



## **Characterization of Peda Patin Jambal with Various Salt Concentration as Environment Control**

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. Author FM designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors EA and R managed the analyses of the study. Author IR managed the literature searches. All authors read and approved the final manuscript.*

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### **ABSTRACT**

The aim of this research is to get the right salt concentration so as to produce the best peda patin jambal products with the best characteristics. The research's method used in this study is an experimental method with three treatments, consists of salt concentrations of 20%, 30%, and 40%. Hedonic tests were then used by 20 semi-trained panellists who had experience in organoleptic assessments which consisted of assessments of appearance, aroma, texture and taste. This research was conducted at the Fisheries Product Processing Technology Laboratory of the Faculty of Fisheries and Marine Sciences, Universitas Padjadjaran, while the salt and water content testing of the final results of the research was conducted at the Laboratory of food technology at Universitas Pasundan Bandung. Based on the results of the research, the treatment of salt concentration of 30% produces the best pangal catfish products with the best characteristics, which are rather clean appearance, dull-white to reddish-white flesh, yellowish skin surface, wrinkles on the surface of the flesh and skin, have a distinctive fermentation aroma, have a pearly texture, and has a delicious, savory, slightly salty taste.

**Keywords:** *Characteristics; fermentation; patin jambal; peda; salt concentration.*

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## 1. INTRODUCTION

Catfish (*Pangasius* sp.) is one commodity that has great potential in its utilization. This is supported by the rising production level every year. The production of catfish in Indonesia in 2013 reached 410,883 tons, then in 2014, it increased to 418,002 tons [1]. Besides having a distinctive taste, catfish meat also has good nutrition. The content of protein, fat, vitamins and minerals in catfish meat is good for meeting the body's needs [2].

Processing of fishery products generally aims to maintain freshness, preserve, and make products that have physical and chemical properties that are different from the original, but still popular with the community. Processing of fishery products in Indonesia is more than 60% in the form of salted fish, smoked fish, pindang and other traditional products. These products are products that are preferred by most Indonesian people from various circles [3].

Peda is one of the fermented fish products with the help of microorganisms in controlled environmental conditions by the addition of salt with certain concentrations [4]. Fermentation carried out on food, including fish can produce food products that have higher nutritional value, as well as distinctive flavours. In addition, fermentation can extend the shelf life, and increase the selling value of the products produced [5].

Common types of fish made peda include Indian mackerel (*Rastrelliger* sp.) and scads fish (*Decapterus* sp.) [6]. So that the selection of catfish jambal (*Pangasius djambal*) as an ingredient for making peda to add variants of peda products, besides the catfish has thick meat reddish to white, thick, chewy, solid and compact, has a fresh smell, neutral to specific types, and has a savory and juicy taste compared to other catfish species [7].

There are several factors that affect the quality of the peda, namely salt concentration and fermentation time [3]. Salt concentration and duration of fermentation will affect the activity of microorganisms that play a role in the fermentation process. The concentration of salt used will affect the water content in the body of the fish, due to the nature of salt that is able to absorb water from body tissues. This can then

affect the microbial activity in the fermentation process, and the characteristics of the resulting peda.

There are problems in the lagging processing industry that exist among the people today, namely the quality of products produced by fishermen or fish farmers has different qualities. This is due to differences in the level of knowledge that occurs among fishermen or fish farmers regarding the use of salt in the processing process. The aim of this research is to get the right salt concentration so as to produce the best peda patin jambal products with the best characteristics.

## 2. MATERIALS AND METHODS

### 2.1 Time and Place of Research

This research was conducted at the Fisheries Product Processing Technology Laboratory of the Faculty of Fisheries and Marine Sciences, Universitas Padjadjaran, while the salt and water content testing of the final results of the research was conducted at the Laboratory of food technology at Universitas Pasundan Bandung. This research was conducted on January 27, 2019, until March 31, 2019.

### 2.2 Tools and Materials

The tools used include knives, cutting boards, digital scales, jars, sacks, measuring cups, and spoons. The materials used included 3 kg of jambal patin (*Pangasius djambal*) obtained from the Depok fish market, block salt, and water.

### 2.3 Observation Parameters

The observed parameters used are the hedonic test, and a chemical test. The hedonic test aims to determine the appearance, aroma, texture and taste. The chemical test aims to determine then salt content and water content. The method used for chemical testing is referred to SNI-01-2354.2-2006 [8] for water content test, SNI 01-2359-1991 [9] for the salt content test. The results of the water and salt content tests are compared with SNI-01-2721-2009 [10] product standards recognized in Indonesia.

### 2.4 Data Analysis

Non-parametric analysis performed for organoleptic testing using a two-way analysis of

the Friedman test using the Chi-square test. The statistical formula used in the Friedman test is as follows [11]:

$$x^2 = \frac{12}{bk(k+1)} \sum_{i=1}^x (R_j)^2 - 3b(k)$$

Information :

- x = Friedman Test Statistics
- b = Repetition
- k = Treatment
- R<sub>j</sub> = Total ranking of each treatment

If there is the same number, a correction factor (FK) is calculated using the following formula:

$$FK = 1 - \frac{\sum T}{bk(k^2 - 1)}$$

$$H_C = \frac{x^2}{FK}$$

Information :

- T = N (t3-t)
- t = The same number of observations for one rank.
- N = The same number of observations for a number with the same value of t.

Multiple Comparisons using the following formula [11]:

$$|R_i - R_j| \leq Z\{\alpha/k(K - 1)\}\sqrt{bk(k + 1)/6}$$

Information :

- R<sub>i</sub> - R<sub>j</sub> = Difference in average rank
- R<sub>i</sub> = Average rating of the i sample
- R<sub>j</sub> = Average rating of the j sample
- α = Experiment wise error
- b = Number of data
- k = Number of treatments
- Z = Value in table Z for multiple comparisons

Bayes Equation :

$$Total\ value_i = \sum_{i=1}^m value_{ij} (Krit_j)$$

Information :

Total value = Total final value of alternative to - i  
 Value = alternative value to - i in the criteria to j  
 Krit<sub>j</sub> = Level of importance (value) criteria to - j

i = 1,2,3, ..... n; n = number of alternatives  
 J = 1,2,3, ..... N; N = number of criteria

## 2.5 Experimentation Process

The following is a research procedure that has been modified from the wet salting process:

1. Preparation of tools and ingredients, knives, cutting boards, digital scales, jars, sacks, measuring cups, and spoons, jambal patin, block salt, and water.
2. Jambal patin was eviscerated, then the meat was weighed.
3. Jambal patin soaked in salt solution according to treatment 20%, 30%, and 40% for 24 hours with a ratio of fish and water of 1: 2.
4. Jambal patin then dried in the sun for about 3 hours per day for 3 days, drying is only done 3 hours with the aim of extending the fermentation period and adjusting to the sun's heat conditions.
5. Peda patin jambal cooked and prepared for hedonic testing with the reference scale used is 9.

## 3. RESULTS AND DISCUSSION

### 3.1 Result

#### 3.1.1 Hedonic test result

The hedonic test results include appearance, aroma, taste, and texture which are presented in Table 1 to Table 4.

#### 3.1.2 Chemical test result

Chemical test results include tests of water content and salt content.

### 3.2 Discussion

#### 3.2.1 The appearance of peda patin jambal

Based on the results of the research, the salt concentration had an effect on the appearance of peda patin jambal (Table 1). The treatment of salt concentration in the manufacture of peda patin jambal gives an influence on appearance. Patin meat which has a bright white colour turns white to dull reddish white. The formation of the red colour is caused by the enzyme activity of the red/orange-forming bacteria during fermentation, the activity of these bacteria also causes an interaction between carbonyl derived from fat oxidation with amino acid groups and proteins [4]. The colour of the skin surface changes from silver-white to yellowish to brownish-yellow.

Colour changes that occur are caused by the elemental content of salt crystals (NaCl) found on the surface of the fish body. Catfish including high-fat fish, high-fat content can cause the penetration of salt in the fish's body to be imperfect and cause more salt to be left on the outside of the fish body [12].

**Table 1. Average appearance of peda patin jambal**

Treatment of salt concentration (%)	Median	Average appearance
20	5	5,8a
30	7	7,3b
40	7	6,4ab

*Description: The average number followed by the same letter shows no significant difference according to the multiple comparison test at the test level of 5%*

Another change in appearance that occurs is the surface of the fish meat becomes wrinkled. Meat shrinkage is caused by a reaction between actin and myosin forming actomyosin at the Rigour Mortis stage [13]. The difference in salt concentration causes differences in the shrinkage of the product. Salt causes denaturation and coagulation of proteins and enzymes, thus affecting the shrinkage of fish meat [14]. Giving salt will cause the concentration of salt outside the body of the fish more concentrated than the liquid in the body of the fish, resulting in the withdrawal of water from the body of the fish while the salt will enter the body of the fish [15]. The higher concentration of salt outside the body of the fish will cause more water withdrawal. The process stops after a balance between the concentration of salt outside and inside the body of the fish, at that time there is thickening of the remaining body fluids and clumping of protein (coagulation) so that nature and physical appearance of the fish will change [16].

The increased use of salt causes the water binding capacity in meat to decrease [17]. The binding capacity of water by protein meat or water holding capacity (WHC) is the ability of meat to bind free water. Meat with a low binding capacity of water will cause a lot of fluid to be lost. A large amount of lost fluid can affect the shrinkage of meat [17].

Based on the panelist's preference level on peda patin jambal appearance can still be accepted by the panellists because the average value of the appearance of all treatments is still above the

product rejection value limit. The limit for rejection of food products is that if the product tested gets a value of  $\leq 5$ , the product is declared not accepted by the panellist.

### 3.2.2 The aroma of peda patin jambal

Based on the results of the research, the salt concentration did not affect the aroma of peda patin jambal (Table 2). The aroma of jambal pangasius in all treatments produces a distinctive aroma of fermentation. The distinctive aroma of fermented products is mainly due to the degradation of proteins and fats in fish meat during fermentation [18]. Scent compounds are chemical compounds that have aromas because they are volatile compounds [19]. Volatile compounds formed from the degradation of proteins and fats are aldehydes, ketones and esters which contribute to the formation of aromas in salt fish fermentation products [18]. The distinctive aroma of fermented fish comes from methyl ketone, butyraldehyde, ammonia, amino compounds and other compounds arising from fat degradation [3]. The higher concentration of salt ( $> 5\%$ ) produces a stronger aroma in fermented products [20].

**Table 2. Average aroma of peda patin jambal**

Treatment of salt concentration (%)	Median	Average aroma
20	7	6,1a
30	7	6,4a
40	6	6,2a

*Description: The average number followed by the same letter shows no significant difference according to the multiple comparison test at the test level of 5%*

### 3.2.3 Taste of peda patin jambal

Based on the results of the research, the salt concentration had an effect on the taste of peda patin jambal (Table 3). Peda patin jambal has a taste that is tasty, savoury and does not give after taste like bitter. The taste produced is influenced by the concentration of salt. Adding different salt concentrations to fermented products produces different flavours [21]. The higher salt concentration given in a fish product will produce a taste that is too salty so it is less preferred [22]. The taste most favoured by panellists in this research is the peda patin jambal, which is tasty, and slightly salty (30% treatment). Peda patin jambal taste in this research is close to the common taste of peda mackerel in the market.

**Table 3. Average taste of peda patin jambal**

Treatment of salt concentration (%)	Median	Average taste
20	5	5,4a
30	7	7b
40	7	6,2ab

*Description: The average number followed by the same letter shows no significant difference according to the multiple comparison test at the test level of 5%*

The difference in salt concentration has an effect on the content of glutamic acid which plays a role in the formation of savoury flavours (umami) in low-grade products [18]. Glutamic acid is a simple molecule produced by the breakdown of proteins by proteolytic enzymes during the fermentation process. The higher salt content, the activity of fermenting microorganisms to break down protein into amino acids especially glutamic acid, decreases, this is due to the high salt concentration can slow down the activity of some fermenting microorganisms and will affect the savoury taste (umami) produced in the peda product [18].

### 3.2.4 The texture of peda patin jambal

Based on the results of the research, the salt concentration did not affect the texture of peda patin jambal (Table 4). Masir texture is a sandy texture that is typical of salted fish due to a reaction between lipoprotein in fish meat and salt that enters fish meat [23]. Soaking fish in a salt solution will cause diffusion of NaCl salt into fish meat, this diffusion of Na<sup>+</sup> and Cl<sup>-</sup> ions causes damage to lipoprotein bonds. The more NaCl concentration that enters the meat releases the lipoprotein bond. This release of lipoprotein bonds causes fat to separate from protein. This results in the merging of proteins which then form solids and cause masir texture [24].

**Table 4. Average texture of peda patin jambal**

Treatment of salt concentration (%)	Median	Average texture
20	5	5,4a
30	7	5,9a
40	7	6,4a

*Description: The average number followed by the same letter shows no significant difference according to the multiple comparison test at the test level of 5%*

### 3.2.5 Water content

Following are the results of the water content of peda patin jambal using SNI-01-2354.2-2006 [8]

for water content test (Table 5). The value of the moisture content in the jambal pathway tends to decrease with increasing salt concentration. The salt that enters the body of the fish will replace the free water that is in the body of the fish, so the water content will decrease [25]. The water content in this research still meets the requirements according to SNI 01-2721-2009, [10] which is a maximum of 40%.

**Table 5. Test results of peda patin jambal water content**

No.	Treatment of salt concentration (%)	Result (%, b/b)
1.	20	37,8511
2.	30	32,5301
3.	40	27,3237

### 3.2.6 Salt content

Following are the results of the salt content of peda patin jambal using SNI 01-2359-1991 [9] for the salt content test (Table 6). The levels of peda patin jambal salts produced in this research ranged from 12.28% - 14.49%. The salt content still meets the requirements of SNI 01-2721-2009 [10], which is a maximum of 20%.

**Table 6. Test results of peda patin jambal salt content**

No.	Treatment of Salt Concentration (%)	Result (%, b/b)
1.	20	12,2836
2.	30	13,1276
3.	40	14,4902

### 3.2.7 Decision making with the bayes method

The calculation results on the weight of the appearance criteria, aroma, texture, and taste of jambal patin using the Bayes method are presented in Table 7.

**Table 7. Weight value of peda patin jambal criteria**

Criteria	Weight of criteria
Appearance	0,14
Aroma	0,26
Taste	<b>0,5</b>
Texture	0,1

Based on Table 7, it shows that taste is the most important criterion that determines the final decision of the panellist in choosing peda patin jambal with the criteria weight value of 0,5. Furthermore, the panellists also considered that

**Table 8. Assessment decision matrix of peda patin jambal with bayes method**

Treatment	Criteria			Alternative value	Rating	
	Appearance	Aroma	Texture			Taste
20%	5,80	6,10	5,40	5,40	5,64	3
30%	7,30	6,40	5,90	7,00	6,78	1
40%	6,40	6,20	6,40	6,20	6,25	2
Criteria value	0,14	0,26	0,10	0,50	18,67	1,00

aroma was an important criterion with a criterion weight of 0,26 followed by appearance and texture namely 0,14 and 0,1. This shows that even though other judgments are good, but if the taste of the pangasius jambal is not liked, the panellist will reject the product. The calculation results in determining the best treatment by considering the appearance criteria, aroma, taste, and texture of peda patin jambal are presented in Table 8.

Table 8 shows that the treatment of 30% salt concentration in making peda patin jambal has the highest alternative value of 6,78 followed by 40% treatment with an alternative value of 6,25 while the treatment of 20% has the lowest alternative value of 5,64. Based on the organoleptic test parameters that were observed, the treatment of 30% salt concentration produced peda patin jambal with the best characteristics favoured by panellists.

#### 4. CONCLUSIONS

Based on the results of the research, the treatment of 30% salt concentration produced peda patin jambal with the best characteristics such are appearance, dull-white to reddish-white flesh, yellowish skin surface, wrinkles on the surface of the flesh and skin, have a distinctive fermentation aroma, have a pearly texture, and has a delicious, savoury, slightly salty taste.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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