



ADDITION OF PETEK FISH (*LEIOGNATHUS SP.*) PROTEIN HYDROLYSATE TO DRY NOODLES

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Abstract

*Petek fish has a very high protein content, reaching 32 grams from 100 grams of fish weight. Making fish protein hydrolysate from petek fish can help add protein to food products. Food products that can be added with functional protein to increase and improve their protein content are dry noodles. The purpose of this study was to determine the effect of different concentrations of fish protein hydrolysate from petek fish on the protein content and organoleptic characteristics of dry noodles. The method used in the study was a Completely Randomized Design (CRD) with the addition of petek (*Leiognathus sp.*) fish protein hydrolysate to dry noodles consisting of several different concentrations, namely A1 (0%), A2 (2%), A3 (4%), and A4 (6%). The parameters to be observed in this study were protein content and organoleptic characteristics in each treatment. The results showed that Analysis of the protein content and organoleptic properties of dried noodles with the addition of fish protein hydrolysate showed significant differences between the different treatments. Treatment A1 was the best overall, while treatment A4 could be considered an alternative if increasing protein is a priority*

Keywords: Dry Noodles, Petek Fish, Protein Hydrolysate

1. Introduction

Indonesia is the world's largest archipelagic country, with over 17,000 islands located in the Indo-Pacific region. Indonesia is situated between the continents of Asia and Australia, flanked by the Pacific and Indian Oceans (Faradillah, 2023). The Indies provides Indonesia with vast maritime territory and the second-longest coastline in the world. This condition makes Indonesia known as a maritime nation. As a maritime nation, Indonesia has more sea waters than land. This has resulted in an abundance of natural resources, one of which is fish. This demonstrates Indonesia's enormous potential for exploiting marine resources, particularly in the fisheries sector (Hastuti et al., 2023). To derive significant benefits from fish resources, the ability to manage them wisely is essential to ensure sustainable benefits. However, to ensure sustainable utilization of this potential, proper management of marine resources, including value-added fishery products, is essential (Narwadan et al., 2024).

One development in the utilization of fish resources is fish protein hydrolyzate. Fish protein hydrolyzate is a processed product obtained from the enzymatic hydrolysis of fish protein into very simple peptides and amino acids that are easily absorbed by the body (Wenno et al., 2022). This process not only plays a role in increasing the solubility and digestibility of the protein, but is also effective in reducing the fishy odor that usually occurs. Furthermore, this process can increase the biological activity of the protein, including its antioxidant properties (Honrado et al., 2024). One type of fish that has great potential as a raw material for fish protein dihydrolysate is the petek fish (*Leiognathus sp.*).



The petek fish is a small pelagic fish commonly found in Indonesian waters and has not been fully utilized. However, it has a very high protein content, reaching 32 grams per 100 grams of fish. Petek fish also contains high levels of omega-3 fatty acids, such as EPA and DHA, which are known to be good for body health (Canti et al., 2020). Making fish protein hydrolysate from petek fish can help increase protein content in food products, as it has excellent emulsifying and water-binding properties. Therefore, fish protein hydrolysate is highly suitable for use as an additive in food products to increase protein content and improve nutritional value (Pires & Batista, 2013).

Dry noodles are a food product with significant potential for the addition of functional proteins to enhance their nutritional content. They are a popular food product but have a low protein content. Adding fish protein hydrolysate to dry noodles is expected to increase their protein content. Furthermore, the addition of fish protein hydrolysate is also expected to improve the noodles' organoleptic characteristics (Resti et al., 2024), because the addition of fish protein hydrolysate will certainly affect the physical properties and taste of the noodles. Therefore, a thorough examination is needed to obtain the correct amount of fish protein hydrolysate added to dry noodles, so that the noodles remain popular with consumers with increased protein content.

Several studies have shown that adding fish protein hydrolysate can increase the protein content and antioxidant activity of the product. Furthermore, adding fish protein hydrolysate also causes significant changes in the product's organoleptic properties, such as taste, aroma, texture, and color, which are important to ensure consumer satisfaction (Oprea et al., 2024), (Nemati et al., 2024), (Hadji et al., 2025). However, research on the addition of fish protein hydrolysate from petek fish to dry noodles has not been conducted, even though petek fish has a high protein content and special characteristics that make it a potential ingredient to improve the quality of dry noodles. Therefore, research is important to determine how the addition of fish protein hydrolysate from petek fish can affect the protein content and organoleptic characteristics of dry noodles. The purpose of this study was to determine the effect of different concentrations of fish protein hydrolysate from petek fish on the protein content and organoleptic characteristics of dry noodles

2. Methods

The fish protein hydrolysate production process, dry noodle production, and organoleptic testing were conducted at the Fishery Product Technology Laboratory, Faculty of Science and Technology, Ibrahimy University, Sukorejo Situbondo. Protein content testing was conducted at the PMP2KP Laboratory, Banyuwangi.

This study used a Completely Randomized Design (CRD) with the addition of petek fish (*Leiognathus* sp.) protein hydrolysate to the dry noodles at different concentrations: 0%, 2%, 4%, and 6%. The parameters observed in this study were protein content and organoleptic characteristics for each treatment. Table 3 presents the treatment design used by this researcher.

Table 1. Treatment design for making dry noodles with the addition of different fish protein hydrolysates

Treatment	Repetition		
	1	2	3
A1	A ₁₁	A ₁₂	A ₁₃
A2	A ₂₁	A ₂₂	A ₂₃
A3	A ₃₁	A ₃₂	A ₃₃
A4	A ₄₁	A ₄₂	A ₄₃

Description:

A1: addition of 0% fish protein hydrolysate

A2: addition of 2% fish protein hydrolysate

A3: addition of 4% fish protein hydrolysate

A4: addition of 6% fish protein hydrolysate

3. Results and Discussion

Protein Analysis

Analysis of the protein content of dry noodles with the addition of fish protein hydrolysate showed a significant difference between the different treatments. The results of the ANOVA (Analysis of Variance) test showed a significance value lower than 0.05, indicating that the addition of fish protein hydrolysate had a significant effect on the protein content of dry noodles. Next, a further Duncan Multiple Range Test (DMRT) was conducted. Table 2 presents the results of the test on the protein content of dry noodles with the addition of fish protein hydrolysate.

Table 2. Results of testing the protein content of dry noodles with the addition of fish protein hydrolysate

Treatment	Protein
A1	13,5933 ± 0,40278 ^a
A2	15,2000 ± 0,38175 ^b
A3	15,4533 ± 0,31214 ^b
A4	16,5933 ± 0,73112 ^c

Description: Numbers followed by different lowercase superscript letters in the same column indicate a significant difference ($p < 0.05$)

Based on the table above, it shows that treatment A1 (control) has the lowest protein content of $13.59 \pm 0.40\%$ and is significantly different from all other treatments. Treatments A2 ($15.20 \pm 0.38\%$) and A3 ($15.45 \pm 0.31\%$) are in the same group (marked with letter b), which means that increasing fish protein hydrolysate from 2% to 4% does not provide a significant difference in protein content. However, treatment A4 has the highest protein content of $16.59 \pm 0.73\%$ and is significantly different.

Based on the table above, it can be seen that the addition of fish protein hydrolysate effectively increases the protein content of dry noodles significantly, and there is a tendency to increase along with the increase in the concentration of fish protein hydrolysate (Resti et al., 2024). Thus, the higher the concentration of fish protein hydrolysate added to dry noodles, the greater the contribution of protein mass to the total composition of dry noodle products, so that the protein content of dry noodles increases significantly (Laishram et al., 2024) The addition of fish protein hydrolysate to pasta results in an increase in protein and changes in technical properties; the increase in protein content is directly related to the level of fortification (Khodaei et al., 2023).

Organoleptic Analysis

Organoleptic testing, also known as sensory testing or sensory testing, utilizes the five human senses as the primary means of measuring a consumer's level of liking or acceptance of a product. It involves the senses of touch, smell, sight, and taste to identify, differentiate, and compare product characteristics (Selvianti et al., 2024). Organoleptic testing can assist in evaluating the quality and innovation of food products by considering target consumer preferences. The sensory capabilities of this test are crucial for detecting

changes in quality, assessing the suitability of taste, odor, color, and texture, and predicting overall consumer acceptance (Rodrigues et al., 2024).

In this study, organoleptic analysis was conducted on dry noodle products with the addition of fish protein hydrolysate. Four treatments, each repeated three times, included treatment A1 as a control (without fish protein hydrolysate), treatment A2 with the addition of 2% fish protein hydrolysate, treatment A3 with the addition of 4% fish protein hydrolysate, and treatment A4 with the addition of 6% fish protein hydrolysate. Sensory parameters assessed included taste, aroma, color, and texture.

Organoleptic analysis (taste, odor, color, and texture) of dry noodles with the addition of fish protein hydrolysate showed that there were significant differences between different treatments. The results of the ANOVA (Analysis of Variance) test showed a significance value lower than 0.05, so that the addition of fish protein hydrolysate had a significant effect on organoleptic (taste, aroma, color, and texture). Next, a further test was carried out Duncan Multiple Range Test (DMRT). The following table 3. presents the results of the organoleptic analysis (taste, odor, color, and texture) of dry noodles with the addition of fish protein hydrolysate.

Table 3. Results of organoleptic analysis of dry noodles with the addition of fish protein hydrolysate

Treatment	Taste	Odor	Color	Texture
A1	4.07 ± 0.740 ^b	3.23 ± 0.774 ^b	3.97 ± 0.615 ^b	3.60 ± 0.814 ^c
A2	2.73 ± 1.015 ^a	2.63 ± 0.928 ^a	3.17 ± 0.791 ^a	2.87 ± 0.819 ^a
A3	2.73 ± 0.868 ^a	2.57 ± 0.568 ^a	2.70 ± 1.022 ^a	3.10 ± 0.960 ^{ab}
A4	3.10 ± 0.923 ^a	2.87 ± 0.860 ^{ab}	3.10 ± 1.423 ^a	3.37 ± 0.896 ^{bc}

Description: Numbers followed by different lowercase superscript letters in the same column indicate a significant difference ($p < 0.05$).

Based on table 3. above, for taste parameters, A1 (4.07^b) is significantly different from A2, A3, and A4. While A2 (2.73^a), A3 (2.73^a), A4 (3.10^a) are not significantly different from each other. For odor parameters, A1 (3.23^b) is significantly different higher than A2 (2.63^a) and A3 (2.57^a). While A4 (2.87^{ab}) is not significantly different from A1 or A2/A3. For color parameters, A1 (3.97^b) is significantly different higher than A2 (3.17^a), A3 (2.70^a), and A4 (3.10^a). While A2, A3, and A4 are not significantly different from each other. For texture parameters, A1 (3.60^c) was the highest, significantly different from all treatments. A4 (3.37^b) was higher than A2 (2.87^a), and significantly different. A3 (3.10^{ab}) was in the middle, not significantly different from A2 or A4.

- a. Taste, the organoleptic test results showed that the highest taste parameters were obtained in the control treatment, which did not include fish protein hydrolysate. This indicates that the panelists accepted this treatment well. This is thought to be due to the absence of the characteristic fishy taste or aroma that could affect the taste of the noodles. Furthermore, the fishy odor typically associated with fish protein, which was less favored by the panelists, may have been the reason why the taste scores for the noodles with the addition of fish protein hydrolysate decreased. The results of the organoleptic (taste) analysis can be seen in Figure 1.

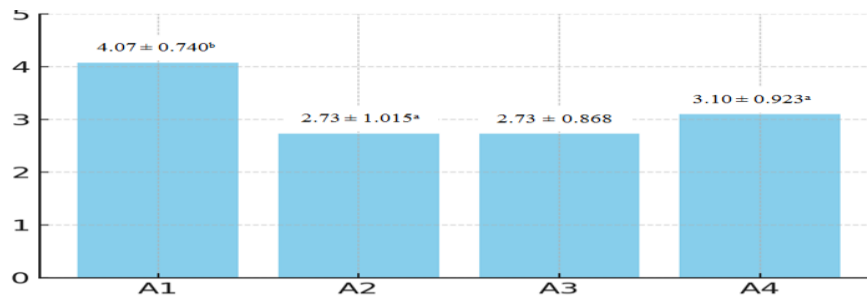


Figure 1. Graph of organoleptic analysis results (taste)

Previous studies have shown that noodle products without fish protein additives have better flavor and aroma than those containing fish protein. Therefore, while fortification with fish protein can enhance nutritional value, sensory quality must be maintained for consumer acceptance (Rachmawati & Wening, 2023).

When fish protein hydrolysate of 2% (A2), 4% (A3), and 6% (A4) was added, the taste score decreased from 2.73 to 3.10. The increase in the intensity of the savory taste and distinctive aroma resulting from the fish protein hydrolysis process, together with the increase in the level of fish protein hydrolysate in the noodles, is thought to have caused a decrease in interest among panelists, especially children. This indicates that although the addition of fish protein hydrolysate can increase the nutritional content, the sensory characteristics (taste) change and experience a decrease in panelist acceptance with increasing addition of protein hydrolysate to the noodles. Therefore, to ensure that the product remains acceptable to customers, it is important to consider this (Fitriani, 2019).

- b. Odor, the results of the organoleptic test showed that the odor parameters in the control treatment (A1), the average odor score reached the highest result, namely 3.23 ± 0.774 . In contrast, treatments with the addition of fish protein hydrolysate (A2 to A4) showed a decrease in odor scores between 2.57 and 2.87. The results of the organoleptic (odor) analysis can be seen in Figure 2.



Figure 2. Graph of organoleptic analysis results (odor)

Based on Figure 2. above shows a tendency to decrease in odor parameters, this decrease is estimated to be caused by the odor of fish originating from the hydrolysis of fish protein which is not always well received by all panelists. The formation of unstable compounds such as aldehydes and ketones that occur during the process of fish protein hydrolysis is usually responsible for the strong odor (Bu et al., 2021). The addition of fish

protein hydrolysate to noodle products can increase the intensity of specific odors along with the increase in the levels of fish protein hydrolysate, which has an impact on the sensory acceptance of the product (Laishram et al., 2024), (Ardila et al., 2025).

- c. Color, the organoleptic (color) analysis results also showed a tendency for panelists to decrease their preference for dry noodles with added fish protein hydrolysate. This can be seen in the following organoleptic (color) analysis graph.

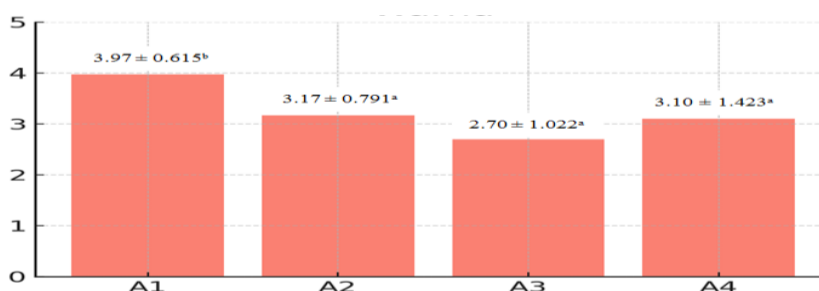


Figure 3. Graph of organoleptic analysis results (color)

Based on the graphic image above, the color parameters show that the control treatment without the addition of fish protein hydrolysate (A1) has the highest organoleptic (color) score. This may be because the color of the noodles remains bright without the effect of the pigment of the fish protein hydrolysate. The addition of fish protein hydrolysate in treatments A2 to A4 causes the color to become darker or yellowish. This is thought to be caused by the Maillard reaction between the free amino acid groups of the protein and the reduced sugars during the drying process at high temperatures, around 100 °C. This reaction results in the formation of melanoidin compounds, which give a yellowish brown color to the product, which changes the color of the noodles compared to the control (Adam Prayudhi, 2022). The addition of rebon shrimp protein hydrolysate causes the noodles to become darker due to the non-enzymatic browning reaction that occurs during the processing process (Purba et al., 2020).

- d. Texture, the results of the organoleptic (texture) analysis of dry noodles that received the treatment of fish protein hydrolysate addition, in treatment A2 there was a decrease in panelists' preferences compared to treatment A1 (without the addition of fish protein hydrolysate), but in treatments A3 and A4 there was an increase in panelists' preferences again, this is as seen in the following graph.

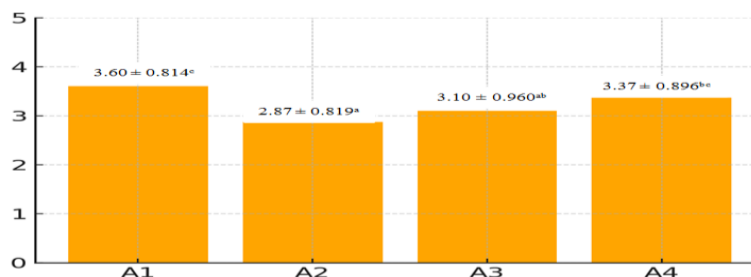


Figure 4. Graph of organoleptic analysis results (texture)

The figure above shows that for texture parameters, A1 received the highest score, but the difference in score with A4 was relatively small. This indicates that the addition of high amounts of fish protein hydrolysate did not significantly affect the noodle's elasticity. Instead, the interaction of the added protein with gluten may affect the noodle's elasticity (Nogueira et al., 2020).

Determining the Best Treatment

The De Garmo method is a variation of the weighted summation approach, facilitating the quantitative and structured evaluation of various criteria such as protein, taste, aroma, color, and texture in dried noodles. To generate an effective score, each parameter is weighted according to its importance. Next, the normalized score for each treatment is multiplied by that weight. The alternative with the highest score is considered to have the best performance. The results of the De Garmo method are shown in Table 4.

Table 4. Results of the analysis of determining the best treatment using the de garmo method

Parameter	Bobot	Treatment							
		A1		A2		A3		A4	
		NE	NP	NE	NP	NE	NP	NE	NP
Protein	0,33	0,00	0,00	0,54	0,18	0,62	0,21	1,00	0,33
Color	0,07	1,00	0,07	0,37	0,02	0,00	0,00	0,31	0,02
Odor	0,13	1,00	0,13	0,09	0,01	0,00	0,00	0,45	0,06
Taste	0,27	1,00	0,27	0,00	0,00	0,00	0,00	0,28	0,07
Texture	0,20	1,46	0,29	0,00	0,00	0,46	0,09	1,00	0,20
Total	1,00		0,76		0,22		0,30		0,69

The table above shows that the best treatment was A1 (without the addition of fish protein hydrolysate). A1's superiority was primarily due to its consistently higher organoleptic scores (taste, odor, color, and texture). Although A1 had the lowest protein content, its substantial organoleptic weighting resulted in its final score being higher than the other treatments. Meanwhile, A4 had the highest protein content (16.59%) and still had a fairly good organoleptic score, thus ranking second. This demonstrates the trade-off: high-protein treatments are not always the best treatment if the organoleptic aspects are less favorable. Previous studies have shown that the addition of fish protein hydrolysate actually increases nutritional content but often reduces sensory quality, particularly taste and aroma (Khodaei et al., 2023). Therefore, A1 was the best overall treatment, while A4 can be considered as an alternative if increasing protein is a priority.

4. Conclusion

Analysis of the protein content and organoleptic properties of dried noodles with the addition of fish protein hydrolysate showed significant differences between the different treatments. Treatment A1 was the best overall, while treatment A4 could be considered an alternative if increasing protein is a priority.

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