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Quality of Snakehead Fish (*Channa Striata*) Bekasam Fermented in Various Media and Salt Concentration

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Abstract. Indonesia is a country which is rich in fish result. As a source of high protein, fish are best medium microbial growth, and this makes them fast deteriorate. Bekasam is fish fermentation product using high salt levels made by inhabitants in Kalimantan, Indonesia, in their effort to extend fish shelf life. Snakehead fish is commonly used for making bekasam as those fish are plentiful there. Fermentation of bekasam requires additional materials as a source of carbohydrates that may selected from rice, cassava, flour and others which will effect bekasam quality. The purpose of this research is to study the effect of salt concentration and fermentation media on quality of snakehead fish bekasam. There was interaction between both treatments in moisture content. The higher salt concentration, the lower moisture content in all media, but increasing in salt concentration until 30 %, also increased moisture in media combined with cassava and sweet potato, differed them with rice combined medium. Higher salt concentration decreased protein content but increased pH value. pH value was maybe related with total lactic bacteria which were increasing with higher salt concentration until 20 % and were decreasing in 30 %.

1. Introduction

Fish is a very potential source of protein and very needed by humans. High levels of protein in fish caused the fish into a medium for microbial growth so that fish could not survive for long. One of the method for extend the shelf life from fish is by fermentation bekasam [1]. In addition to extending the shelf life bekasam also have functional value as anticholesterol [2][3] and antihypertensive [4][5].

Bekasam is one product of fermentation of fish using high levels of salt by adding rice as a source of karbohidrat [1] [6]. The fish used to make bekasam fish such as nile tilapia [6] [7] [8], [9] the catfish, milkfish [5] [10] [11], silver rasbora [1], anchovy [12], snakehead fish [2] [3] [13] [5], tuna, Siamese gourami [14] etc. In the research used snakehead fish as a raw material to make bekasam.

The snakehead fish (*Channa striata*) are members of the freshwater fish and Channidane family. Which is commonly used in the fermentation process bekasam. Protein content of the snakehead fish higher about 20.8% than family Channidane others [15].

Sources of carbohydrates in making bekasam generally by adding rice. In addition to rice may use other sources of carbohydrates such as rice flour, comstarch, wheat flour, tapioca flour and [9] as well as banana flour [16]. In research used a variety of sources of carbohydrates (rice, sweet potatoes, and cassava) in making bekasam to know the quality of them. Suspected from combination of carbohydrate source and salts concentrations raise the quality of snakehead fish bekasam effect.



2. Material and Method

2.1. Snakehead fish preparation

Snakehead fish (*Channa striata*) was obtained from Larangan traditional market, Sidoarjo. Then cleaned the snakehead fish to eliminate the head, the tail, and the contents of the stomach. Then the fish are cut according to the size.

2.2. Fermentation Bekasam

Snakehead fish (*Channa striata*) (100 gr) was used as main raw material for making bekasam. Salt (10, 20, 30%), tape (75%), and rice, cassava, and sweet potatoes each other (25%) was added to the fish and then until seven days to produce bekasam.

3. Statistical Analysis

Variables observed were chemical analysis (moisture content, pH, and protein), microbiological analysis (total lactic acid bacteria). Data compiled were analyzed with analysis of variance and continued with HSD 5 % test. Those treatments are repeated three times.

3. Result and Discussion

3.1. Moisture Content

Table 1. The average moisture content of snakehead fish bekasam with different treatment.

Salt Concentration	Moisture Content (%)		
	Rice	Casava	Sweet potatoes
10%	41.33 d	29.83 c	30.67 c
20%	19.67 a	18.50 a	18.57 a
30%	17.17 a	20.67 ab	26.83 bc
BNJ 5%	1.54		

The result of the analysis showed that a variety of salt concentration and source carbohydrate highly significant effect on moisture content of snakehead fish bekasam. The combined effect both salt concentration and fermentation media on moisture content. Average moisture content bekasam can be seen in Table 1. Bekasam with salt concentration of 10% has the highest moisture content (41.33%), which is the smallest concentrations in this study. The less salt is added, then the water levels rise on bekasam. This is in accordance with previous research suggesting that the addition of salt will result in reduced water levels in the fish. Penggaraman performed will result in fish protein terdenaturasi and experience the coagulation so the water in the fish tissue will be out [9].

Moisture content of snakehead fish bekasam were in the range 44,33%-17,17%. Previous studies reported that the moisture content of the Wadi Batok after 7 days of fermentation were in the range of 33,29%-35,32% [18], the moisture content of the fish *clarias gariepinus* bekasam 72,14%-74,81% [9], the moisture content of fish bekasam Cork samples with 3 day, 5 day, and 7 day fermentation time were 65,73%, 64,089%, and 63,28% [13]. The difference in moisture content of bekasam can be caused by a variety of factors between fermentation method is used, long fermentation, salt concentration, and the size of the fish used in the manufacturing process bekasam [17].

In table 1, the average of the highest water content obtained from the use of rice as a source of karhohidrat i.e. 41,33%. In this case, the results of this study in accordance with the literature that says that the greater the content of starch in fermentation media, then the moisture content will be increasing because of the starch into glucose degradation reaction produces water, which is known in the core content of rice. The starch content of rice is about 90% whereas 34% of cassava and sweet potatoes 24,28% [16].

2. Protein Content

The results of the analysis of the variety shows there is no interaction between these two treatment of protein bekasam fish Cork. The treatment effect is not real fermentation media against the protein concentration salt treatment, but the real effect against protein bekasam fish Cork (table 2).

Table 2. The average protein content and pH of snakehead fish bekasam with different treatment.

Salt Concentration	Protein content (%)	pH
10%	38.91 b	3.85 a
20%	31.91 a	4.49 b
30%	32.69 a	4.66 b
BNJ 5%	1.54	0.004
Source Fermentation		
Nasi	34.24	4.44
Singkong	33.08	4.34
Ubi jalar	36.19	4.21
BNJ 5%	tn	tn

Table 2, show that fish bekasam Cork with a 10% concentration of salt treatment had the highest protein levels between the two concentrations of salt treatment i.e. 38.91%. This is in accordance with (table 3) are present in highest bekasam BAL with 10% salt concentration. The high content of BALES along with an increase in proteolytic activity of BAL degrade proteins into amino acids. Therefore at measuring the levels of proteins kjedahl method N levels in the 10% most bekasam high concentration [10].

In this study the fermentation media does not have an effect on protein content of carbohydrates because media is almost the same as the protein content of each media also almost the same IE 1.20% of cassava, sweet potatoes, rice 3 1.65% so as not to influential.

3. pH

The results of the analysis show the variety of prints there is no interaction between these two treatment of pH bekasam fish Cork. The treatment effect is not real fermentation media against pH, salt concentration treatment but the real effect of pH bekasam fish Cork. In this study, the value of pH bekasam fish Cork produced ranged from 4,96-3.81. The results of the previous research to pH 4.66 bekasam Red tilapia fish [12], the pH of the fish clarias gariepinus 3.99-4.41 [9], and the pH of the milkfish 3.88 -398 fish [10].

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The pH value is influenced by many of the least amount of BAL in bekasam. The more the number of BALES packed bekasam pH is getting lower. This is caused by the ability of the BALES of organic acids produces especially lactic acid at the time of fermentation bekasam. Table 3 shows the highest obtained BAL on 10% salt concentration bekasam, where there are also the lowest pH at salt concentrations bekasam 10% [9].

3.4. Lactic Acid Bacteria (LAB)

Table 3 shows the higher konsentasi of salt then the number of BALEs is getting low. It is appropriate the results of the analysis of pH (table 2) that the higher salt concentration, pH value is higher. High low pH is equivalent to many at least BAL on bekasam. Where the BALEs will break down the substrate in bekasam acid-organic acids that cause a sour taste on bekasam [9]. BALEs was the lowest with a concentration of salt bekasam. The low salt concentration on most BALEs high due to bacterial cell plasmolysis occurs. This is in accordance with previous research suggesting that there is maximum concentrations for the growth of the BAL, BAL. where can generally grows on salt concentration 10-18% [18]. So at this time the salt concentration of research more than 10% can decrease the number of BALEs in bekasam.

Table 3. Total lactic acid bacteria snakehead fish bekasam with different treatment.

Salt Concentration	Lactic Acid Bacteria (cfu/mg)		
	Source Fermentation		
	Rice	Casava	Sweet potatoes
10%	1.4 x 10 ⁹	9.6 x 10 ⁹	1.3 x 10 ⁹
20%	8.5 x 10 ⁹	6.6 x 10 ⁹	6.4 x 10 ⁹
30%	8.3 x 10 ⁷	1.2 x 10 ⁷	5.3 x 10 ⁷

4. Conclusions

There are interactions on one variable observations are observed, namely, water content. Therefore salt concentration high significant effect on moisture content and significant effect on pH and protein in snakehead fish bekasam. Also, Fermentation media treatment high significant effect on moisture content of snakehead fish bekasam. But not significant effect on pH and protein. Which is total lactic acid bacteria (LAB) found in the highest concentration of salt fermentation medium with 10%, 75% black sticky tape: 25% of cassava.

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