

FORMULATION AND CHARACTERIZATION OF RICE FLOUR-BASED INSTANT NOODLES WITH THE ADDITION OF AFRICAN CATFISH (*CLARIAS GARIEPINUS*) MEAT FLOUR AS A PROTEIN SOURCE

Formulasi Dan Karakterisasi Mi Instan Berbasis Tepung Beras Dengan Penambahan Tepung Daging Ikan Lele Dumbo (*Clarias gariepinus*) Sebagai Sumber Protein

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ABSTRACT

Instant noodles are generally made from wheat flour, which still relies on imported raw materials. An alternative approach is utilizing rice flour with the addition of African catfish (*Clarias gariepinus*) meat flour as a protein source. This study aimed to formulate rice flour-based instant noodles enriched with African catfish meat flour and analyze its effects on chemical, physical, and organoleptic characteristics. The study employed a Completely Randomized Design (CRD) with four treatment levels: P0 (0 g), P1 (15 g), P2 (25 g), and P3 (35 g), each with three replications. Chemical and physical data were analyzed using ANOVA followed by Duncan's test, while organoleptic data were analyzed using the Kruskal-Wallis test followed by Dunn's test at a 95% confidence level. The results showed that the addition of African catfish meat flour increased moisture content from $3.69 \pm 0.20\%$ to $7.30 \pm 0.39\%$, ash content from $4.43 \pm 0.14\%$ to $5.84 \pm 0.24\%$, fat content from $4.41 \pm 0.11\%$ to $5.73 \pm 0.06\%$, protein content from $11.07 \pm 0.20\%$ to $12.75 \pm 0.28\%$, and rehydration time from 12.18 ± 0.05 minutes to 16.14 ± 0.05 minutes. However, it decreased carbohydrate content from $76.40 \pm 0.28\%$ to $68.02 \pm 0.93\%$, as well as the hedonic quality scores and panelists' preference levels for appearance, aroma, texture, and taste. All treatments still complied with the instant noodle requirements based on SNI 3551:2018 and BPOM Regulation Number 26 of 2021.

Key words: African catfish, Fish Meal, Instant Noodle, Rice Flour

ABSTRAK

Mi instan umumnya dibuat dari tepung terigu sehingga masih bergantung pada bahan baku impor. Salah satu alternatif adalah menggunakan tepung beras dengan penambahan tepung daging ikan lele dumbo (*Clarias gariepinus*) sebagai sumber protein. Penelitian ini bertujuan menyusun formula mi instan berbasis tepung beras dengan penambahan tepung daging ikan lele dumbo serta menganalisis pengaruhnya terhadap karakteristik kimia, fisik, dan organoleptik. Penelitian menggunakan Rancangan Acak Lengkap (RAL) dengan empat taraf perlakuan, yaitu P0 (0 g), P1 (15 g), P2 (25 g), dan P3 (35 g), masing-masing tiga ulangan. Data kimia dan fisik dianalisis menggunakan ANOVA yang dilanjutkan uji Duncan, sedangkan data organoleptik dianalisis menggunakan uji Kruskal-Wallis yang dilanjutkan uji Dunn pada taraf kepercayaan 95%. Hasil penelitian menunjukkan bahwa penambahan tepung daging ikan lele dumbo meningkatkan kadar air dari $3,69 \pm 0,20\%$ menjadi $7,30 \pm 0,39\%$, kadar abu dari $4,43 \pm 0,14\%$ menjadi $5,84 \pm 0,24\%$, kadar lemak dari $4,41 \pm 0,11\%$ menjadi $5,73 \pm 0,06\%$, kadar protein dari $11,07 \pm 0,20\%$ menjadi $12,75 \pm 0,28\%$, dan waktu rehidrasi dari $12,18 \pm 0,05$ menit menjadi $16,14 \pm 0,05$ menit, tetapi menurunkan kadar karbohidrat dari $76,40 \pm 0,28\%$ menjadi $68,02 \pm 0,93\%$ serta nilai mutu hedonik dan tingkat kesukaan panelis terhadap kenampakan, aroma, tekstur, dan rasa. Seluruh perlakuan tetap memenuhi persyaratan mi instan berdasarkan SNI 3551:2018 dan Peraturan BPOM Nomor 26 Tahun 2021.

Kata Kunci: Lele Dumbo, Mi Instan, Tepung Beras, Tepung Daging Ikan

INTRODUCTION

Instant noodles are a widely consumed food product due to their convenience, affordability, and ease of preparation. Data from the World Instant Noodles Association (2025) indicates that Indonesia ranks second among 56 countries in instant noodle consumption, reaching 14.68 billion servings in 2024. This high level of consumption suggests significant potential for developing instant noodles with improved nutritional value. However, instant noodles typically rely on wheat flour which contains gluten, a protein responsible for the elastic and chewy texture of the dough as the primary ingredient (Husain *et al.*, 2025). Meanwhile, Indonesia remains dependent on wheat imports, necessitating the use of local raw materials as alternatives. One promising ingredient is rice flour (*Oryza sativa*), which contains 82.3% total starch, approximately 20.1% amylose, and 7.9% protein (Farooq *et al.*, 2021). Amylose content plays a crucial role in gel formation and the product's cooking characteristics (Puhin *et al.*, 2021). However, the absence of gluten results in suboptimal textures for rice flour-based products, such as a tendency to become sticky and a loss of solids during cooking (Jiang *et al.*, 2024). Therefore, incorporating a protein source is necessary to enhance nutritional value while simultaneously improving the characteristics of the instant noodles.

Research by Putriyana *et al.* (2025) demonstrated that noodles made from rice flour and tapioca flour, supplemented with purple sweet potato flour, exhibited favorable chemical characteristics and high panelist acceptance. However, that study was limited to wet noodles and did not utilize protein sources derived from fishery products. Meanwhile, Mulyana & Farida (2024) reported that adding fish flour to rice flour-based *kwetiau* (flat rice noodles) increased protein content while maintaining acceptable sensory quality. Nevertheless, the application of fish flour in the development of rice flour-based instant noodles remains limited. One material with potential for utilization is African catfish (*Clarias gariepinus*) meat flour, as it is an aquaculture commodity that is readily available in Indonesia. Furthermore, the protein content of catfish meat can increase to 60–75% after processing into flour (Asrim *et al.*, 2022), thereby offering the potential to boost protein levels while influencing the characteristics of the instant noodles.

Based on this background, this study developed a rice flour-based instant noodle formulation incorporating African catfish meat flour as a protein source. The research utilized the formulation established by Putriyana *et al.* (2025) but substituted purple sweet potato flour with African catfish meat flour and adapted the product from fresh noodles into instant noodles. The objective of this study was to formulate rice flour-based instant noodles with varying levels of African catfish meat flour and to analyze the effects on the chemical, physical, and organoleptic characteristics of the resulting product. The findings are expected to provide an alternative for developing instant noodles based on local ingredients that offer higher protein content and desirable quality characteristics.

RESEARCH METHODS

Time and Place

This research was conducted at the Integrated Maritime Laboratory of the Faculty of Marine Science and Fisheries Technology, Universitas Negeri Gorontalo, which served as the site for chemical analysis and organoleptic testing. Meanwhile, the production of rice flour-based instant noodles and the rehydration time testing were carried out at the researcher's residence. The study spanned five months, from February to June 2026.

Tools and Materials

The equipment used in this study included a digital scale, plastic basins, a spoon, a glass, a noodle-making machine, flat plates, a gas stove (Rinnai), a cooking pot, a stem thermometer, a drying oven (Hakasima), clear airtight plastic containers (Klir), a laboratory coat, and plastic gloves.

The materials used in this study consisted of rice flour (Sania), African sharptooth catfish (*Clarias gariepinus*) meat flour (GiZae), tapioca flour (Rose Brand), table salt, and refillable drinking water.

Research Procedure

This study began by establishing a basic formulation for rice flour-based instant noodles to serve as a reference. The initial formulation was based on the study by Putriyana *et al.* (2025), which utilized a mixture of 100 g rice flour, 100 g tapioca flour, 225 mL water, 4 g salt, and 150 g purple sweet potato flour. In the current study, the purple sweet potato flour was replaced with African sharptooth catfish (*Clarias gariepinus*) flesh flour as the protein source. The basic formulation was determined through a series of trial-and-error experiments, varying the amounts of tapioca flour and water until a smooth, pliable dough was obtained one that was easy to shape and yielded noodles that did not break easily during cooking. Experimental results indicated that a formulation consisting of 100 g rice flour, 70 g tapioca flour, 2 g salt, and 120 g water produced the best dough and noodle characteristics; consequently, this was selected as the basic formulation and control (P0).

This basic formulation served as the reference for producing instant noodles with the addition of African sharptooth catfish flesh flour at three treatment levels 15 g (P1), 25 g (P2), and 35 g (P3) alongside a control treatment (P0) containing no fish flour. These levels were established based on the 10% to 30% fish flour fortification range reported by Pham *et al.* (2026). Varying the amount of catfish flesh flour allowed for the assessment of its impact on the instant noodles' characteristics.

The instant noodle production process followed the method described by Apriansyah *et al.* (2021). All ingredients were mixed to form a pliable dough, which was then kneaded until smooth and homogeneous. The dough was divided into sections and processed using a noodle-making machine. Rolling and folding steps were repeated until a smooth dough sheet was obtained. The sheet was allowed to rest for approximately 15 minutes before being rolled

again and cut into noodle strands. The raw noodles were allowed to rest for approximately 30 minutes before being steamed at 100°C for 12 minutes. The steamed noodles were drained and then dried in an oven at 70°C for 4 hours. The dried product was cooled for 15 minutes and stored in polypropylene (PP) plastic containers prior to testing.

The resulting instant noodles were analyzed to determine their chemical, physical, and organoleptic characteristics. Chemical analysis included the determination of moisture, ash, fat, protein, and carbohydrate contents. Physical analysis was conducted by measuring rehydration time. A hedonic quality test was performed to evaluate the sensory quality of the instant noodles based on appearance, aroma, taste, and texture parameters across the various treatments involving the addition of African sharptooth catfish (*Clarias gariepinus*) meat flour.

Data analysis

This study employed a Completely Randomized Design (CRD) with a single treatment factor varying concentrations of African catfish (*Clarias gariepinus*) meat flour with three replicates per treatment, while organoleptic testing was conducted by 25 semi-trained panelists. Data on chemical and physical characteristics were analyzed using Analysis of Variance (ANOVA) at a 95% confidence level ($\alpha = 0.05$), followed by Duncan's Multiple Range Test (DMRT) to determine significant differences between treatments. Data on organoleptic hedonic quality were analyzed using the Kruskal-Wallis test, followed by Dunn's test to identify significant differences ($p < 0.05$).

RESULTS

Table 1. Chemical test results for instant noodles

Instant Noodle Formula	Nutritional Content				
	Water (%)	Ash (%)	Fat (%)	Protein (%)	Carbohydrate (%)
P1	3,69±0,20 ^a	4,43±0,14 ^a	4,41±0,11 ^a	11,07±0,20 ^a	76,40±0,28 ^a
P2	5,71±0,50 ^b	4,88±0,42 ^a	5,73±0,06 ^b	11,72±0,21 ^b	71,96±0,34 ^b
P3	7,30±0,39 ^c	5,84±0,24 ^b	5,54±0,92 ^b	12,75±0,28 ^c	68,02±0,93 ^c

(Note: Different letter notations in the same column indicate significant differences based on the ANOVA and Duncan's post-hoc test.)

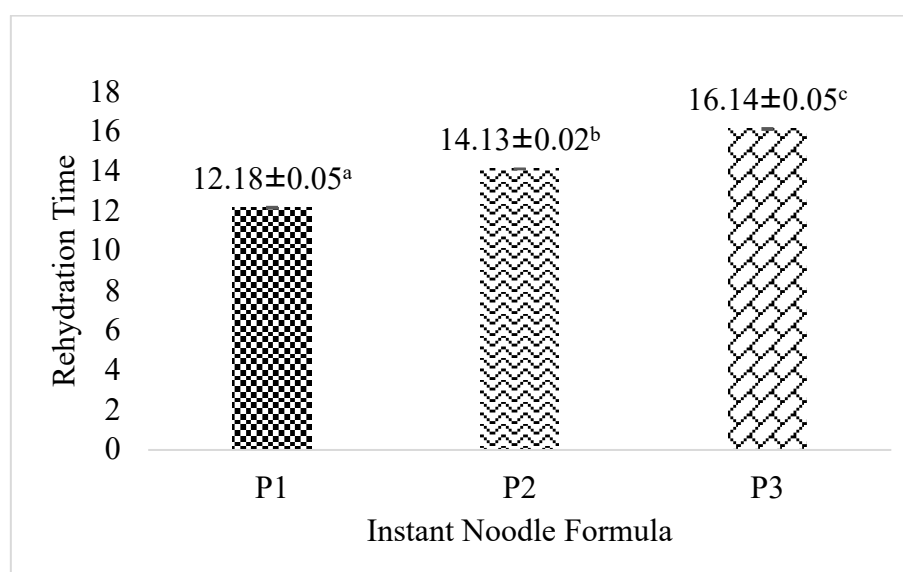


Figure 1. Rehydration time of instant noodles

(Note: Different letter notations above the chart bars indicate significant differences based on the ANOVA test and Duncan's post-hoc test.)

Table 2. Results of the organoleptic test of the hedonic quality of instant noodles

Instant Noodle Formula	Test Parameters			
	Appearance / Feature	Aroma	Texture	Flavor
P0	8,36±0,95 ^a	7,08±1,08 ^a	8,04±1,31 ^a	7,00±1,53 ^a
P1	7,80±1,15 ^a	8,04±1,31 ^a	7,96±1,17 ^a	7,96±1,17 ^a
P2	6,20±1,15 ^b	7,32±1,70 ^a	4,76±1,33 ^b	5,48±1,66 ^b
P3	5,40±1,41 ^b	7,08±1,78 ^a	4,28±1,62 ^b	4,68±1,80 ^b

(Note: Different letter notations in the same column indicate significant differences based on the Kruskal-Wallis test and Dunn's post-hoc test.)

DISCUSSION

The moisture content of the instant noodles changed in correlation with the increasing concentration of African sharptooth catfish (*Clarias gariepinus*) meat flour. The moisture content test results are presented in Table 1. Treatment P1 resulted in lower moisture content compared to the control, whereas moisture content increased in treatments P2 and P3. This increase is attributed to the higher proportion of protein from the catfish meat flour, which interacts with water molecules via hydrogen bonding, thereby retaining more water within the noodle matrix despite the drying process. Proteins, alongside starch, play a role in forming a water-binding structure; consequently, the higher the concentration of added fish flour, the greater the amount of water retained in the product. These findings align with Li *et al.* (2018), who stated that water distribution in food products is influenced by interactions between water and proteins, starch, and other macromolecular components acting as water binders. Research by Nawaz *et al.* (2021) also demonstrated that increasing the addition of fish-based ingredients can raise the amount of bound water, leading to a tendency for increased product moisture content. All treatments yielded moisture content values ranging from 3.69% to 7.30%, remaining below the maximum limit of 14% for non-fried dried instant noodles as stipulated by SNI 3551:2018 (National Standardization Agency, 2018). These results indicate that the drying process effectively reduced moisture content to meet quality standards, while the addition of catfish meat flour contributed to a rise in moisture content due to enhanced protein water-binding capacity—without exceeding the established standard limits.

The ash content of the instant noodles increased alongside the rising concentration of catfish meat flour, shifting from 2.84% in the control to 5.84% in treatment P3. The ash content test results are presented in Table 1. This increase indicates that the catfish meat flour contributed to the product's mineral content, as it contains various minerals such as calcium, phosphorus, iron, and sodium. During the ashing process, organic components degrade while minerals remain as residue; consequently, increasing the amount of fish meal added results in a higher ash content. This finding aligns with Restuti *et al.* (2025), who reported that catfish meal possesses a high mineral content and has the potential to enhance the nutritional value of food products. Furthermore, Indra *et al.* (2022) stated that ash content serves as an indicator of the mineral or inorganic matter present in a product, meaning an increase in ash content reflects a rise in mineral levels. The increase in ash content observed in this study indicates that fortifying the product with African sharptooth catfish (*Clarias gariepinus*) meat meal not only boosts protein content but also enriches the mineral profile of the instant noodles. Thus, the use of this catfish meat meal offers the potential to improve the product's nutritional value through mineral supplementation, although the concentration used must be carefully adjusted to ensure the noodles' physical and sensory characteristics remain acceptable to consumers.

The fat content of the instant noodles tended to increase following the addition of African sharptooth catfish (*Clarias gariepinus*) meat flour, although a slight decrease was

observed in treatment P3 compared to P2. The fat content test results are presented in Table 1. Generally, the increase in fat content indicates that the catfish meat flour contributed to the product's fat profile, as it retained lipids derived from the fish tissue. These findings align with Nawaz *et al.* (2021), who reported that adding fish meat to noodle products can raise fat levels in proportion to the amount of fish ingredient used in the formulation. The decrease in fat content observed in P3 was likely influenced by variations during processing or analysis, as well as potential lipid alterations caused by heating. Lekjing *et al.* (2026) explained that lipid peroxidation and polymerization reactions during processing can reduce the extractable fat fraction, meaning fat content does not always increase linearly. The fat content across all treatments ranged from 4.20% to 5.73%, remaining below the maximum total fat limit of 20 g/100 g stipulated in BPOM Regulation Number 26 of 2021 (Indonesian Food and Drug Authority, 2021). These results demonstrate that fortifying the product with African sharptooth catfish meat flour increases fat content without exceeding regulatory limits. In addition to enhancing nutritional value, an appropriate fat content plays a role in developing the product's flavor and textural characteristics (Apriansyah *et al.*, 2021); thus, the addition of this catfish meat flour is a viable approach that does not compromise nutritional quality or product safety.

The protein content of the instant noodles increased with the rising concentration of African sharptooth catfish (*Clarias gariepinus*) meat flour. The results of the protein content analysis are presented in Table 1. This increase indicates that the catfish meat flour serves as an effective protein source for enriching the nutritional value of the instant noodles, as it possesses a higher protein content compared to rice flour and tapioca flour. The higher the proportion of fish flour added, the greater the protein contribution to the final product's composition. These results align with the study by Parvathy *et al.* (2017), which reported that fortifying noodles with fish-based ingredients significantly increases protein content as the proportion of fish in the formulation rises. All treatments yielded protein levels exceeding the minimum requirement for instant noodles set by SNI 3551:2018 (6.0%). This increase in protein content demonstrates that fortification with catfish meat flour enhances the nutritional quality of instant noodles without compromising compliance with quality standards. These findings are also supported by research from Litaay *et al.* (2023), which reported that fish flour fortification in noodle products increases protein content and nutritional value, although the addition concentration must be adjusted to ensure physical and sensory characteristics remain acceptable to consumers.

The carbohydrate content of the instant noodles decreased as the concentration of African sharptooth catfish meat flour increased. The results of the carbohydrate content analysis are presented in Table 1. This decline indicates that the addition of fish flour reduces the proportion of carbohydrate-rich ingredients specifically rice flour and tapioca flour within the noodle formulation. Catfish meat flour has higher protein and mineral content but significantly lower carbohydrate content compared to those two flours; consequently, increasing the fish flour concentration leads to a decrease in the product's carbohydrate percentage. These results are consistent with findings by Rahim & Musta (2019), who reported that tapioca flour is a rich source of carbohydrates, and Farooq *et al.* (2021), who stated that rice flour is dominated by starch components. Corrêa *et al.* (2023) also explained that fortifying food products with fish flour can increase protein and mineral content while simultaneously reducing carbohydrate content. Beyond the influence of changes in raw material composition, the reduction in carbohydrate levels is also linked to the "by difference" analytical method, wherein carbohydrate content is calculated by subtracting the moisture, ash, protein, and fat contents from the total. Consequently, the increase in protein, fat, ash, and moisture levels resulting from the addition of African sharptooth catfish (*Clarias gariepinus*) meat flour directly leads to a lower carbohydrate percentage. These results indicate that fortifying with this catfish meat flour improves the nutritional composition of instant noodles by boosting

protein and mineral content without negating the role of carbohydrates as the primary energy source.

The rehydration time of the instant noodles increased with higher concentrations of the catfish meat flour, indicating that the addition of fish flour slows down water absorption during cooking. The rehydration test results are presented in Figure 1. This is likely due to the increased protein content in the formulation, which binds water via hydrophilic groups; consequently, some water interacts with the protein before becoming available for starch gelatinization. Furthermore, the interaction between protein and starch during dough formation creates a denser noodle structure, thereby slowing the diffusion of water into the noodle strands. These findings align with Ye *et al.* (2024), who stated that the hydration level of proteins plays a crucial role in water-binding capacity and final structure formation within dough systems. The prolonged rehydration time is also likely influenced by the reduced proportion of starch resulting from the addition of the catfish meat flour. Starch is the primary component undergoing gelatinization during cooking; thus, a decrease in its proportion can retard water absorption and starch granule swelling. Chittrakorn *et al.* (2026) reported that alterations in noodle ingredient composition can inhibit water diffusion and extend cooking time. Nevertheless, the increased rehydration time observed in this study indicates that fortification with African catfish meat flour affects the cooking characteristics of instant noodles by altering the interactions between protein and starch within the product matrix.

The appearance score of the instant noodles tended to decrease as the concentration of African sharptooth catfish (*Clarias gariepinus*) meat flour increased. The results of the hedonic quality test for appearance are presented in Table 2. The addition of fish flour darkened the noodle color, thereby reducing brightness and visual appeal compared to the control. After rehydration, differences in appearance between treatments became more pronounced; starch gelatinization rendered the noodle structure more translucent, making the color of the fish flour appear more dominant. These results align with Jeong & Lee (2025), who stated that heating during gelatinization can reduce the brightness of rice flour-based products. Beyond affecting color, increasing the concentration of catfish meat flour likely altered the noodle surface structure through protein-starch interactions. Proteins can form a network around starch granules, inhibiting starch swelling and reducing water-binding capacity; this results in a less homogeneous and duller noodle surface. These findings are supported by Chen *et al.* (2022), who reported that protein-starch interactions influence starch granule swelling and the physical characteristics of rice flour-based products. Consequently, adding high concentrations of catfish meat flour tended to lower panelist acceptance regarding the appearance of the instant noodles after rehydration.

The addition of catfish meat flour influenced the aroma characteristics of the instant noodles after rehydration. The results of the hedonic quality test for aroma are presented in Table 2. Treatments with moderate amounts of fish flour yielded a more preferred aroma by balancing the characteristic fish scent with the base noodle aroma; conversely, higher concentrations made the fish aroma increasingly dominant, thereby reducing panelist acceptance. These results are consistent with Pratama *et al.* (2018), who stated that volatile flavor compounds are the primary determinants of aroma characteristics in fish-based food products. The decline in aroma quality at higher fish flour concentrations is likely attributable to the increased release of volatile compounds during the rehydration process. Heating can enhance the release of volatile compounds such as amines, aldehydes, ketones, and lipid oxidation products thereby intensifying the characteristic fishy aroma. Liu *et al.* (2021) reported that these compounds contribute to the formation of a fishy odor in fishery products. Furthermore, Fan *et al.* (2025) stated that the heating process influences the formation and release of flavor compounds in fishery products. Consequently, the addition of African catfish meat flour at moderate concentrations yields a more balanced aroma, whereas higher levels of

addition tend to reduce panelist acceptance due to the heightened intensity of the characteristic fishy aroma.

The addition of African catfish meat flour affects the textural characteristics of instant noodles after rehydration. The results of the hedonic texture quality test are presented in Table 2. Treatments with lower concentrations of fish flour produced a chewier texture that was preferred by panelists, whereas increasing the fish flour concentration resulted in a less elastic texture and reduced acceptance levels. These changes are attributed to a reduced proportion of starch in the formulation and increased protein-starch interactions, which suboptimize the processes of gelatinization and starch granule swelling during rehydration. Zhang *et al.* (2025) reported that non-starch components, including proteins, can inhibit water absorption and starch granule swelling during gelatinization. Additionally, the protein in African catfish meat flour possesses water-binding capacity, thereby limiting the amount of water available for starch gelatinization. Protein-starch interactions during cooking lead to the formation of a denser noodle structure, resulting in reduced elasticity at higher fish flour concentrations. These findings are supported by Zang *et al.* (2022), who stated that proteins can interact with starch granules and inhibit water diffusion into the starch during gelatinization. Thus, the addition of African catfish meat flour in moderate amounts still yields an acceptable texture, whereas higher levels of addition tend to lower panelist preference regarding the texture of the instant noodles.

The addition of African sharptooth catfish (*Clarias gariepinus*) meat flour influenced the flavor characteristics of the instant noodles after rehydration. The results of the hedonic quality test for flavor are presented in Table 2. Treatments involving a moderate amount of fish flour yielded a more preferred flavor, as they struck a balance between the savory taste of the noodles and the characteristic fish flavor. Conversely, increasing the fish flour concentration caused the fish flavor to become dominant, thereby reducing panelist acceptance. These results align with Zhou & Wang (2019), who stated that the interaction between free amino acids and nucleotides plays a role in umami flavor formation, yet changes in ingredient composition can affect the flavor balance of food products. The decline in preference scores for treatments with higher fish flour concentrations is likely linked to the increased release of flavor-contributing compounds during the rehydration process. Heating can enhance protein solubility and the formation of free amino acids, which contribute to the product's flavor. Li *et al.* (2022) reported that heating affects the free amino acid and nucleotide composition of fishery products, thereby altering their flavor characteristics. These findings are further supported by Agung *et al.* (2025), who noted that high concentrations of fish flour tend to lower panelist preference due to the increasingly dominant fish flavor and aroma. Thus, the addition of African sharptooth catfish meat flour at a moderate concentration resulted in the most balanced flavor profile and was more acceptable to the panelists.

CONCLUSION

Based on the research results, it can be concluded that the addition of African sharptooth catfish (*Clarias gariepinus*) meat flour significantly influenced ($p < 0.05$) the chemical, physical, and organoleptic characteristics of rice flour-based instant noodles. Increasing the concentration of catfish meat flour raised the moisture content from $3.69 \pm 0.20\%$ to $7.30 \pm 0.39\%$, ash content from $4.43 \pm 0.14\%$ to $5.84 \pm 0.24\%$, fat content from $4.41 \pm 0.11\%$ to $5.73 \pm 0.06\%$, protein content from $11.07 \pm 0.20\%$ to $12.75 \pm 0.28\%$, and rehydration time from 12.18 ± 0.05 minutes to 16.14 ± 0.05 minutes. Conversely, carbohydrate content decreased from $76.40 \pm 0.28\%$ to $68.02 \pm 0.93\%$, accompanied by a decline in hedonic quality scores and panelist preference levels regarding appearance, aroma, texture, and taste. Nevertheless, all treatments still met the quality requirements for instant noodles stipulated in SNI 3551:2018 and BPOM Regulation Number 26 of 2021. Therefore, African sharptooth catfish meat flour has the

potential to be used as a fortifying ingredient in rice flour-based instant noodles to enhance nutritional value while maintaining product organoleptic acceptability.

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