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Research article

PROXIMATE ANALYSIS, PHYSICAL QUALITIES AND CONSUMER PREFERENCES OF GLUTEN-FREE CHICKEN *OTAK-OTAK*

Soraya Kusuma Putri[1]✉, Muhammad Iqbal Fanani Gunawan[1], Pradipta Bayuaji Pramono[2], Hanis Gani[3] Ulil Afidah[4], Sri Mulyani[4]

[1]Department of Food Technology, Faculty of Agriculture, Tidar University, Magelang, Indonesia
[2]Department of Animal Science, Faculty of Agriculture, Tidar University, Magelang, Indonesia
[3]School of Food Industry, Faculty of Bioresources and Food Industry, Universiti Sultan Zainal Abidin, Besut Campus, Terengganu, Malaysia
[4]Department of Food Technology, Faculty of Animal and Agricultural Sciences, Universitas Diponegoro, Semarang, Indonesia
✉Corresponding author: E-mail: sorayakusumaputri@untidar.ac.id
ORCID Number 0000-0001-7634-7228

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Abstract: The development of *otak-otak* utilizing locally sourced food ingredients remains to be an area of interest. This study aimed on developing a gluten-free *otak-otak* by incorporating arrowroot flour and mocaf as alternatives for wheat and tapioca flour. The study assessed its chemical composition, physical quality, and sensory attributes to evaluate its overal quality. The study was divided into four different formulations combining arrowroot flour and mocaf flour in varying proportions; P1, P2, P3 (50:50, 70:30, and 90:10, respectively), while P0 served as the control using a 50:50 ratio of wheat and tapioca flours. A randomized design (CRD) with five replications tested for each formulation was applied in the experimental design. The proximate analyses results indicated that thefat content at P0 – P3 levels ranged from 2.70 to 4.04%; protein content from 7.12 to 8.18%; moisture content from 47.95 to 51.16%; ash content from 2.03 to 2.35%; and carbohydrates content from 33.05 to 38.67%. Additionally, cooking loss was between 14.94 and 18.61%, and water holding capacity ranged from 12.4 to 20.8%. Results from sensory evaluation indicated that consumers exhibited no significant preference for the ak-otak prepared with wheat and tapioca flour compared to those made with varying levels of arrowroot and mocaf flour. The hedonic scores varied from 2.35 to 2.87.. All parameters exhibited no significant effect (P>0.05) on *otak-otak* quality; yet, it met SNI standards, suggesting that arrowroot and mocaf flour are viable alternatives to wheat and tapioca flour.

1. Introduction

Otak-otak is prepared from Mackerel (*Scromberomorus commersonii*) specifically formed from spicy ground fish dough coupled with flour then boiled and drained (Susbandi et al., 2019). However, with a little supply and high demand, the price of mackerel becomes expensive, so it is necessary to diversify raw materials by using chicken meat as an alternative basic ingredient for producing *otak-otak* (Putra, et al., 2015). Global chicken meat consumption is increasing due to the rising population, as it is regarded as food with high protein content (Putri et al., 2024). By 2030, poultry meat is projected to comprise 41% total meat sources (Shahbandeh, 2024). Since 1990, the global population of chickens has more than doubled, the number of chicken globally increased from 13,9 billion in 2000 to approximately 26,56 billion in 2022 (Putri et al., 2024). According to this research, chicken meat is suitable as a primary ingredient for the production of *otak-otak*.

In general, *otak-otak* can be produced using chicken meat blended with flour, coconut milk, eggs, pepper, and other spices (Srihidayati & Firdamayanti, 2021). In the following procedure, the dough is put into banana leaves, rolled, then steamed or baked. The production of *otak-otak* uses wheat flour, which contains gluten, imparting a soft and elastic texture. The production of *otak-otak* uses wheat flour, which contains the ingredient gluten, which has a soft and elastic texture. However, Dahlia (2014) stated that certain sufferers will have difficulties affected by consuming food containing gluten, like celiac disease and autism spectrum disorder (ASD). About 25% of Americans consume Gluten Free Products (GFP), which is a significantly higher than the number of Americans with celiac disease (Prada et al., 2019). Approximately 6 million individuals without celiac disease in Italy have adopted a gluten-free diet (Kamiński et al., 2020). This suggests that most of Gluten Free Products (GFP) users do not consume them for any health-related purposes. A gluten-free diet is healthier and more effective approach for weight management, contributing to the rise in GFP consumption (IMARC Group, 2023).

Currently, limited studies investigated gluten-free flour substitution in traditional Indonesian cuisines regarding both nutritional and sensory qualities. This study involved the diversification of indigenous gluten-free raw resources to manufacture *otak-otak*. Wheat flour is frequently used as an ingredient in *otak-otak*, athough it can be substituted with regional gluten-free options such as arrowroot starch flour and mocaf flour. Arrowroot starch is recognised for its high viscosity, almost double that of other flours. This characteristic facilitates the development of transparent, easily digestible products that are gentle on the digestive system (Hakim et al., 2013). The optimal texture is obtained by combining it with other flours, such as adding mocaf flour since this flour has the qualities of high viscosity, the capacity to form a gel that has dehydrating power and is easily soluble in water (Augustyn et al., 2017). Mocaf flour, derived from cassava, abundant in many regions of Indonesia, serves as a substitute for wheat flour (Wahjuningsih et al., 2024). Addition of a large proportion of mocaf flour will cause the product texture to become softer (Simanjuntak & Effendi, 2017), therefore a combination of the two types of flour is needed to produce better texture according to market desire (Yusuf et al., 2018). Given these challenges, it is imperative to conduct a comprehensive study on the effects of substituting arrowroot flour and modified cassava flour (mocaf) in the production of gluten-free *otak-otak*.

2. Materials and methods

2.1. Materials

2.1.1. Raw material preparation

A 35-day-old male broiler breast meat were obtained from chicken meat local traders in Rejowinangun Market, Magelang city. The ingredients used in the otak-otak making were wheat flour, tapioca flour, arrowroot starch flour, mocaf flour, spinach, shallots, garlic, chicken eggs, pepper, salt, sugar, water, coconut milk, flavouring, banana leaves, and cooking oil. Chemical reagents used for proximate analyses were analytical grades.

2.2. Methods

2.2.1. Production of Chicken Otak-otak

Otak-otak was produced as method conducted by Susbandi et al., (2019). Shallots and garlic were peeled, lightly dried over medium heat for 3–5 minutes, and subsequently. Spinach leaves were washed, separated from their stems, steamed for 20 seconds, pureed using a chopper, and accurately weighed to 50 grams. Eggs were beaten and weighed to a precise quantity of 30 grams. Chicken breast was pureed with ice cubes using a chopper to preserve its texture. The pureed chicken was subsequently mixed with the prepared shallots, garlic, spinach, sugar, salt, pepper, coconut milk, and seasoning. This mixture was then processed in a chopper for approximately 4 minutes to achieve a homogeneous consistency. The resulting otak-otak mixture was transferred into a ziplock plastic bag and stored in a chiller. For the final preparation, the mixture was portioned onto banana leaves, steamed for 30 minutes, and briefly baked for 2 minutes to enhance its flavor and texture. The finished product was then analyzed to assess its chemical, physical, and sensory characteristics. The use of arrowroot starch is based on the fact that arrowroot starch can replace wheat flour in various processed foods with a percentage addition of 50%-100% (Novitasari et al., 2022). The specific formulation of each treatment can be seen in the Table 1.

Table 1. The ingredient and percentage of chicken *otak-otak*

Material	Treatment			
	PO	**P1**	**P2**	**P2**
Chicken Meat (%)	50	50	50	50
Flour (%)	15	-	-	-
Tapioca Flour (%)	15	-	-	-
Arrowrout Flour (%)	-	15	21	27
Mocaf Flour (%)	-	15	9	3
Spinach (%)	5	5	5	5
Shallot (%)	2.5	2.5	2.5	2.5
Garlic (%)	2.3	2.3	2.3	2.3
Salt (%)	0.8	0.8	0.8	0.8
Sugar (%)	0.5	0.5	0.5	0.5
Coconut Cream (%)	3	3	3	3
Egg (%)	3	3	3	3
Pepper (%)	3	3	3	3
Flavoring (%)	0.4	0.4	0.4	0.4
Water (%)	2	2	2	2

Notes: P0 = wheat flour 50 : tapioca flour 50, P1 = arrowroot flour 50 : mocaf flour 50, P2 = arrowroot flour 70 : mocaf flour 30, P3 = arrowroot flour 90 : mocaf flour 10

2.2.2. Protein Content Analysis

The methodology employed for the determination of protein content was based on Aini & Sani, (2022). The operational procedure is as follows, Initially fresh samples were dried in an oven at 105˚C for 4 hours, followed by grinding the sample; 2) The sample was weighed as much as 2 grams on a watch glass and transferred to a destruction flask; 3) Seven grams of K_2SO_4 and 5 grams of $CuSO_4$ were added; 4) Slowly added fifteen mL of concentrated H_2SO_4 and allowed it to stand for 10 minutes in the acid chamber; 5) Digestion step proceeded at 410˚C for approximately 2 hours or until the solution became clear, then allowed it to cool to room temperature and 50 mL of distilled water then was added; 6) An Erlenmeyer flask containing 25 mL of 4% H_3BO_3 solution with an indicator was prepared as a container for the distillate; 7) The ash containing the results of the digestion in the steam distillation apparatus circuit was installed ; 8) Fifty mL of sodium hydroxide-thiosulfate solution were added; 9) Distillation was carried out and The distillate was collected in the Erlenmeyer flask until the minimum volume of

150 mL (the distillate will turn yellow); 10) The distillate was titrated with standardized 0.1 N HCl until the color changes from green to neutral gray (natural gray).

$$\%protein = \frac{(V_A - V_B) \times HCl \times N\ HCl \times 14.007 \times 6.25 \times 100\%}{Wx1000} \quad (1)$$

Notes:
V_A : mL HCl for sample titration
V_B : mL HCl for blank titration
N : Normality of the standard HCl used
14.007 : Atomic weight of hydrogen
6.25 : Protein conversion factor
W : Sample weight

2.2.3. Fat Content Analysis

The method used for the analysis of crude fat content is the Soxhlet method (Aini & Sani, 2022). The procedures carried out were as follows, 1) Fresh samples were first dried using an oven at a temperature of 105˚C for 4 hours, then the sample was ground 2) The fat flask to be used was dried in an oven at a temperature of 105˚C for 30 minutes; 3) The fat flask was cooled in a desiccator for 15 minutes and weighed (W2); 4) A sample of ± 5 g was weighed (W1) and wrapped; 5) The extraction tool was assembled from a heating mantle, fat flask, **98oxhlet**, and condenser; 6) The sample was inserted into the **98oxhlet** which was then added with sufficient hexane solvent for 1½ cycles; 7) Extraction was carried out for ± 2 hours until the solvent returns through the siphon into the clear colored fat ash; 8) Distillation I used to separate the extracted fat and hexane from the extraction results from the fat flask; 9) The fat that had been separated with hexane was then heated using an oven at a temperature of 105˚C for 1 hour; 10) The fat ash was cooled in a desiccator for 15 minutes and weighed; 11) Heating using an oven was carried out again for 1 hour, if the difference in weighing the last extraction result with the previous weighing does not reach 0.0002 g.

$$\%fat = \frac{W3 - W2}{W1}\ x\ 100\% \quad (2)$$

2.2.4. Moisture Content Analysis

This moisture content analysis was based on the oven method (Aini & Sani, 2022). Porcelain crucibles were dried in a 105˚C oven for 3 hours, then placed in a desiccator for 1 hour. After that, it was weighed with an analytical balance (a). Then 2.5 grams of sample was added to the crucible (b); The crucible containing the sample was placed in a 105˚C oven for 3 hours. After that, it was placed in a desiccator for 1 hour.

$$\%\text{Dry Weight} = \frac{c - a}{b}\ x\ 100\% \quad (3)$$

$$\%Moisture\ content = 100 - \%\text{Dry Weight} \quad (4)$$

A = weight of the weighing crucible
B = sample weight
C = weight of crucible + dry sample

2.2.5. Ash Content Analysis

The ash content analysis was conducted in accordance with the method outlined by Aini & Sani, (2022). Porcelain crucibles were subjected to drying in an oven at 105˚C for 3 hours, followed by a 1-hour placement in dessicator. The crucible was subsequently weighed using an analytical balance (a). Then 2.5 grams of the prepared sample was added to the crucible (b). The crucible and sample were subjected to drying in an electric furnace at 550˚C for a duration of 4 hours. The ash sample was thereafter placed in a desiccator for 1 hour. The weight of the cup and ash was weighed (c).

$$\%Ash\ content = \frac{(\text{c} - \text{a})}{b} x100\% \quad (5)$$

2.2.6. Carbohydrate Content Analysis

Carbohydrate analysis was conducted according to (Novitasari et al., 2022). This method was commonly known as carbohydrate by difference or carbohydrates through differences.

Carbohydrate analysis calculation formula:

%Carbohydrate = 100% - (fat content + protein content + ash content + moisture content) (6)

2.2.7. Cooking Loss Analysis

Cooking loss analysis was conducted according to the (Soeparno, 2005). *Otak-otak* samples wrapped in banana leaves were weighed. Then the *otak-otak* was steamed for 30 minutes and baked for 10 minutes. The cooked *otak-otak* was weighed again The percentage was calculated using the formula:

$$\frac{weight\ before\ cooking - weight\ after\ cooking}{weight\ before\ cooking} x\ 100\% \quad (7)$$

2.2.8. Water Holding Capacity

The water holding capacity (WHC) was measured utilizing the centrifugal method as outlined by (Muchtadi & Sugiyono, 1992). The *otak-otak* were collected and subsequently chopped. and the weight of the chopped sample was measured at 5 grams. The sample was placed in a 10-mL centrifuge tube. 5 mL of distilled water was added and the mixture was centrifuged for 20 minutes at 3000 rpm. The supernatant in the tube underwent separation and its volume was subsequently measured. The calculation of the percentage of WHC is performed using the following formula:

$$\frac{Volume\ of\ water\ absorbed (ml)}{sample\ weight\ (gr)} x100\% \quad (8)$$

2.2.9. Sensory Analysis

The sensory analysis carried out was an organoleptic test using a hedonic test with 40 untrained panelists, both male and female. The panelist were Tidar University students, aged 19-23 years old. Before entering the laboratory room, panelists were given instructions by the researcher and must obey the rules during the test. Each panelist was given 4 samples with random three-digit codes and given a questionnaire to assess color, aroma, taste, texture and overall appearance. The test was carried out in one session using five-point hedonic scale (Simanjuntak & Effendi, 2017) (1: really like it, 2: like it, 3: neutral, 4: don't like it, 5: really don't like it)

2.3. Data analysis

A completely randomized design (CRD) was used and data were analyzed using analysis of variance (ANOVA). Tukey's post-hoc test was used to know the differences among treatments using SPSS Statistics 22.0 (IBM, USA).

3. Results and discussions

3.1. Proximate Analysis

The proximate analysis results presented in Table 2 indicate that no significant differences among P0 (control), P1, P2, and P3 in all measured parameters. The results of fat content analysis conducted using the Soxhlet method on gluten-free *otak-otak* showed no statistically significant difference (P >0.05). The maximum allowable fat content in otak-otak is 16%. Consequently, the gluten-free chicken *otak-otak* produced in the three treatments complies with the Indonesian national standard. The results that were not staticslly significant coulde be due to the limited range of flour percentages utilized, which may have constrained the capacity to identify meaningful differences or trends. The fat content of arrowroot flour is 0.59 % (Lewis, 2012), mocaf flour 0.83 % (Badan Standarisasi Nasional, 2013); wheat flour 1.0%; and tapioca flour 0.5% (Asmoro, 2021). The relationship between fat content and protein content is inversely proportional; an increase in protein content corresponds to a decrease in fat content, and conversely (Idrus & Rossi, 2016). The fat content in a product directly influences the resulting taste and texture, thereby impacting the sensory quality.

Table 2. Proximate analysis of chicken *otak-otak* with substitution of arrowroot flour and mocaf flour

Parameter	Fat^{ns}	Protein^{ns}	Moisture^{ns}	Ash^{ns}	Carbohydrate^{ns}
P0	4.04±0.92	8.18 ± 8.42	50.48±1.66	2.03 ± 0.22	35.26±9.58
P1	3.63±1.37	7.99 ± 7.75	47.95±5.04	2.08 ± 0.54	38.67±10.38
P2	3.91±1.59	7.93 ± 7.06	50.93±4.21	2.35 ± 0.64	33.05±7.01
P3	2.70±0.43	7.12 ± 7.71	51.16±2.74	2.34 ± 0.66	36.85±9.24

Notes:

P0 : *Otak-otak* (control) wheat flour with tapioca flour (50:50).

P1: Substitution of flour with arrowroot flour and flour mocaf (50:50).

P2: Substitution of flour with arrowroot flour and mocaf flour (70:30).

P3: Substitution of flour with arrowroot flour and flour mocaf (90:10).

ns : not significantly different

The results indicating a non-significant protein content may be due to the limited range of flour percentages utilised. The analysis of crude protein content in gluten-free chicken otak-otak, conducted using the Kjeldahl method, indicatedno significant difference (P >0.05). According to the quality requirements outlined in the Indonesian National Standard for fish otak-otak (7757 - 2013), the minimum protein content specified is 5%. Therefore, the gluten-free chicken otak-otak produced in the three treatments complies with this standard. Arrowroot flour has a protein content of approximately 3.05%. (Lewis, 2012) indicates that mocaf flour has a protein content of approximately3.42 % (Badan Standarisasi Nasional, 2013), wheat flour contains 9.0% protein, and tapioca flour contains 1.1% protein (Novitasari et al., 2022).According the regulation protein in the jurisdictations and codex, food contains at least 6,5 g primarily intact protein in a reasonable daily adult intake(Sundari et al., 2015).

The non-significant moisture content results might be attributed to the narrow range of percentages of flour used. According to Indonesia National Standard (Lewis, 2012), mocaf flour has a maximum moisture content of 13%. In addition, the moisture content of *otak-otak* is also influenced by the fiber content, while mocaf flour has a high fiber content of 6% (Faridah et al., 2014). The higher the fiber, the higher the moisture content produced (Rosita et al., 2015); (Wibawanti et al., 2021); (Pratama et al., 2018)

The results of ash content was non-significant which might be attributed to the narrow range of percentages of flour used. This result is might be affected by the processing of several types of flour used and can also caused by differences in starch types and their environment (Kang et al., 2017). The ash content results of the flour gluten-free chicken *otak-otak* samples met the requirements set by SNI (Badan Standarisasi Nasional, 2013) of a 2% as a maximum percentage. Fermentation of mocaf flour affects the ash content produced. The longer the fermentation period, the lower the ash concentration tends to be. This is due to the dissolution of mineral content in cassava as the main ingredient in making mocaf flour. The dissolution of mineral content in cassava serves as the main factor in production of mocaf flour. Fermented cassava has the potential to leas to the dissolution of certain minerals, thereby decreasing the ash content that comprises various mineral contents (Setyani & Astuti, 2017).

3.2. Physical Quality Analysis

The results of the study below pertain to the physical quality of chicken *otak-otak* when substituting arrowroot flour and mocaf flour, as presented in Table 3.

Table 3. Physical quality of chicken *otak-otak* with substitution of arrowroot flour and mocaf flour

Treatment	Parameters (%)	
	Cooking Loss [ns]	Water Holding Capacity [ns]
P0	17.06±6.85	12.4±7.26
P1	15.94±8.49	17.6±7.53
P2	18.61±6.47	16.0±5.47
P3	14.94±7.63	20.8±7.29

Notes:
P0 : *Otak-otak* (control) wheat flour with tapioca flour (50:50).
P1: Substitution of flour with arrowroot flour and flour mocaf (50:50).
P2: Substitution of flour with arrowroot flour and mocaf flour (70:30).
P3: Substitution of flour with arrowroot flour and flour mocaf (90:10).
ns : not significantly different.

Cooking loss is a condition when meat or processed products shrink during processing, such as heating. The substitution of arrowroot flour and mocaf flour in the chicken *Otak-otak* did not result in a significant impact on cooking losses. Reduced cooking losses indicate superior product quality, as there is less moss loss during the cooking process. Conversely, higher cooking loss values are associated with a deterioration in product quality (Widyawati et al., 2023). Studies on noodles have consistently shown that cooking losses greater than 12% correlate with lower-quality noodles (Kamiński et al., 2020). Several factors have been identified as contributing to cooking loss in noodles, including incomplete starch gelatinization, weakened gluten strength, and the incorporation of additional ingredients (Hajriatun et al., 2017).

Water holding capacity (WHC) is the ability of meat to absorb and retain water during mechanical treatment (stirring, tenderising, seasoning and moulding), temperature treatment, storage and transport (Zayas, 1997) The results of the analysis of variance showed that the substitution of arrowroot flour and mocaf flour did not have a significant effect (P >0.05). The non-significant results might be attributed to the narrow range of percentages of flour used. Study conducted by (Firahmi et al., 2015)explained that water holding capacity (WHC) was significantly influenced by the properties of the ingredients, particularly flour. The proportion of arrowroot flour affected water-binding ability, when pressure was applied to the nuggets, water release occured. The extent of water release is determined by the amylose content in the flour and the formation of matrices involving in water, flour, and meat proteins (Firahmi et al., 2015).

3.3. Organoleptic test

The results of the sensory evaluation, which assess the level of liking (hedonic) for chicken *otak-otak* made with arrowroot starch flour and mocaf flour, are presented in Table 4. The aspect of colour serves to capture consumer interest in a product, derived from the visual sense (Jayanti et al., 2023). The results presented in Table 4 indicate that the colour scores for P0 (control), P1, P2, and P3 did not show significant differences (P>0.05). The colouration of chicken otak-otak exhibited a predominantly white hue, with a subtle greenish tint. The colour of the Otak-otak increases in darkness with a higher proportion of arrowroot starch. Study conducted by (Herlambang et al., 2019) explained tha the bright color of the meatballs produced comes from the high proportion of mocaf flour. The addition of spinach showed a white color with a slight greenish due to its high chlorophyll content as a natural food coloring (Soenarno et al., 2023).

Table 4. Organoleptic test of chicken *otak-otak* with substitution of arrowroot flour and mocaf flour

Parameter	Treatment			
	P0	**P1**	**P2**	**P3**
Color^{ns}	2.65±0.89	2.47±0.87	2.57±0.74	2.72±0.84
Aroma^{ns}	2.40±0.92	2.37±0.95	2.55±0.81	2.87±0.99
Taste^{ns}	2.57±0.95	2.67±1.11	2.55±0.90	2.50±1.03
Texture^{ns}	2.55±0.93	2.52±0.98	2.45±0.81	2.55±0.93
Overall Appearance^{ns}	2.57±0.87	2.45±0.90	2.40±0.70	2.35±0.80

Notes:
P0 = wheat flour + tapioca flour (50:50) as control, P1 = arrowroot starch flour + mocaf flour (50:50), P2 = arrowroot starch flour + mocaf flour (70:30), and P3 = arrowroot starch flour + mocaf flour (90:10). ns= *not significantly different*.
Hedonic scale: 1= like very much, 2= like, 3= neutral, 4= don't like, 5= really don't like

Aroma is a sensory attribute that creates an impression of a product through the sense of smell (Saptadinata & Putra, 2022). The results presented in Table 4 indicate that the aroma levels of chicken otak-otak produced in P0 (control), P1, P2, and P3 did not exhibit a statistically significant difference (P>0.05). The addition of arrowroot starch and mocaf flour was suspected to have no influences on the panelists' preference of the aroma attributes of chicken *otak-otak*. Volatile compounds and water vapor can affect the aroma during the cooking process. One of the spices used in making *otak-otak*, such as shallots and garlic, releases a distinctive aroma when cooked, which can attract consumers to the product (Purwanto et al., 2015).

The flavour profile of a food product is influenced by the interplay between its shape and ingredients, as detected by the gustatory system (Herlambang et al., 2019). The data presented in Table 7 indicate that there were no significant differences in the taste of Otak-otak among the groupsP0 (control), P1, P2, and P3 (P>0.05). The perceptions held by consumers regarding products can impact the flavour profile of a food item (Augustyn et al., 2017). (Srihidayati & Firdamayanti, 2021) stated that taste can be influenced by the raw materials used, such as the type of raw materials and the addition of spices. This was also conveyed by (Augustyn et al., 2017) who stated that the taste of a product is greatly influenced by the spices added, and the amount of spices can be adjusted to suit consumer preferences

Texture also plays an important role in all types of food or influences the selling value of consumer acceptance of a product (Herlambang et al., 2019). The texture of chicken *otak-otak* in P0 (control), P1, P2, and P3 exhibited no significantl differences in consumer preference (P>0.05). The results indicated that the texture score levels for P0, P1, P2, and P3 fell within a value range of 2. The combination of arrowroot starch and mocaf flour was evaluated and assigned a value equivalent to that of the control treatment, according to the preferences of the panellists. The observed outcome can be attributed to the increased proportion of arrowroot starch, which resulted in a chewier texture. This aligns with the findings of (Soenarno et al., 2023), who reported that increasing the proportion of arrowroot starch results in a chewier texture in sausage products.

The overall appearance is the panelist's assessment before tasting the product which can be seen in general based on product's color, flavor, texture, and taste while evaluating it (Purwanto et al., 2015). Based on Table 7, the overall appearance of the chicken *otak-otak* was not significantly different (P>0.5). In general, the panelists gave a score to the overall attribute of chicken *otak-otak* with a value range of 2 (like). This showed that the panelists liked the overall appearance attributes of chicken *otak-*

otak in all proportions of arrowroot starch and mocaf flour.

4. Conclusions

In conclusion, the substitution of arrowroot flour and mocaf flour in chicken *otak-otak* results in a gluten-free that is safe for consumption. These formulations preserve the levels of fat, protein, moisture, ash, and carbohydrate levels, as well as cooking loss and water-binding capacity, in compliance with SNI standards. The study findings demonstrate that the incorporation of arrowroot starch and mocaf flour does not lead to notable variation in consumer acceptance of chicken otak-otak. This substitution represents a potential innovation for the development of gluten-free products and holds promising applications in the food industry

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