition of snakehead fish at 100 grams. The ash content is related to the mineral content in brownies with the addition of snakehead fish (Wahyuningsih et al., 2014). The components contained therein include potassium, calcium, sodium, iron, magnesium, and manganese (Sumartini et al., 2020).

The average fat content of brownies with the addition of snakehead fish ranged from 32,89% - to 35,34% (Table 1). The highest fat content was obtained from the treatment with the addition of 80 grams, while the treatment with the addition of 100 grams had the lowest fat content. Fat can improve the taste and slow down the hardening of the texture, making it softer (Karimuna, 2018). Sources of fat in brownies with the addition of snakehead fish include chocolate, butter, eggs, and snakehead fish.

The average carbohydrate content of brownies with the addition of snakehead fish ranged from 14,88% - 22,78% (Table 1). The highest carbohydrate content was obtained from the treatment with the addition of 100 grams of snakehead fish, while the lowest carbohydrate content was found in the treatment with the addition of 50 grams of snakehead fish. The primary source of carbohydrates in these brownies is mocaf flour. Mocaf flour contains 83,32% carbohydrates (Rianta et al., 2019). Mocaf is cassava flour modified through a fermentation process by lactic acid bacteria, which can change its functional properties and replace food products made from wheat flour (Sumartini et al., 2020).

The effect of treatment on water, ash, fat, protein, and carbohydrate content is shown in Table 2. The treatment of snakehead fish can change the water content (%) and protein content (%). The group given 60 grams of snakehead fish had a water content of 6.212 higher than the control group, and this increase was statistically significant (p=0.031). Giving 60 grams of snakehead fish can increase the water content by 25,81%. The group given 60 grams of snakehead fish had protein levels 4,039 lower than those in the control group, and this reduction was statistically significant (p=0,006). Giving 60 grams of snakehead fish can reduce protein levels by 38,55%. The group given

80 grams of snakehead fish had protein levels 4,321 lower than those in the control group, and this reduction was statistically significant (p=0,004). Giving 80 grams of snakehead fish can reduce protein levels by 41,80%. The group given 100 grams of snakehead fish had protein levels 4,275 lower than those in the control group, and this decrease was statistically significant (p=0,031). Giving 100 grams of snakehead fish can reduce protein levels by 26,01%.

Table 2. Effect of treatment on water content, ash content, fat content, protein content, and carbohydrate content

Dependen Variabel	Treatment	B	Std Error	t	p	95% Confidence Interval		Partial Eta Squared
						Lower Bound	Upper Bound	
Water content (%)	60 gram	6,212	2,633	2,359	0,031	0,630	11,794	25,81%
	80 gram	-1,910	2,633	-0,725	0,479	-7,493	3,672	3,18%
	100 gram	-2,746	3,724	-0,738	0,471	-10,641	5,148	3,29%
	Control	(Group Refferent)						
Ash content (%)	60 gram	-,014	0,096	-0,151	0,881	-0,217	0,188	0,14%
	80 gram	-,058	0,096	-,0606	0,553	-0,261	0,145	2,24%
	100 gram	0,063	0,135	0,463	0,650	-0,224	0,350	1,32%
	Control	(Group Refferent)						
Protein content (%)	60 gram	-4,039	1,275	-3,168	0,006	-6,741	-1,336	38,55%
	80 gram	-4,321	1,275	-3,390	0,004	-7,023	-1,619	41,80%
	100 gram	-4,275	1,803	-2,371	0,031	-8,097	-0,453	26,01%
	Control	(Group Refferent)						
Fat content (%)	60 gram	0,503	2,175	0,231	0,820	-4,108	5,115	0,33%
	80 gram	2,389	2,175	1,098	0,288	-2,223	7,000	7,01%
	100 gram	0,350	3,076	0,114	0,911	-6,172	6,872	0,08%
	Control	(Group Refferent)						
Carbohydrate content (%)	60 gram	-2,662	4,243	-0,627	0,539	-11,656	6,332	2,40%
	80 gram	3,901	4,243	0,919	0,372	-5,094	12,895	5,02%
	100 gram	6,609	6,000	1,101	0,287	-6,111	19,329	7,05%
	Control	(Group Refferent)						

Changes in water and protein content when the supply of snakehead fish was increased to 80 grams and 100 grams were tested using Least Significant Difference (LSD), as shown in Table 3. Increasing the supply of snakehead fish from 50 to 80 grams provided a significant difference in water content (p=0,169), likewise increasing the supply of snakehead fish from 50 to 100 grams provided a significant difference in water content (p=0,029), but increasing the provision of snakehead fish from 50 to 80 grams did not provide a significant difference in protein content (p=0,828).

Table 3. Differences in treatment for water content and protein content

Dependen Variabel	Treatmant (I)	Treatmant (J)	Mean Difference (I-J)	Std Error	p	95% Confidence Interval	
						Lower Bound	Upper Bound
Water content (%)	60 gram	80 gram	8,12	2,63	0,007	2,54	13,70
		100 gram	8,96	3,72	0,029	1,06	16,85
		Control	6,21	2,63	0,031	0,63	11,79
	80 gram	60 gram	-8,12	2,63	0,007	-13,70	-2,54
		100 gram	0,84	3,72	0,825	-7,06	8,73
		Control	-1,91	2,63	0,479	-7,49	3,67
	100 gram	60 gram	-8,96	3,72	0,029	-16,85	-1,06
		80 gram	-0,84	3,72	0,825	-8,73	7,06
		Control	-2,75	3,72	0,471	-10,64	5,15
Kadar protein (%)	60 gram	80 gram	0,28	1,27	0,828	-2,42	2,98
		100 gram	0,24	1,80	0,897	-3,59	4,06
		Control	-4,04	1,27	0,006	-6,74	-1,34
	80 gram	60 gram	-0,28	1,27	0,828	-2,98	2,42
		100 gram	-0,05	1,80	0,980	-3,59	3,78
		Control	-4,32	1,27	0,004	-6,74	-1,62
	100 gram	60 gram	-0,24	1,80	0,897	-4,06	3,59
		80 gram ikan	0,05	1,80	0,980	-3,78	3,87
		Control	-4,28	1,80	0,031	-8,10	-0,45

Physical Characteristics of Mocaf Brownies with the Addition of Snakehead Fish

Texture is one of the most critical parameters of a food product's quality. Texture parameters are grouped into hardness, cohesiveness, viscosity, elasticity, and adhesiveness (Salsabella, 2019). The average texture hardness of brownies with the addition of snakehead fish ranged from 3.406,75 grams/mm – to 4.228,41 grams/mm (Table 4). The highest texture hardness was obtained from the treatment by adding 50 grams of snakehead fish, while the lowest texture hardness was found with the treatment by adding 100 grams of snakehead fish. The increase in hardness value shows that the brownie texture becomes harder with the addition of snakehead fish. The hardness of the texture is influenced by the degree of gelatinization, water absorption index, volume absorption index, and water content (Purnomo et al., 2015). The hardness of mocaf brownies with the addition of snakehead fish is influenced by mocaf flour which does not contain gluten. As a result, it is less able to bind and retain water, so the water content evaporates during the baking process and produces a dry and hard texture (Affandi et al., 2016). The average elasticity of brownie texture with the addition of snakehead fish ranged from 1.106,41 grams/mm - to 23.655,50 grams/mm (Table 4). The highest texture elasticity was obtained from the treatment without the addition of snakehead fish. In contrast, the lowest texture elasticity was found in the treatment with the addition of 50 grams of snakehead fish. The elasticity of the texture of brownies is influenced by

several factors, such as high sugar and liquid content, low fat, high proportion of eggs, flour with high protein content, and gluten formation during the kneading process (Rumadana & Salu, 2020). Gluten is not found in mocaf flour. Gluten consists of gliadin and glutenin, which affect dough development because gluten can hold gas. Gluten is also elastic and chewy (Yasa et al., 2016).

Table 4. Physical Characteristics In Brownies With The Addition Of Snakehead Fish

Physical Characteristics	Snakehead Fish Addition			
	0 gram	60 gram	80 gram	100 gram
Hardness (gram)	3757,75 ± 751,73	4228,41 ± 748,97	4148,08 ± 980,03	3406,75 ± 880,36
Elasticity (mm)	6,51 ± 1,23	8,66 ± 1,03	7,38 ± 1,91	7,01 ± 1,76
Cohessivenes	0,43 ± 0,21	0,41 ± 0,27	0,36 ± 0,24	0,31 ± 0,26
Adhesion (mj)	0,42 ±	0,78 ± 0,34	0,55 ± 0,62	0,85 ± 0,56
Gumminess (gram/mm)	1560,35 ± 1184,44	1522,63 ± 1055,67	1423,34 ± 34	1106,41 ± 1430,09

The average cohesiveness of brownies with the addition of snakehead ranged from 0,31 – 0,43 (Table 4). The highest cohesiveness was obtained from the treatment without the addition of snakehead fish, while the lowest cohesiveness was found in the treatment with the addition of 100 grams of snakehead fish. The cohesiveness of brownies with the addition of snakehead fish describes the extent to which the product isn't damaged when bitten (Sarifudin et al., 2015). Cohesiveness in the product is influenced by water and lecithin content (Nova et al., 2015). The lecithin from mocaf brownies, with the addition of snakehead fish, comesfrom egg yolk, which functions as an emulsifier (Sarifudin et al., 2015).

The average adhesion of brownies with the addition of snakehead fish ranged from 0,42 – 0,85 mj (Table 4). The highest adhesion was obtained from the addition of 100 grams of snakehead fish, while the lowest adhesion was found in the treatment without the addition of snakehead fish. Adhesion texture properties are related to amylose content and starch retrogradation. Products with high amylose content usually have low adhesion values (Haliza et al., 2017).

The average stickiness of brownies with the addition of snakehead fish ranged from 1.106,41 – 1.560,35 grams/mm (Table 4). The highest stickiness was obtained from the treatment without adding snakehead fish, while the lowest stickiness was found in the treatment with adding 100 grams of snakehead fish. The protein content influences the stickiness of the texture in brownies. A 3-dimensional matrix is formed between the myofibril protein in snakehead fish meat and the starch in mocaf flour, thus forming a sticky texture (Fitriani et al., 2022).

The effect of treatment on hardness, elasticity, cohesiveness, adhesion, and stickiness is shown in Table 5. The treatment with snakehead fish can change its elasticity significantly. It was found that the group with the addition of 60 grams of snakehead fish had 2.15 times higher elasticity than the control group. This increase was statistically significant (p=0.027). Giving 60 grams of snakehead fish can increase elasticity by 22,23%.

Table 5. Effect of treatment on Hardness, Elasticity, Cohessivenes, Adhesion, Gummines

Dependen Variabel	Treatment	B	Std Error	t	p	95% Confidence Interval		Partial Eta Squared
						Lower Bound	Upper Bound	
Hardness (gram)	60 gram	470,67	488,33	0,96	0,347	-547,97	1489,31	4,44%
	80 gram	390,33	488,33	0,80	0,433	-628,31	1408,97	3,10%
	100 gram	-351,00	488,33	-0,72	00,481	-	667,64	2,52%
	Control	(Group Refferent)				1369,64		
Elasticity (mm)	60 gram	2,15	0,90	2,39	0,027	0,27	4,03	22,23%
	80 gram	0,87	0,90	0,96	0,347	-1,01	2,74	4,44%
	100 gram	0,50	0,90	0,56	0,584	-1,38	2,38	1,52%
	Control	(Group Refferent)						
Cohessivenes	60 gram	-0,01	0,15	-0,05	0,964	-0,31	0,30	0,01%
	80 gram	-0,07	0,15	-0,47	0,643	-0,37	0,23	1,10%
	100 gram	-0,11	0,15	-0,78	0,444	-0,42	0,19	2,96%
	Control	(Group Refferent)						
Adhesion (mj)	60 gram	0,36	0,27	1,34	0,196	-0,20	0,92	8,23%
	80 gram	0,13	0,27	0,48	0,634	-0,43	0,69	1,16%
	100 gram	0,44	0,27	1,62	0,120	-0,12	1,00	11,66%
	Control	(Group Refferent)						
Gumminess (gram/mm)	60 gram	-37,72	736,48	-0,05	0,960	-	1498,55	0,01%
	80 gram	-137,00	736,48	-0,19	0,854	1573,99	1399,27	0,17%
	100 gram	-453,94	736,48	-0,62	0,545	-	1082,33	1,86%
	Control	(Group Refferent)				1673,27 - 1990,21		

When the supply of snakehead fish was increased to 80 grams and 100 grams, changes in elasticity were tested using the Least Significant Difference (LSD), as shown in Table 6. Increasing the supply of snakehead fish from 60 to 80 grams gave an insignificant difference (p=0,169). However, increasing the supply of snakehead fish from 60 to 100 grams provided a difference that was close to significant (p=0,081).

Table 6. Differences in treatment for elasticity

Dependen Variabel	Treatment (I)	Treatment (J)	Mean Difference (I-J)	Std Error	p	95% Confidence Interval	
						Lower Bound	Upper Bound
Elasticity (mm)	60 gram	60 gram	1,28	0,90	0,169	-0,59	3,16
		100 gram	1,65	0,90	0,081	-0,23	3,53
		Control	2,15	0,90	0,027	0,27	4,03
	80 gram	60 gram	-1,28	0,90	0,169	-3,16	0,59
		100 gram	0,37	0,90	0,688	-1,51	2,24
		Control	0,87	0,90	0,347	-1,01	2,74
	100 gram	60 gram	-1,65	0,90	0,081	-3,53	0,23
		80 gram	-0,37	0,90	0,688	-2,24	1,51
		Control	0,50	0,90	0,584	-1,38	2,38

Sensory Characteristics

Colour

Figures 1 and 2 show that increasing the number of snakehead fish will lead to a tendency for changes in hedonic quality and lower hedonic colour. Research by Afianti and Indrawati (2015) stated that the higher the concentration of snakehead fish flour, the lowest the appearance of the crackers-like colour. The picture of changes in hedonic and hedonic quality scores shows that the best addition was the addition of 60 grams of snakehead fish, with a hedonic quality score of 2,32 and a hedonic score of 2,72.

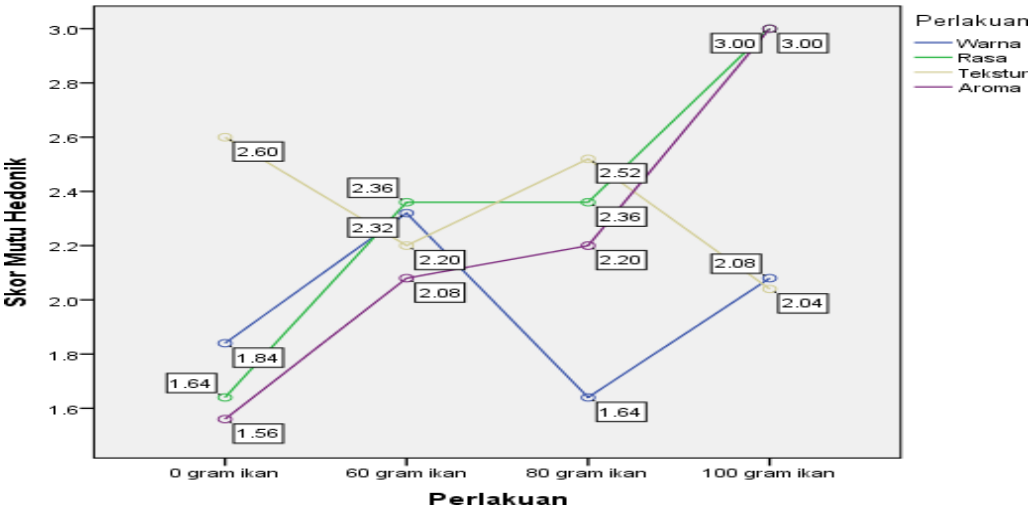

Figure 1. Changes In Hedonic Quality Scores Based on The Addition of Snakehead Fish

The significance of adding the number of snakehead fish was carried out by the Least Significant Difference (LSD) test, as shown in Table 7. Table 7 shows that adding 60 grams of snakehead fish to 1 brownie recipe only increases the colour of the hedonic quality score by 10.3%, which isn't significant (p = 0,110). Apart from that, in Table 8,

the significance of adding 60 grams of snakehead fish to 1 brownie recipe increases the colour hedonic by 28,5%, and this increase is very significant (p = 0,005).

The panellists most liked the addition of 60 grams of snakehead fish, showing the appropriate composition to show the attractive appearance of snakehead fish brownies. This is because the colour of the brownies produced is dark brown. Dark brown is the typical color of brownies, which is influenced by the composition of the food's raw materials and chemical properties (Nurwanti dan Hasdar, 2021). The use of raw materials in the form of chocolate in brownies provided changes in colour, texture, and distinctive smell. In addition, the brown colour occurs when the *Maillard* reaction occurs in the roasting process. This reaction is the browning process of food due to the response between carbohydrates (reducing sugar) and amino acids from proteins, which will produce a brown colour (Novia, 2022).

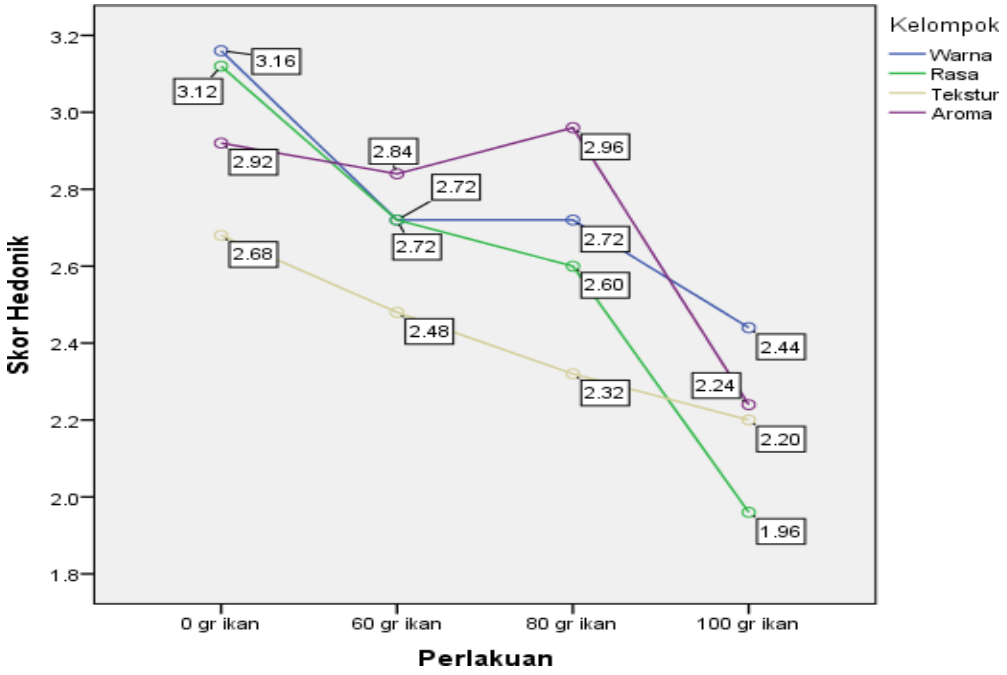

Figure 2. Changes In Hedonic Score Based on The Addition of The Number of Snakehead Fish

Taste

Figures 1 and 2 show that increasing the number of snakehead fish will give a tendency for changes in the hedonic quality of taste to be higher but will give a tendency for changes in hedonic quality to be lower. Research made by Putra *et al*. (2015) stated that the higher the addition of snakehead fish, the more the hedonic taste of crackers decreases. From the picture of changes in hedonic quality and hedonic quality scores, it is shown that the best addition was the addition of 60 grams of snakehead fish, with a hedonic quality score of 2,36 and a hedonic score of 2,72.

The significance of adding the number of snakehead fish to improving hedonic and hedonic quality was carried out by the Least Significant Difference (LSD) test, as shown in Table 7. Table 7 shows that adding 60 grams of snakehead fish to 1 brownie recipe can increase the hedonic taste quality score by 40.5%, and the increase was very significant ($p < 0,001$). In Table 8, adding 60 grams of snakehead fish to 1 brownie recipe can increase the taste hedonic score by 14,3%, which is close to significant ($p < 0,057$).

Based on statistical analysis, panelists preferred brownies with a lower concentration of snakehead fish. This is because the brownies didn't taste like fish when added. Snakehead fish meat added to the product produces a distinctive fish taste. Research by Afianti and Indrawati (2015) stated that the addition of snakehead fish flour significantly affected the taste of *crackers*, which had the highest value of 3,17.

Table 7. Changes in Hedonic Quality based on snakehead fish addition compared to without adding Snakehead Fish to Mocaf Brownies

Hedonic Quality	Treatment	Type III Sum of Squares	df	Mean Square	F	P	Partial Eta Squared
Colour	60 grams vs 0 grams	5,76	1	5,76	2,75	0,110	10,3%
	80 grams vs 0 grams	1,00	1	1,00	0,50	0,486	2,0%
	100 grams vs 0 grams	1,44	1	1,44	0,50	0,485	2,1%
Taste	60 grams vs 0 grams	12,96	1	12,9	16,3	0,000	40,5%
	80 grams vs 0 grams	12,96	1	6	4	0,005	28,2%
	100 grams vs 0 grams	46,24	1	12,9	9,41	0,000	48,2%
Texture	60 grams vs 0 grams	4,00	1	4,00	3,69	0,067	13,3%
	80 grams vs 0 grams	0,16	1	0,16	0,28	0,603	1,1%
	100 grams vs 0 grams	7,84	1	7,84	5,85	0,024	19,6%
Aroma	60 grams vs 0 grams	6,76	1	6,76	7,29	0,012	23,3%
	80 grams vs 0 grams	10,24	1	10,2	9,54	0,005	28,4%
	100 grams vs 0 grams	51,84	1	4	41,2	0,000	63,2%

Texture

Figures 1 and 2 show that increasing the number of snakehead fish will give a tendency for higher changes in the texture quality but will give a tendency for lower hedonic changes. Research by Siahaan *et al*. (2015) stated that adding a concentration of snakehead fish to kwetiau dough could make the texture of the dough hard, making it

unpopular among panellists. Generally, panellists like soft brownies (Nurwati & Hasdar, 2021).

Table 8. Hedonic Quality Scores in Adding Snakehead Fihs compared to without Adding Snakehead Fish

Hedonic Quality	Treatment	Type III Sum of Squares	df	Mean Square	F	P	Partial Eta Squared
Colour	60 grams vs 0 grams	4,84	1	9,55	9,55	0,005	28,5%
	80 grams vs 0 grams	4,84	1	9,55	9,55	0,005	28,5%
	100 grams vs 0 grams	112,96	1	20,6	20,6	0,000	46,3%
Taste	60 grams vs 0 grams	4,00	1	4,00	4,00	0,057	14,3%
	80 grams vs 0 grams	6,76	1	6,76	13,2	0,001	35,6%
	100 grams vs 0 grams	33,64	1	33,6	5	0,000	68,7%
Texture	60 grams vs 0 grams	1,00	1	1,00	1,20	0,284	4,8%
	80 grams vs 0 grams	3,24	1	3,24	3,27	0,083	12,0%
	100 grams vs 0 grams	5,76	1	5,76	5,27	0,031	18,0%
Aroma	60 grams vs 0 grams	0,16	1	0,16	0,28	0,603	1,1%
	80 grams vs 0 grams	0,04	1	0,04	0,07	0,788	0,3%
	100 grams vs 0 grams	11,56	1	11,5	17,9	0,000	42,8%

The picture of changes in hedonic and hedonic quality scores shows that the best addition was the addition of 60 grams of snakehead fish, with a hedonic quality score of 2.08 and a hedonic score of 2,48. The texture of the brownies with the addition of 60 grams of snakehead fish was not liked by the panelists because the texture was not soft. The protein content in snakehead fish causes this. Fish containing proteins decreases the swelling power, thereby decreasing the texture of the product (Alkhamdan

& Husain, 2022). Research by Yunisah, Herpandi, and Sudirman (2022) stated that the addition of snakehead fish decreased the resulting texture, so the panellists didn't like it.

The significance of adding the number of snakehead fish to improving hedonic and hedonic quality was carried out by the Least Significant Difference (LSD) test, as shown in Table 7. Table 7 shows that adding 60 grams of snakehead fish to 1 brownie recipe can increase the texture hedonic quality score by 13,3%, and the increase approached significant ($p < 0,067$). In Table 8, adding 60 grams of snakehead fish to 1 brownie recipe can increase the texture hedonic score by 4,8%, but this increase is insignificant ($p < 0,284$).

Aroma

Figures 1 and 2 show that increasing the number of snakehead fish will give a tendency for higher changes in texture quality but will give a tendency for lower hedonic changes. Research by Yuliani *et al*. (2018) stated that the addition of snakehead fish caused a decrease in the liking of the aroma of the *crackers* produced. From the picture of changes in hedonic and hedonic quality scores, it is shown that the best addition was the addition of 60 grams of snakehead fish, with a hedonic quality score of 2,2 and a hedonic score of 2,84.

The significance of adding the number of snakehead fish to improving hedonic and hedonic quality was carried out by the Least Significant Different (LSD) test, as shown in Table 7. Table 7 shows that adding 60 grams of snakehead fish to 1 brownie recipe can increase the aroma hedonic quality score by 23,3%, and the increase was significant ($p < 0,012$). In Table 8, adding 60 grams of snakehead fish to 1 brownie recipe can increase the aroma hedonic score by 1,1%, which isn't significant ($p < 0,603$).

The panellists most liked the addition of 60 grams of snakehead fish because this addition didn't have the typical fish aroma. Research by Yunisah, Herpandi, and Sudirman (2022) states that the addition of snakehead fish causes a decrease in the aroma value of the gandus cake produced. This is caused by the amino acid content in fish, which can cause a distinctive fish aroma that the panellists do not prefer. The distinctive aroma of fish is caused by free amino acids from protein content and free fatty acids (Hasanah et al., 2017).

CONCLUSIONS AND RECOMMENDATIONS

Adding snakehead fish affected the water and protein content and the sensory properties of colour, taste, aroma, and texture. The best addition is the addition of 60

grams of snakehead fish with a nutritional value of 6.212% water content, 4.039% protein content, 0.14% ash content, 0.503% fat content, and 2.662% carbohydrate content. This addition has dark brown sensory properties, no fishy taste or fishy aroma, and is not tender.

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