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Utilization of hampal (*Hampala macrolepidota* Kuhl & van Hasselt, 1823) meat on fish crackers preference level

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ABSTRACT

The purpose of this research was to found out the percentage of hampal meat addition on crackers preferred by panelists based on organoleptic, physic, and chemic. The research was carried out at the fisheries Product Processing Laboratory, Faculty of Fisheries and Marine Sciences, Padjadjaran University, and Food Technology Laboratory, Faculty of Engineering, Pasundan University, from March 2019. The research method used was an experimental method with the addition of hampal meat by 0%, 25%, 50% and 75% based on the amount of tapioca flour. Observations were made on the level of preference which included appearance, smell, texture and taste by semi-trained panelists, test of efflorescence, water content and protein content in hampal crackers. The results showed that the addition of 50% hampal meatwas the treatment preferred by panelists compared to other treatments with an average value of 7.6, smell 7.7, texture 8.3, and taste 8, moisture content 4.79% and proteint content of 10.78%.

***Keywords*:** crackers, hampal fish, level of preference, protein source, *Hampala macrolepidota*

1. INTRODUCTION

An empty hampal fish is a wide spread of fish. This type of fish has an area of irrigation or distribution of freshwater, Indo-Australian, Archipelago namely Sumatra, Java, Kalimantan, Malaysia, Thailand, and Indochina.

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The meat of the hampal fish has a lot of thorns but high protein (19.31%) And good calories for growth. The fish also has an essential amino acid that when consumed by humans can trigger the activity of hormones and glands, such as the serotonin hormone and the pineal gland, have levels of phosphorus and Omega 3. Based on this, the hampal fish can be used as a source of protein in the processed, one of which is crackers.

The development of diversification of local products will increase food security, availability of food variation, nutritional response and Economic community. Diversification of products is one way to increase the volume of sales that can be done by the company especially if the company has been in the maturity stage. Diversification is a growth strategy of the company by starting a new business or buying a company.

Diversification of the hampal fish products can be in the form of meatballs, nuggets, sausage even crackers. Fish crackers are processed made from a mixture of fish meat, starch and water. Indonesian people have long known crackers as a small food ingredient. This type of food is commonly consumed as a food that can stir up appetite or simply be consumed as a snack. Crackers are known for both age and community level. Crackers are easily acquired in a place, both in the hotel restaurant. Efforts in this field of crackers are able to increase public income. Considering the crackers are cheap and familiar with the tongue of the people of Indonesia. It is not surprising if the business in the field of crackers has enough bright prospects.

According to Indonesian industry standard 0272-90 (1990), crackers are defined as products that have dry, mild porous properties, which are made from tapioca flour dough. Crackers containing high carbohydrate, but low in protein, then need to be added hampal fish meat as a source of protein. The selection of fish used must have a strong flavor smell so as to increase the taste of fish crackers. Organoleptic test, also known as sensing measurement, is a test or assessment conducted with the organ of the human senses consisting of vision, smell, taste or flavor and the test is subjective as everyone has Different assessments. Hampal fish (Hampala macrolepidota) has a nutritional composition of fish namely water content of 71.15%, ash 2.21%, 19.31% protein, fat 6.86% and carbohydrate 0.47%.

2. MATERIALS AND METHODS

2. 1. Tools and research materials

The equipments used in the process of making fish crackers are: basin, filet knife, cutting board, Food Prosecor, digital scales, wok, boiler/pan, and stove. The tools used in organoleptic and proximate testing are as follows: Tools for organoleptic test, which are plates as sample serving, assessment sheets and stationery.

Tools for chemical test (water content, protein and fat), namely glassware (Erlenmeyer, Burette, volumetric pipette, pipette drops, pumpkin measure etc.), volumetric measuring instruments, blender, aluminum Cup, desicator, destructor, condenser, pumpkin Kjeldahl, mortar, Analytical balance, oven and electric heater. The raw materials used are fresh fish from Jatigede reservoir, if the raw material used is less good in its freshness will affect the flavor, appearance and smell of the product is produced crackers.

The research was conducted in March 2019 at the Fishery Production Processing laboratory of the Faculty of Fisheries and Marine Sciences of Padjadjaran University, and test proximate conducted in the Faculty of Food Technology Laboratory, Pasundan University. An empty fish crackers formulation is presented in Table 1.

Table 1. Empty Fish Crackers Based on the Weight of Tapioca Flour.

No.	Materials	Treatment			
		A	B	C	D
1.	Tapioca Flour	300 g	300 g	300 g	300 g
2.	Hampal Meat	0 g	125 g	250 g	375 g
3.	Egg	2 grain	2 grain	2 grain	2 grain
4.	Salt	12 g	12 g	12 g	12 g
5.	Sugar	20 g	20 g	20 g	20 g
6.	Backing Soda	6 g	6 g	6 g	6 g

The percentage of fish meat use in the manufacture of fish crackers based on the weight of tapioca flour with the following treatment:

1. Treatment A: Without replenishment of fish hampal meat 0%
2. Treatment B: Extra fish hampal meat replenishment 25%
3. Treatment C: Increase in fish hampal meat (50%)
4. Treatment D: Replenishment of fish hampal meat 75%

Panelists in this study are students of the Faculty of Fisheries and Marine Sciences Universitas Padjadjaran who have known and have experience in organoleptic testing.

The process of making crackers through several stages namely the preparation stage, the implementation stage, and the completion stage:

Preparation phase

Prepare all the tools, basic materials and additional materials needed in the manufacture of fish crackers, weighing the ingredients needed in the manufacture of crackers, making the fish filet hollow by separating the fish meat from the head, skin, bones, and Contents of the stomach, and the next empty fish filet in pulverized with Food procesor

Implementation stage

The stage of implementation in the manufacture of hampal fish crackers include mixing, blending, cooling, forming, drying and frying.

Completion stage

Fish crackers that have been printed then dried can be directly fried using oil that has been hot until the cracker expands and matures.

2. 2. Observed parameters

Observations made to fish crackers in research are organoleptic, physical, and chemical. Organoleptic parameters include the appearance, smell, flavor and texture of fish crackers. Organoleptic testing is done with hedonic test (favorite test). Physical parameters include the efficacy of fish crackers. The observed chemical parameters are moisture content, and the fish crackers protein is most preferred panelist.

2. 3. Yield Filet and Yield Crackers

The filet's low test is done to determine the initial weight of the fish. The filet is placed on top of the calibrating scale, then observe the weight of both different conditions of the whole fish and the filet meat. The results shown on the digital scales are calculated using the percentage of the filet's yield formula. In the case of crackers, the test is important to be known in order to avoid wrong in calculating the selling price. The formula of the lesser Filet percentage and the yield Crackers are as follows:

$$\text{Yield Filet} = \frac{\text{Heavy Filet}}{\text{Heavy Fish}} x\ 100\%$$

$$\text{Yield Crackers} = \frac{\text{Heavy Raw Crackers}}{\text{Heavy Dough}}\ x\ 100\%$$

2. 4. Hedonic test (favorite test)

This test aims to identify the panelist's response to crackers based on organoleptic characteristics that include the appearance, smell, flavor and texture. Based on its favorite level, organoleptic test is done with 20 semi-trained panelists the favorite level of panelist is used in range from 1 to 9, namely:

- 1 = very dislikes
- 3 = Do not like
- 5 = neutral/Ordinary
- 7 = Likes
- 9 = very fond

The rejection limit for this product is if the product is tested to acquire a value of ≥ 5 then the product is stated to be accepted by panelist.

2. 5. The Florescence test

The efficacy of crackers is measured by comparing the circumference of raw crackers with the crackers that have been fried. How to measure the florescence of crackers is to complete the measuring instrument in the form of yarn with ruler. Raw crackers are measured by using yarn. Next, measure back around the rice crackers after frying to find out the magnitude of the crackers. Percentage of the florescence is calculated by formula:

$$\text{Florescence} = \frac{\text{The circumference of ripe crackers} - \text{Roving Raw Crackers}}{\text{Roving Raw Crackers}} x100\%$$

2. 6. Proximate Testing

A) Moisture content

The principle of water content analysis is the process of evaporation of water from a material by heating. Water content is determined by the formula:

$$\text{Moisture Content (\%)} = \frac{\text{BI}-\text{B2}}{\text{B}} x100\%$$

Description:

B = weight of sample (g)
B1 = weight (sample + cup) before drying (g)
B2 = weight (sample + cup) after drying (g)

B) Protein levels

The principle of analysis of protein levels and total Nitogen is the release of nitrogen from proteins in materials using sulfuric acid with heating. Determination of total nitrogen and protein levels using micro-Kjeldahl method. The protein levels are determined as follows:

$$Protein = \frac{(\text{VA} - \text{VB})\text{HCl X N HCl X 14,007MX 6,25}}{W\ X\ 1000} x100\%$$

Description:

VA = ml HCl for sample titration
VB = ml HCl for Blanko titration
N = Standard HCl normality used
14.007 = Nitrogen Atom weight
6.25 = Protein – nitrogen conversion factor for fish and Sampingnyai products
W = Sample weight (gram)

2. 7. Data Analysis

Data on chemical measurement (moisture content and protein levels) is the most liked crackers compared with the value of Indonesian national standard (SNI) for crackers. Non parametric analysis is performed for organoleptic testing using a two-way analysis of Friedman test variant with a Chi-squared test. The statistics used in Friedman's trials are defined with the following formula.

$$X^2 = \frac{12}{nk\ (nk+1)} \sum_{i=1}^{t} \frac{(Rj)^2}{\text{n}} - 3\ (\text{nk} + 1)$$

Description:

X^2 = Friedman Test statistics
n = Replay
k = Treatment
$(Rj)^2$ = Total ranking of each treatment

If there is the same number done calculation factor of the Coection (FK) with the formula as follows:

$$FK = 1 - \frac{\sum T}{(nk^3) - (nk)} X^2 = \frac{X^2 1}{FK}$$

Significant value of an observation price of X2 can be noted using price – a critical price with DB = K – 1; A = 0.05

The rules of the decision to test the hypothesis are:

X2 0 = The treatment does not give a real level A = 0.05

X2 1 = The treatment gives a noticeable difference to the level A = 0.05

If the price is X2 < X2 (α (k-1)), then X2 0 is accepted and X2 1 is rejected, and if the X2 > X2 (α (k-1)), then X2 0 is rejected and X2 1 is received. If X2 1 is received, the treatment gives a noticeable difference and the test continues to know the median value is not equal or to know the difference between treatment using multiple comparison test (Multiple Comparson) with formula as follows:

$$[R_i - R_j] \leq Z[\frac{\alpha}{k(k-1)}] \frac{\sqrt{nk\ (k+1)}}{6}$$

Description:

[Ri – Rj] = difference in number of each treatment
Ri = Average rating from the to-I sample
Rj = Average rating from the J sample
Z = value on Z factor for multiple comparison
α = Wise Error Experiment
n = lots of data/replay
k = the amount of treatment

3. RESULTS AND DISCUSSION

3. 1. The Lowfish Filet

The yield is the percentage of the main raw material that becomes the final product or a comparison of the final product with the main raw material. The fish used this study as much as 8 tails weighing 2.48 kg then the fish in the filet, separated from the bones, skin, head, and stomach contents.

The fish meat produced weighs 1.24 kg so the yield of the Hampal fish filet is produced by 50.3%. The empty fish yield is more than 50% because of the vacuum used by many and the filet process is done well so that the rest of the flesh sticking to the bones is not much. In foodstuffs, the higher the yield value is generated, the more economical the food material.

Based on the usage of the fish, the filet's yield is 81,73%, so from 750 g of raw materials can be obtained a fish cracker in the total of 613 grams.

3. 2. Hedonic Test (favorite test)

A. The Appearance

The rating is aimed at knowing the acceptance of panelists assessed from the appearance of the shape and color of the fish crackers. The observation of the Hampal fish crackers is presented in Table 2.

Tabel 2. Average of Hampal Fish Crackers.

Concentrations of Hampal fish meat (%)	Median	Average
0	5	5,3 a
25	5	5,7 a
50	7	7,6 c
75	7	7,4 c

Description: The average number of treatments followed by the same letter Show no real difference according to comparison test 5% level.

Based on the results of statistical tests on the appearance of crackers, the treatment without the addition of empty fish meat is distinct from the addition of the fish meat with a concentration of 50%. Based on the results of the research of panelists on the Hampal fish crackers, the average value of the pan ranged from 5.3 to 7.6 with median values ranging between 5 (neutral/Ordinary) and 7 (likes). The crackers produced from all the treatment have a homogeneous shape that has a circular shape though not a perfect circle and the edges are wavy. The resulting color of each treatment has a homogeneous color, 0% concentration is white, 25% of the concentration is white cream, the concentration is 50% yellowish white, and the concentration is 75% brownish yellow. The color difference of crackers on each treatment is caused by the protein content contained in the fish and sugar, so that when the process of warming will occur Maillard reaction. The addition of empty fish meat gives a constriction of brownish yellow color to the fish crackers. The more concentration of the empty fish meat is added, it will greatly affect the color of the crackers produced.

The appearance of crackers with the addition of empty fish meat as much as 50% has the highest average of 7.6 that produces a fish crackers with a yellowish white color. The appearance of crackers without the addition of an empty fish has the lowest average value of 5.3 that produces crackers with a white colour tone of bones. Along with the amount of extra fish meat added as much as 0%, 25%, 50% and 75% with the average value of the highest, there is a 50% treatment of 7.6 which produces the crackers with the yellowish white color most liked panelist. Every treatment is liked panelist but the concentration of 50% is the most liked panelist because it has an interesting color that is yellowish white.

Color factors determine the valuation of food ingredients before the factors – other factors are considered visually. The color acceptance of a different material varies depending on the natural, geographical, and social aspects of the recipient's community. Colours can also be used

as an indicator of freshness or maturity. Maillard reaction is a reaction that occurs between carbohydrates in particular the reducing sugar with the primary amino acid group contained in the material so that it will produce a brown colored material called called. Maillard reaction is strongly influenced by moisture content, pH, temperature, and the type of sugar that plays. This reaction is required on certain foodstuffs to obtain certain colors, smell and flavors. The color of the product will affect the consumer's efficacy and acceptance of foodstuffs.

The appearance of crackers without the addition of extra fish and meat treatment in addition to each treatment is served in Figure 1.

Figure 1. An appearance of the empty fish crackers every treatment from left to right with concentrations of 0%, 25%, 50% and 75%

B. Smell

The smell assessment aims to determine the evaluation of panelists assessed from the smell of an empty fish cracker. Observations of the smell of the fish crackers are presented in Table 3.

Table 3. Average smell of fish crackers.

Concentrations of Hampal fish meat (%)	Median	Average smell
0	5	5,5 a
25	6	6,1 a
50	8	7,7 b
75	7	6,9 a

Description: The average number of treatments followed by the same letter Show no real difference according to comparison test 5% level.

Based on the results of statistical tests on the smell of crackers, treatment without adding fish meat or 0%, 25% and 75% differ in real with the addition of fish in the meat with a concentration of 50%. Based on the results of the panelist's assessment of the vacual fish crackers, the scent average value ranged from 5.5 to 7.7 with median values ranging between 5 (neutral/Ordinary), 6 (likes), 7 (likes) and 9 (very fond). The smell of crackers with the addition of the fish meat as much as 50% is the highest average value of 7.7 that produces a fish crackers with a distinctive smell of fish is strong enough. The smell of crackers without the addition of an empty fish has the lowest average value of 5.5 that produces crackers with a distinctive scent and even tends to be neutral. Addition of fish meat is empty. From the addition of fish meat, 0%, 25%, 50% and 75% average value-the highest average in the treatment of 50% ie 7.7 that produce crackers with a distinctive smell of fish is quite strong the most liked panelist.

The higher the addition of the meat of fish in the crackers then the smell of fish crackers increasingly stronger. At 25% treatment there is little special smell of fish and for the treatment of 75% have a fish smell that is quite strong and tends to smell fishy. The smell produced by each treatment is liked by panelists but the smell of the most well-loved fish crackers is at 50% concentration with the smell of fish. Sensory test with smell attribute is shown to know the favorite level of panelist on the smell of crackers with the addition of empty fish meat. The addition of fish meat treatment affects the smell of fish crackers[24]. Smell is one of the flavors of food ingredients that many determine the delicacy of the food ingredient. There is a noticeable difference in the addition of fish meat in the fish crackers with 5 additional treatment of fish meat in tapioca flour by comparison 0:1; 1:1; 1.5:1; 2:1; 2.5:1.

The more fish levels are added in tapioca flour on the manufacture of fish crackers then the smell rate in the crackers will increase. The results of Firlianty Research (2009) also showed a noticeable difference in the addition of shrimp waste in the manufacture of fish crackers. The more concentration of shrimp head waste is added in crackers, the more powerful the smell will be. The smell of empty fish crackers comes from the raw material of the vacuum that decomposes in the processing because there is a reaction of the breakdown of protein and fat compounds into volatile compounds due to food degradation by the heat. The smell arises as a result of the combination of the volatile compounds of fish meat derived from volatile protein degradation such as Merkaptan, Skatol, and H_2S.

C. Texture

Table 4. Average of Hampal fish crackers texture

Consentrations of hampal fish meat (%)	Median	Average texture
0	5	5,5 a
25	6	6,2 a
50	9	8,3 b
75	7	7,3 a

Description: The average number of treatments followed by the same letter Show no real difference according to comparison test 5% level.

The texture assessment aims to determine the level of acceptance of panelists against the texture of an empty fish cracker. The observation of the texture of the empty fish crackers is very important. This is because texture is one of the things that distinguishes fish crackers with other fishery products the texture of the fish crackers is presented in Table 4.

Based on statistical test results against the texture of crackers, the treatment without the addition of empty fish meat is distinct from the addition of the fish meat with a concentration of 50%. Based on the results of the panelist's assessment of the Hampal fish crackers, the average value of the textures ranged from 5.5 to 8.3 with a median value of 5 (neutral/Ordinary), 6 (likes), 7 (likes) and 9 (very fond). All the treatment is crispy but has a different level of crispiness, for the treatment 0% slightly crispy texture but a little hard, the treatment 25% of the texture is slightly crisp, the treatment 50% crispy texture and the treatment 75% very crispy. The texture of crackers with the addition of the fish meat as much as 50% has a mean value-the highest average of 8.3 that produces a fish crackers with crisp texture. The texture of crackers without the addition of empty fish has the lowest average value of 5.5 that produces crackers with a slightly crispy texture but a little harsh.

Textures are produced from all the favored treatment of panelists because everything is crispy despite having different levels of hardness but of all the panelist treatment most liked the crackers with a concentration of fish meat replenishment 50%. But the 75% treatment has a median value lower than the 50% this is thought to occur because the texture of the crackers 75% are too fragile so that the panelist is less liked. Texture is one of the factors that affects the choice of consumers of a food product. Texture is an important attribute in a crispy food such as crackers. Each meal has a texture and a different level of panelist. The addition of meat will affect the level of crackers, the more meat is added then the crunch of crackers will increase. Processed fish containing flour, while heating will cause the process of gelatinization, starch granules absorb water and occur process expands. Furthermore, this granule will rupture so that the water inside the grains – grain can not move freely. This results in the texture of the product becoming dense and compact between particles.

D. Flavor

Assessment of the taste of this research is done by using a sense of flavor that assesses the taste of the fish crackers with the treatment of differences in the concentration of the fish meat. The observation of the flavor of an empty fish is presented in Table 5.

Table 5. Average taste of Hampal fish crackers

Consentrations of Hampal fish meat (%)	Median	Average taste
0	5	5,6 a
25	7	6,4 a
50	9	8 b
75	7	6,6 a

Description: The average number of treatments followed by the same letter Show no real difference according to comparison test 5% level.

Based on the results of statistical tests on the smell of crackers, the treatment without the addition of empty fish meat is distinct from the addition of the fish meat with 50% Concentrai. Based on the results of the panelist's assessment of the empty fish crackers, the average value of flavors ranged from 5.6 to 8 with a median value ranging from 5 (neutral/Ordinary), 7 (like), 9 (very fond). The taste of crackers with the addition of the fish meat as much as 50% has a flat value-the highest average of 8 that produces an empty fish crackers with a typical flavor of savory fish. The taste of crackers without the addition of empty fish meat has the lowest average value of 5.6 that produces crackers with a taste of crackers as in general. The addition of total fish meat added as much as 0%, 25%, 50% and 75% produce a distinctive flavor of fish that is stronger with the average value of the highest in the treatment of 50% is 8 that produces crackers with the typical flavor of fish most liked Panelists. In the treatment of 25% there is a distinctive flavor of fish that is not strong compared with the treatment of 50%, while the treatment of 75% typical fish are very strong tends to smell fishy. Taste of all treatment is liked by panelist but fish crackers with a concentration of 50% most liked panelist.

Generally, there are four flavors of sweet, bitter, sour, and salty. Sensitivity to flavor is found in taste buds on the tongue. The relationship between the chemical structure of a compound is easier to determine with its taste. The taste of food derived from the food itself and when it has received treatment or processing, it is influenced by the ingredients-the materials added during the processing. The addition of fish meat treatment affects the taste of fish crackers.

The component of the flavor of food ingredients associated with protein in foodstuffs will affect the flavor and the level of its love, the more protein is contained then the resulting product will feel more savory. The flavor also comes from the hydrolytic protein in fish meat to the amino acid that creates a savory flavor to the fish crackers.

3. 3. Decision-making by *Bayes* Method

Decision making to the value of alternative weights and the criteria of the introduction, smell texture and the taste of fish crackers with differences in the concentration of fish meat is done by comparison test in pairs (pairwase comparison). Data on comparative test results in pairs against the sensitivity criteria, smell, texture, and taste of the 20 panelists presented on (appendix 9). The comparison of the pairs was done by the manipulation of the matrix to determine the weight of the criteria (appendix 10). Calculation results of the weight of the criteria, smell, texture, and the flavor of the fish crackers are presented in Table 6.

Table 6. Weight value of Hampal fish crackers criteria.

Criteria	Wheighing Criteria
Appearance	0,12
Smell	0,18
Texture	0,15
Taste	0,55

Based on the results of calculations on the weight of the criteria, smell, texture, and the taste of the fish crackers with differences in the concentration of fish meat is obtained by the results that indicate that the taste has a greater value compared to Other criteria. This proves that the addition of empty fish meat gives a noticeable effect on the assessment of the taste of the fish crackers. The result of calculating the weight of the criteria and determination of the best treatment by considering the appearance criteria, smell, texture, and the flavor of the fish crackers are presented in Table 7.

Table 7. The decision matrix for the Fish Crackers Assessment Bayes method.

Treatment (%)	Criteria				Alternate value	Priority value
	Appearance	Smell	Texture	Taste		
0%	5	5	5	5	5,00	0,19
25%	5	6	6	7	6,43	0,24
50%	7	8	9	9	8,58	0,32
75%	7	7	7	7	7,00	0,26
Weight	0,12	0,18	0,15	0,55	27,01	1,00

Based on the calculation result with the Bayes method indicates that fish crackers with the addition of the fish meat as much as 50% to obtain the highest alternative value of 8.58 followed by the addition of fish meat in the treatment as much as 25% has an alternate value of 6.43, fish meat replenishment treatment of 75% have an alternate value of 7.00 and the treatment without the addition of the fish meat has the lowest alternative value of 5.00. Based on the overall results that include the evaluation, smell, texture, and flavor, it can be concluded that the addition of fish meat as much as 50% is the most liked treatment panelist compared with other treatments.

3. 4. Hampal Fish Crackers Test

One of the quality determinants of good crackers is the power of the flower because it determines consumer acceptance. The results of the calculation of crackers are presented in Table 8.

Table 8. Results of the calculation of cracker stability test.

Deuteronomy	Treatment			
	Control (0%)	25%	50%	75%
1	42,10	55,55	83,67	102,02

2	48,93	65,93	92,70	116,49
3	50,52	52,68	96,84	124,48
Total	141,55	174,16	273,21	343,17
Average	47,18	58,05	91,07	114,39

Based on the results of the movement of the florescence showed the value of the florescence in the treatment of fish meat replenishment 75% has the highest value of the rate of 114.3%. The addition of meat affects the efficacy of crackers, more and more fish meat added levels of crackers are increasingly higher. This occurs due to the difference in the addition of fish meat, resulting in a change in the concentration of protein in the dough.

One of the factors that can affect the volume of crackers is protein content. The lower the use of sago flour and the higher the addition of fish meat will result in higher development volumes and the texture of hollow and smooth crackers. While the use of sago flour too much will result in an increasingly dense texture. This is suspected because the water binding power caused by each other's resisting protein rejects the resulting space between the miofilament becomes widespread and water enters into the flesh which causes the hardness to become smaller and the development increasingly higher. Decreased moisture content is not always a violent occurrence, the level of violence is influenced by muscle proteins.

The frying process causes the cracker to undergo development. There are three phases namely the plastization phase, the inflated phase, and the fixed phase. In the plastization phase of crackers are flexible and not inflated. In the phase expands the crackers undergo a change of shape and expands. In the fixed phase crackers are no longer undergoing development.

Development can occur because it is caused by the formation of the air cavity that is affected by temperature, causing water that is bound in the gel to Steam. The durability of crackers is very related to the starch in the product. Basically the phenomenon of the development of crackers caused by the pressure of steam formed from the heating, so that the water content on the material urged the structure of the material that causes the product to inflate.

The factors affecting the power of crackers can be seen from Amilopectin, and stirring. One of the factors affecting the power of crackers is amilopectin. Gelatinization is a process of swelling of starch granules, so in this event the granule can not return to its original condition. On the occasion of the gelatinization of the starch, the water molecule will enter the part-part of the starch that will form the bond-the bond of the gel starch. In order to obtain the Maximun volume development of crackers, bound water content should spread evenly. This can be done by homogenizing the dough so that the process of gelatinization occurs perfectly and the water content spread evenly.

3. 5. Proximate Test Results

Proximate test is done to know the nutrient content of crackers with the treatment of the addition of the meat of the fish in a different concentration of each treatment. The proximate test is the moisture content and protein levels that the results are presented in Table 9.

Table 9. Proximate test results.

No.	Proximate test	Sample of Hampal Fish crackers			
		0%	25%	50%	75%
1.	Kadar Air (%)	4,76	4,63	4,79	4,47
2.	Kadar Protein (%)	4,56	6,03	10,78	12,60

A. Moisture

Based on the results of the water content test against the vacual fish crackers, there is a difference between crackers without the addition of the fish meat in the cracker with the addition of empty fish meat. The value of the resulting water content ranges between 4.47 and 4.79, the resulting moisture content is still included in SNI No. 01-2713-1999 because the moisture content is at a maximum of 11%. The value of water content generated fluctuations, this is due to differences in drought due to the thickness of different fish crackers and the moisture of the dough produced with the difference in the amount of fish raw material added each different treatment Concentrations affect the drying process at the time of the clothesline so that it has different drought levels.

Water is a very important characteristic of food, because water can affect the appearance, texture, and taste of food. Moisture content in food ingredients to determine the freshness and durability of the foodstuffs. The importance of water in foodstuffs needs to be more understanding. The presence of water also affects the deterioration of food quality chemically and microbiology. Similarly, the removal of water (drying) or water freezing is very important in some methods of food preservation.

The addition of fish meat concentrations affects the water content value of fish crackers. The resulting kadarair tends to increase with the added of fish meat into the cracker dough. This is because the increased moisture content in the material is inversely proportional to the style of emphasis and power of interest.

B. Protein Levels

Based on the results of the test of protein levels on the fish crackers, there is a difference between crackers without the addition of the fish meat in a cracker with the addition of an empty fish. The value of the resulting protein levels ranged from 4.56% and 12.60%, the protein content produced is higher with more and more of the addition of meat as a source of protein and SNI is still standard No. 01-2713-1999 protein content in SNI at least 6% .

Protein is one of the essential chemical components for the body and has a very vital role. Protein source is found in animal products, plant products. Protein is a group of macronutrient substances. Proteins have a structure that contains N (nitrogen), in addition to C (carbon), H (hydrogen), O (oxygen) (as well as carbohydrates and fats), S (sulfur) and sometimes – sometimes P (phosphorus), Fe (iron), and Cu (copper) (as compounds of complex proteins). Like other polymer compounds (e.g. cellulose, starch) or compounds – compounds that condense some molecular units (e.g. triglycerides) then proteins can also be hydrolyzed or

parsed into component units – the components by water molecules. Hydrolysis in proteins will release the acid – its constituent amino acids.

The addition of fish meat affects protein levels, the more fish daing then the protein levels of fish crackers will increase. This increase is caused by the difference in the addition of fish meat, resulting in a change in the concentration of proteins in the dough. Minimum protein levels in raw fish crackers by 6% (SNI 2713.1 – 2009).

3. 6. Recapitulation of Observation Results

The overall results of research that has been conducted on the favorite test, physical test (efficacy test), and chemical test (water content test and protein level) with the addition of fish meat in the crackers are presented in Table 10.

Table 10. Recapitulation of Hampal fish cracker observation results.

Observation	Average of the Hampal fish meat Addition treatment				SNI No. 01-2713-199
	0%	25%	50%	75%	
Hedonik test					
Appearance	5,3 a	5,7 a	**7,6 c**	7,4 bc	-
Smell	5,5 a	6,1 a	**7,7 b**	6,9 a	-
Textur	5,5 a	6,2 a	**8,3 b**	7,3 c	-
Taste	5,6 a	6,4 a	**8 b**	6,6 a	-
Bayes Methods					
Alternate value	5,00	6,43	**8,58**	7,00	-
Physical test					
Florescence	47,18	58,05	**91,07**	114,39	-
Chemical test					
Moisture content (%)	4,76	4,63	**4,79**	4,47	-
Protein levels (%)	4,56	6,03	**10,78**	12,60	-

Based on the results of the favorite test (Hedonik), the addition of fish meat in crackers gives a noticeable effect on the characteristics of the appearance, smell, texture, and flavor. Characteristic smell, texture, and the taste of the fish crackers in the treatment of 50% have a mean value – the highest average is the appearance with a value of 7.6 (liked), smell with a value of 7.7 (liked), a texture with a value of 8.3 (liked), and a taste with a value of 8 (liked).

Recapitulation of the favorite test observation results are presented in Appendix 9. After the Bayes test, the highest alternative value gained in the 50% treatment is 8.58, so it can be concluded that the fish crackers with the addition of 50% are the Hampal fish crackers that are preferred by panelists than the treatment Other.

Based on the physical testing of the stability test, the addition of fish meat treatment of 75% has the highest value of efficacy of 114.39%. The addition of fish meat affects the efficacy of crackers, more and more fish meat addition is the higher the efficacy of crackers. This occurs due to differences in the addition of fish meat concentrations, resulting in a change in the concentration of proteins in the dough.

Based on the results of chemical tests conducted on all treatments, the lowest water content is at 75% treatment with a value of 4.47%. The addition of fish meat concentrations affects the water content value of fish crackers. The resulting moisture tends to increase with the added fish meat to the cracker dough. This is due to the water content that is owned by the fish meat that is used more than the content of tapioca starch[24]. Anomalies of the results are caused by the difference in drought because of the limitations of land, tools for drying and the difference in the concentration of crackers dough, thus having a different drought level.

The value of fish crackers protein levels, the lowest of which is in the control treatment with a value of 4.56% and the highest at the addition of fish meat treatment with a concentration of 75% with a value of 12.60, this is because the addition of fish meat affects protein levels, The more fish meat the protein levels increase. This increase is due to differences in the addition of fish meat, resulting in a change in the concentration of proteins in the dough. Based on the research objectives you want to achieve, your favorite level is the main consideration. The addition of fish meat to 75% can still be received panellist, but the 50% treatment is the most liked treatment by panelist. Nutritional value is a supporting power in attracting consumers to consume fish crackers. This indicates that the addition of fish meat as much as 50% is a better treatment than other treatments, because it produces the more liked oraganoleptic characteristics as well as the presence of proteins contained therein.

4. CONCLUSION

Based on the results of the study can be concluded that the addition of fish in the meat with a concentration of 50%, is the most liked treatment by panelists with a value of 7.6, smell 7.7, texture 8.3, flavor 8, the test of the florescence 91.07%, the rate Water 4.79% and protein content 10.78%.

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