

FORTIFICATION OF PROTEIN HYDROLYZATE OF MUJAIR FISH (*Tilapia mossambica*) IN EYEK-ENYEK (*Cassava crackers*)

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ABSTRACT

Indonesia has abundant types of crops and fisheries, which can be further processed as alternative daily foods. Considering that fact, this study aims to determine the best-enriched formula for tilapia fish using an analysis of chemical and organoleptic characteristics. The research was carried out at the Chemical Laboratory of Pakuan University, Bogor from March to May 2021. The method used was an experimental method with six additional treatments of tilapia protein hydrolyzate, namely 0%, 2.5%, 5%, 7.5%, 10%, and 12.5% with 20 semi-trained panelists as replicates. The observed variables consisted of the hydrolyzed protein yield of African catfish, the panelists' preference for the color, texture, and taste of geeks, and a proximate test on water content, ash content, and insoluble ash in acids, proteins, fats, and carbohydrates. The level of liking was calculated by Friedman Tet, which followed by Bayes Test to find out the best formula with the addition of tilapia fish protein hydrolyzate. In conclusion, the result from the test showed that the addition of tilapia protein hydrolyzate in the research was still considered favorable, but the preferred treatment was the addition of 5% tilapia protein hydrolyzate.

Keywords: Fortification, Fish Protein Hydrolyzate, Enyek-enyek

1. INTRODUCTION

Indonesia's abundant natural wealth can produce many types of crops, including cassava. Cassava (*Manihot esculenta*), also known as a wood tuber, is an annual food plant of euphorbiaceae in tropical and subtropical climates. According to Wahyuni [1], cassava is a carbohydrate-producing plant. In addition, the leaves are widely used for vegetables. According to the Central Statistics Agency [2], Indonesia produced 21.8 million tons of cassava in 2015.

Meanwhile, the abundance of low economic-value fishery products has not been used optimally in Indonesia, even though the production of low economic-value fish such as tembang, petek, and mujair are high in numbers. According to the Central Statistics Agency [2], From West Java province, Indonesia produced 1.17 to 1.37 million tons of mujair fish respectively from 2017 to 2019. Despite the low economic value, the fishes are quite potential given the

protein, as well as the high and complete essential amino acids contained.

On the other hand, enyek-enyek, which is a traditional snack food is commonly found in West Java. According to Koswara [3], enyek-enyek is made by grating, seasoning, molding, and steaming peeled cassava until gelatinization occurs. In another study [4] shows that even though enyek-enyek contains a nutritional characteristic, it is mainly dominated by carbohydrates. Hence, further research is needed to improve the protein deficiency, one of which can be done by combining the commodity with protein hydrolyzate tilapia (*Tilapia mossambica*), which can be obtained from fish that have a low economic value yet has relatively fast growth and strong environmental resistance.

This study consists of several stages: (i) the manufacture of protein hydrolysates from tilapia fish material; (ii) the process of making enyek-enyek (cassava crackers) with some variation of protein

hydrolysates from the first stage; (iii) organoleptic testing to determine the most preferred formula; and finally (iv) quality testing.

2. METHODS

The materials used in the manufacture of cassava crackers are cassava flour, tilapia fish protein hydrolyzate, water, baking powder, and seasoning. In addition, enzyme papain, as well as some chemicals including n-hexane, 40% NaOH, concentrated sulfuric acid, selenium, boric acid, 0.1 N hydrochloric acid, methyl red, and bromine creosol green indicator with PA specification.

In this research, the experimental method used to determine the preference level for enyek-enyek formulation, followed by the non-parametric statistical method Friedman's test consisting of 20 semi-trained panelists as replicates with six treatments, where some of the treatments are being mixed with tilapia protein hydrolyzate, with a percentage of: 0%; 2.5%; 5%; 7.5%; 10%; and 12.5%. The observations included organoleptic (taste and colour) and chemical tests (moisture, ash, protein, fat, and carbohydrate content) to select the most preferred enyek-enyek.

Organoleptic testing of preference level for color, aroma, texture, and taste is conducted, followed by Bayes test to determine the best decision-making analysis from several alternatives or treatments, considering the mentioned criteria. Following that, the panelists test chemical parameters are conducted to measure the water, protein, and carbohydrate content of the selected mix, before comparing them with the value of the Indonesian National Standard (SNI).

3. RESULTS AND DISCUSSION

3.1 Fish Protein Hydrolyzate Yield

In this study 5% papain enzyme concentration was used in the protein hydrolyzate of mujair and produced 1.3% yield of fish protein hydrolyzate. The dissolved nutritional components such as fat, protein, and minerals during the hydrolysis process affected the yield of the hydrolysate product.

3.2 Organoleptic Test

3.2.1 Colour

The results of the Friedman color parameter test showed that there was a significant difference in the color of the tilapia hydrolyzate with the addition of tilapia hydrolyzate, the level of preference for the color of tilapia with the addition of tilapia protein hydrolyzate on the addition of 0% protein hydrolyzate with a brownish color with an uneven appearance and an average value of 7.2 or preferably, in the 2.5%-5% treatment the addition of the protein hydrolyzate was brownish in color and the appearance was uneven and the average value was 7.0-7.1 or preferred, in the 7.5-10% treatment the addition.

3.2.2 Texture

The results of the Friedman test for texture parameters showed that there was a significant difference in the texture of the sensation with the addition of tilapia hydrolyzate, the protein hydrolyzate addition treatment of 0%-7.5% had a crunchy texture with an average value of 6.2-7.2 with the criteria favored so that it was not significantly different because the texture is still crunchy, the 10%-12.5% protein hydrolyzate addition treatment has a less crunchy texture with an average value of 4.2-5.3 with the criteria of not liking it so that it is significantly different because the texture is less crunchy.

The texture of the taste buds is getting less crunchy along with the increase in protein hydrolyzate of tilapia, this is reinforced by research [4] that the addition of protein has an effect on the crispness of the product, because in the gelatinization process the starch is reduced due to the reaction of protein with sugar so that the crunch becomes reduced as water becomes less bound to starch granules.

Table 1. Average Texture of Enyek-enyek Based on Addition of Mujair Fish Protein Hydrolyzate

Treatment	Median	Average Texture
0%	7	6.9 a
2.5%	7	7.1 a
5%	7	7.2 ab
7.5%	6	6.2 bc
10%	5	5.3 d
12.5%	4	4.2 e

3.2.3 Smell

The results of the Friedman test for aroma parameters showed no significant difference to the aroma of nutmeg with the addition of tilapia hydrolyzate. In the addition of 0-12% tilapia protein hydrolyzate treatment, it has a distinctive aroma of cassava combined with salty tilapia protein so that the resulting aroma becomes neutral with an average value of 6.4-7.2 on the preferred criteria.

Table 2. Average Aroma of Enyek-enyek Based on Addition of Mujair Fish Protein Hydrolyzate

Treatment	median	Average Aroma
0%	7	6.8 a
2.5%	7	6.8 a
5%	7	7.2 a
7.5%	6	6.3 a
10%	7	6.3 a
12.5%	6	6.4 a

3.2.4 Flavor

The results of the Friedman test for taste parameters, there was a significant difference in the taste of nagging with the addition of tilapia hydrolyzate, in the treatment the addition of 0% mujair protein hydrolyzate had a significant difference with the treatment of 7.5%-12.5% or gave an influence on the taste with an average value 4.1-5.4 on the criteria somewhat disliked, the addition of 2.5%-5% has a good taste with an average value of 6.7-7.7 on the criteria favored.

In the organoleptic test, the taste parameters with the addition of 2.5%-5% tilapia protein hydrolyzate showed an increase in taste when compared to no additional treatment, but the feeling of tingling decreased along with the increase in the amount of tilapia protein hydrolyzate in the 7.5%-12 treatment. .5% because the more protein hydrolyzate added, the taste becomes saltier.

Protein hydrolysates generally have short-chain peptides that make the taste bitter [5], while the content of tilapia protein hydrolyzate added to these enzymes makes the taste savory. According to [6], the amino acid glutamate which makes the taste sweet, delicious results from protein denaturation during the

heating process. According to [5] the results of enrichment with protein hydrolyzate using the papain enzyme during hydrolysis will have a salty taste so that it is carried into the enrichment product.

Table 3. Average Taste of Gastronomy Based on Addition of Mujair Fish Protein Hydrolyzate

Treatment	median	Average Taste
0%	7	6.7 a
2.5%	7	6.9 ab
5%	7	7.7 b
7.5%	6	5.4 c
10%	5	4.5 de
12.5%	4	4.1 e

The same letter indicates that the treatment is not significantly different, and the different letter indicates that the treatment causes a significant difference.

3.3 Decision Making Using Bayes Method

The best decision-making process is carried out using the Bayes method. In making decisions, information in the form of probabilities is needed for each alternative that exists in the problem at hand and will produce an expected value as the basis for decision making. Based on calculations using the Bayes method, it was found that the results of the addition of 5% tilapia protein hydrolyzate (treatment C) obtained the highest alternative value compared to other treatments, namely with a value of 7.27 based on the organoleptic parameters observed, fortification of tilapia protein hydrolyzate 5 % is the preferred treatment by the panelists compared to other treatments.

Table 4. Assessment Decision Matrix with Bayes Method

Treatment	Criteria				Alternative value	Priority value
	Color	Aroma	Texture	Flavor		
0%	7.20	6.77	6.90	6.67	6.88	0.19
2.5%	7.00	6.83	7.10	6.88	6.95	0.19
5%	7.10	7.12	7.18	7.72	7.27	0.20
7.5%	5.47	6.30	6.23	5.40	5.87	0.16
10%	5.29	6.38	5.27	4.45	5.38	0.14
12.5%	4.32	6.38	4.22	4.05	4.78	0.13
Criteria Weight	0.25	0.27	0.25	0.24	37.13	1.00

3.4 Proximate Analysis

3.4.1 Moisture Content

Water is the main component in foodstuffs that can affect the taste, appearance of color and texture of food, water content testing aims to determine changes in water content with the addition of fish hydrolyzate protein mujair, besides that water also greatly affects the growth of microorganisms so that it is related to the durability of the processed products.

Based on the results of the proximate analysis, the most preferred treatment or formula C with the addition of 5% protein hydrolyzate tilapia has a water content of 6.07%. Based on the quality standard of crackers with the addition of protein hydrolyzate (SNI 8272-2016), it is stated that the maximum water content in crackers is 12%, meaning that the water content of enyek-enyek is still below the maximum limit and in accordance with SNI for crackers with the addition of fish protein, the water content of the hydrolyzed tilapia protein itself contains 5.65% water.

3.4.2 Protein Content

Protein is one of the most important chemical parameters in the pain, the results of the analysis of proximate protein levels with the most preferred treatment or formula C with the addition of 5% tilapia protein hydrolyzate has a protein content of 6.2%, based on the quality standard of crackers with added protein [8] the minimum protein content in crackers is at least 12% grade I, at least 8% grade II and at least 5% grade III, meaning that the protein content of the crackers is in accordance with the quality standard of grade III crackers with a minimum protein of 5%, the presence of the addition of mujair protein hydrolyzate can increase the protein content in enyek-enyek.

The increase in protein content in nymphs is due to the addition of protein derived from tilapia protein hydrolyzate as a source of animal protein, so that the addition of fish protein hydrolyzate can increase protein content, the increase in protein content is related to the proportion of protein hydrolyzate added [7], The protein content of mujair protein hydrolyzate itself is 59.85%.

3.4.3 Fat Content

The results of the proximate analysis of the fat content of the most preferred tilapia with 5% mujair protein hydrolyzate was 0.83%, while the fat content of tilapia without the addition of mujair protein was 0.75%. Based on these data, the more addition of tilapia

fish protein hydrolyzate, the fat content contained will increase, the fat content comes from the fat content of the tilapia fish protein hydrolyzate so that it slightly affects the fat content and causes the fat content to increase. The fat content of tilapia fish protein hydrolyzate itself is 2.3%.

3.4.4 Total Ash Content and Acid Insoluble Ash

The results of the analysis of tilapia treated with 5% mujair protein hydrolyzate showed an ash content of 1.93% and an acid insoluble ash content of 0.17%. acid insoluble ash is 0.14%, based on the quality standard of crackers with the addition of protein hydrolyzate [8] the maximum limit of acid insoluble ash content in crackers is 0.2% meaning that the acid insoluble ash content of enyek-enyek is still below the limit maximum and in accordance with the quality standards of crackers with the addition of protein, the increase in ash content was due to the addition of tilapia protein hydrolyzate to the nymphs.

3.4.5 Carbohydrate Content

The carbohydrate content of tilapia resulted in a reduction in the amount of protein, water, ash and fat, the results of the analysis showed that the most preferred addition of tilapia protein hydrolyzate 5% had a carbohydrate content of 85.11%, while the carbohydrate content of tilapia without protein hydrolyzate was the most preferred. tilapia fish is 88.2%.

4. CONCLUSION

The research Fortification of Mujair Fish Protein Hydrolyzate (*Tilapia mosambica*) on Enyek-enyek (Cassava crakes) concludes that the amount of tilapia protein hydrolyzate in most treatments are still considered, with the most preferred treatment is the addition of 5% tilapia fish protein hydrolyzate with a preference value of appearance, texture, taste, and aroma of 7 (preferred) and proximate test result.

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