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Effect of Storage Temperatures on the Quality and Microbial Safety of Fish-Based Sausage Analogs: A Physical and Microbial Assessment

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ABSTRACT

Sausage is a food product that has a shelf life of a certain time from production to consumption. Before the product experiences a decrease in quality or damage and is not suitable for consumption. This is related to food quality, so it is necessary to see the shelf life of the sausage product. The shelf life of sausages is related to the composition of the food itself, the processing and type of packaging used, storage conditions, distribution and handling mechanism. Semi-finished Food Products (Analog Sausage) through Physical Test, Shelf Life and Microbial Test. Physical test, shelf life tests on sausage products are carried out by observing the product for 1-3 months (30 days-90 days) by storing the product in the freezer at different temperatures, namely 10℃, 0℃, -5℃. The parameters used in this observation are taste, aroma, color and texture. The parameters used in this observation are taste, aroma, color and texture. Shelf life testing describes how long the product can stay at the same quality during the storage process. Changes in quality and research results in the form of standardization of storage of fish-based semi-finished food products (Analog Sausage). Physical tests on the storage of fish-based semi-finished food products (Analog Sausage). Analog sausage has a shelf life before and after changes can affect. Moisture content, ash content, carbohydrate content, protein content, fat content, fiber content in analog sausages. Shelf life of fish-based semi-finished food products (Analog Sausage). Product shelf life test in the quality durability test or shelf life test of analog sausage products stored in the freezer at 10℃, 0℃ and -5℃, the results showed that analog sausage products can last for 30-90 days. Organoleptic test was conducted on 30 panelists. The organoleptic test is a hedonic test, related to color, aroma, texture and general appearance. This test is interconnected Microbial tests carried out on analog sausages with a shelf life of 0, 30, 60 and 90 days at 0℃ with the ALT test parameter found that all met the requirements in accordance with the ISO 4833-1 standard: 2013 standard which is 10^6 kol/g.

1. INTRODUCTION

Sausage is a food product that has a shelf life of a certain period of time. The quality of sausage food composition can be influenced by the shelf life of the sausage product. The shelf life of sausages is related to the composition of the food itself, processing, type of packaging used, storage conditions, distribution and handling mechanisms [1]. Sausages can be a healthy food for children, but they must be consumed in reasonable quantities and in a safe way.

The condition of failure to thrive in toddlers due to chronic malnutrition that occurs since the baby is in the womb and in the early days after the baby is born is called stunting. Stunting is a growth disorder due to malnutrition in childrenund [2]. Stunting can also be defined as a short or very short body condition based on the index of Body Length for Age (PB/U) or Height for Age (TB/U) with a threshold z-score between -3 SD to < -2 SD. Stunting is measured as nutritional status by taking into account the height or length, age and sex of the toddler. The problem of stunting is one of the nutritional problems faced by the world, especially in poor and developing countries because it is associated with the risk of morbidity and mortality [3].

Nutrition plays an important role in achieving optimal growth including the development of a person's brain and intelligence so that in the end it also influences the quality of human resources [4]. The incidence of stunting is the impact of inadequate nutritional intake, both in terms of quality and quantity, high morbidity or a combination of the two [5].

Stunting occurs because of the pattern of feeding and not implementing a clean and healthy life. Inadequate nutritional intake, infectious diseases are factors that greatly contribute to the problem. Stunting is very closely related to feeding patterns, because children aged 2 years cannot express their desires, therefore parents must provide food intake that has good nutrition [6].

Indonesia is a country ranked 17th out of 117 countries with stunting, wasting and overweight complex nutritional

problems. This is proven by the high prevalence of malnutrition (19.6%), stunting (37.2%) and the increasing problem of obesity in toddlers (11.8%) [7]. Nutritional problems in toddlers show approaching. high prevalence according to the 2016 Indonesian Health Profile data. The percentage prevalence of underweight in children under five in Indonesia is 19.3%, stunting is 27.6%, wasting is 11.1% and the tendency for toddlers to be obese (overweight) 4.3% [8]. The North Bengkulu Regency Stunting Rate is quite high in Bengkulu Province, reached 38.5 percent. And there was a decrease in the stunting rate in North Bengkulu in 2019 to 10.35 percent or a decrease of 28.15 percent from 38.5 percent. Derso et al. [9] stated that the prevalence of stunting (58.1%) for children aged 6-24 months in Ethiopia was correlated with gender and parental income.

The problem of malnutrition in children starts with malnutrition during pregnancy which results in low cognitive abilities, the risk of stunting, and in adulthood the risk of suffering from chronic diseases [10]. Vonaesch et al. [5] shows that there is a relationship between stunting and being overweight, even in the poorest countries in the world.

The main causes of stunting include growth retardation in the womb, insufficient intake of nutrients to support rapid growth and development in infancy and childhood and frequent exposure to infectious diseases during early life [11] based on the results of research by Kusumawati et al. [12], the factors that influence stunting include most of the children having infectious diseases, children having low body length at birth, giving complementary foods that are not suitable for age accompanied by the consistency of the food and the child has a low birth weight at birth.

Ernawati et al.'s [13] research results found 9.5% of babies with low birth weight and 22% of them were stunted. According to Soekirman and the United Nations Children's Emergency Fund (UNICEF) low nutritional status can be directly affected by low nutrient intake and malignancy of infectious diseases. If not treated, this condition will continue until the child grows into a teenager [14].

Indonesia has never been free from the problem of food insecurity caused by a gap between a large population and national food availability. The biggest food need is food sources of carbohydrates which are sufficient for >50% of energy needs/person/day. Consumption of recommended food and actual consumption (kcal/capita/day) is only met by the grains group [15]. The potential of local food in Indonesia should be an alternative. Based on the 2014 Global Nutrition Report.

One effort that can be made to overcome this problem is to approach local food products that are rich in protein. The type of food that can be optimized according to the location is sea fish. The use of fish in Indonesia is generally fried or processed using spices therefore fish food ingredients have innovations to become a product food is sausage. Sausage is a processed meat food product packaged in a tightly closed container. In general, sausages are made from a mixture of mashed meat or fish and flour or with the addition of spices and other food additives. Sausage is one of the foods locally, processed sausage variations have prospects that are popular with the community and are very practical for consumption by children because animal-based sausages contain high protein and are very good for the growth and development of children and toddlers.

Fish has a high nutritional value, especially the animal protein content, so it is suitable as food to support the growth of toddlers. Processing fish into several products can be used as an alternative food for stunting food diversity. Stunting is still quite common in North Bengkulu district. There needs to be an effort to improve behavior health, one of which is consumption behavior. Efforts to overcome the problem of food-based stunting, especially animal protein sources, continue to be carried out to reduce the prevalence of stunting in children. Fish consumption behavior is carried out by utilizing the results of this fish processing which is used as an alternative stunting food diversification. From the perspective of sustainable food security, alternative foods based on local food, one of which is fish, are regional food sources whose potential can be increased for programs to overcome stunting problems [8].

Yuliantini's [16] research made an analogue sausage formulation from sea cork fish with the addition of oyster mushrooms in elementary school children who showed a lot of likes. Analog sausage contains 11.8% protein, 7.2% fiber, 46.12% potassium and 70.58% water. Analysis of the nutritional value of 100 grams of analog sausage shows an energy content of 377 kcal, protein 11.8%, fiber 7.2%, potassium 46.12% and water 70.58%. Analysis of the nutritional value of 100 grams of analogue sausage showed an energy content of 377 kcal, 17.5 grams of protein, 19 grams of fat and 24.45 grams of carbohydrates, 123.2 grams of calcium and 1.58 grams of dietary fiber. So that in 1 serving of 50 grams contains energy of 188.5 kcal, 8.75 grams of protein, 12.23 grams of fat and 61.6 grams of carbohydrates.

Research in DIY in 2011, the female population in DIY was recorded at 50.7%. Their potential should be used to support the family economy or reduce the household budget through the utilization of local food sources in their surroundings [13]. By increasing the role of groups of housewives through the introduction of technology for processing non-rice and non-wheat food sources so that they can be used to maintain food security and improve the household economy [17].

The North Bengkulu regional government, especially those who are members of the Stunting Reduction Team and all levels of society, are committed to continuing to reduce stunting rates in 2020, so that North Bengkulu Regency is free of stunting and active in adopting a healthy lifestyle.

2. MATERIALS AND METHODS

This research is an experimental research by conducting an experiment on the Standardization Study of Storage of Fish-Based Semi-finished Food Products (analog sausages) through Physical Tests, Shelf Life and Microbial Tests. Physical testing, shelf life test on sausage products was carried out by observing the product for 1-3 months (30 days - 90 days) by storing the product in the freezer at different temperatures of 10℃, 0℃, -5℃.

The method used to determine the shelf life of sausage products. Describes any quantitative or statistical methods used to analyze shelf life data. The reason is temperature. The quantitative method used to analyze shelf life data is by using Total Plate Count (TPC), which is a way of calculating the number of microbes contained in sausage products stored at 10℃, 0℃ and -5℃ with a storage period of 30 days, 60 days and 90 days. To show the number of microbes that grow on the media. Analysis of the calculation of bacterial colonies that grow on agar media for sausage products using media and reagents BPW 0.1% and PCA.

3. RESULT AND DISCUSSION

3.1 Results

3.1.1 Standardization of storage of fish-based semi-finished food products (analog sausages)

Sensory characters (preferability and descriptive in the form of color, elasticity, hardness, slice properties, stickiness, sandy texture and beany flavor), physical characteristics (cooking loss, emulsion stability, color, elasticity, hardness and microscopic appearance of the emulsion) and chemical characters (moisture content, protein, fat, ash and carbohydrates). The characters seen in this study were moisture content, ash content, carbohydrate content, protein content.

Fat content and fiber content. Preferred sausage analogues are stored at freezing temperatures. Shelf life test on sausage analogue of sea cork fish and oyster mushrooms was carried out by means of observe the product for 30-90 days by storing the product in the freezer with a temperature of 10℃, 0℃ and -5℃. The parameters used in these observations are taste, aroma, color and appearance.

The data above shows that the panelist's preference level for the appearance of the average color of the sausage is in the range of 3 (quite like) to 4 (like) on F2, namely sausages stored at 0℃ for 30 days, while the taste of the sausage is in the range of number 3 (pale). The color of the sausage is influenced by several factors such as the type of fish, the condition of the oyster mushrooms, the nation, the cage environment, the slaughtering environment, the condition before cutting. cutting and storage conditions, intramuscular fat, water content of the meat and the feed given [18], the color of the meat is also influenced by the water content and pH of the meat [19].

3.1.2 Physical test on the storage of fish-based semi-finished food products (analog sausages)

From Figure 1, the analysis parameters for analogue sausages for water content, it shows that the F1 treatment before 68.66 and after 69.89 experienced an increase in water content, F2 before 72.07 and after 73.9 experienced an increase in water content, and F3 before 72.85 after 73.76 also experienced an increase in water content. Formulations in F2 and F3 decreased due to the length of storage of 60 days and 90 days causing the amount of water content to increase so that the protein content in the sausage decreased significantly [20].

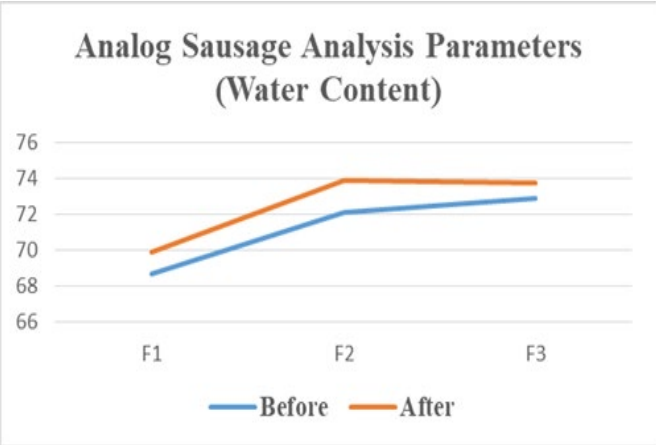

Figure 1. Analog sausage analysis parameters of water content

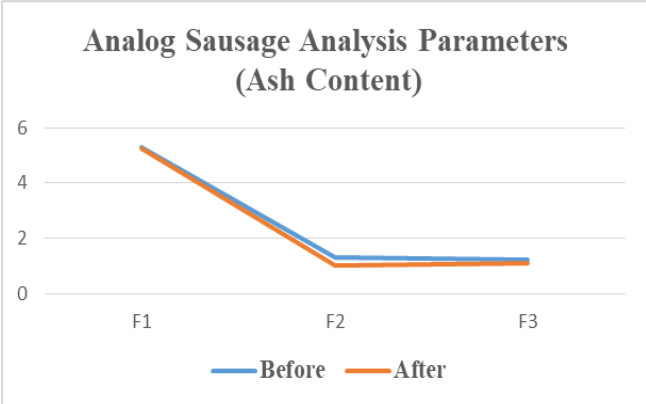

Figure 2. Analog sausage analysis parameters of ash content

From Figure 2, the analysis parameters for analogue sausages, the ash content showed that the three treatments, namely F1, F2 and F3, decreased. Where is the ash content before F1 5.29, after 5.26, F2 before 1.33 and after 1.02, then F3 before 1.22 and after 1.1.

Figure 3 shows a decrease in carbohydrate content after storage of the three treatments, namely F1 before 6.41 after 6.31, F2 before 10.57 after 10.17, and F3 before 9.46 after 9.45.

Figure 4 shows a decrease in protein levels after storage of the three treatments, namely F1 before 4.4 after 4.3, F2 before 4.4 after 2.5 and F3 before 3.5 after 1.8.

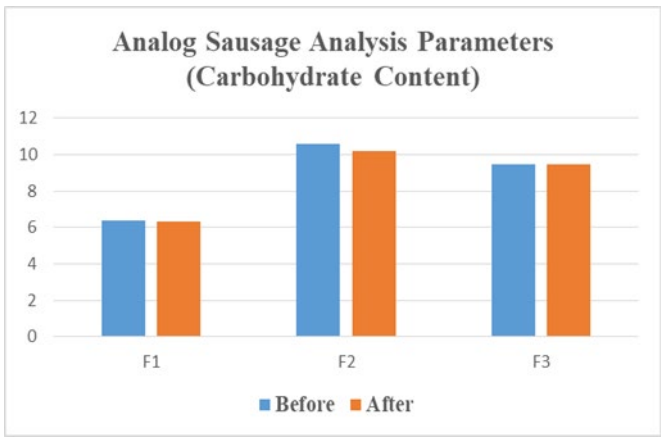

Figure 3. Analog sausage analysis parameters of carbohydrate content

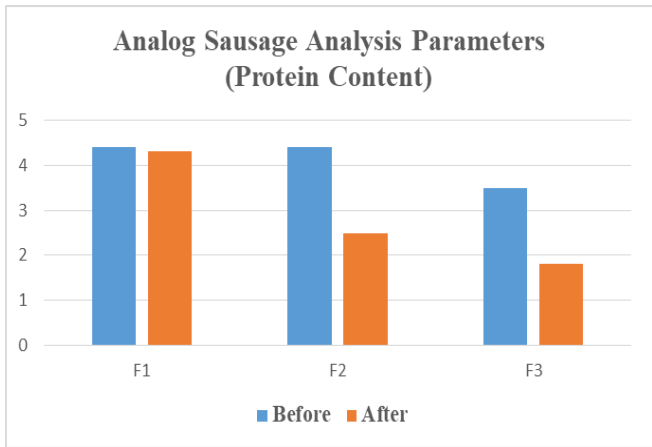

Figure 4. Analog sausage analysis parameters of protein content

Based on Table 1, it shows that the microbial tests carried out on analogue sausages with a shelf life of 0, 30, 60 and 90 days at 0°C with the ALT test parameters found that all met the requirements of the ISO 4833-1: 2013 standard.

From Table 1, it can be seen the Organoleptic Quality of Analog Sausages before and after being stored at a shelf life of 30 days, 60 days and 90 days at temperatures of 10°C, 0°C, -5°C.

Table 1. Organoleptic quality of Sausage Analog at temperature and shelf life different

Characteristics	Shelf Life					
	30 days		60 days		90 days	
	Before	After	Before	After	Before	After
FI Temperature 10°C						
Look	4	3.5	3.6	3.6	3.2	3
Taste	3.3	3.2	3.6	3	3.2	3.1
Color	3	3	3.3	3	2.9	2.4
Scent	3.5	3	2.5	2.2	2.7	2.5
F2 Temperature 0°C						
Look	4	3.4	4.2	3.5	3.6	3
Taste	3.3	3.2	3.6	3	3.4	3.3
Color	3	2.9	3.3	2.7	2.8	2.5
Scent	3	3	3.5	3.2	2.7	2.5
F3 Temperature -5°C						
Look	4	3.5	4.2	3.1	3.5	3.3
Taste	3.3	3.2	3.7	3	3.1	3
Color	3	3	3.3	3	3	3
Scent	3	3	3.5	3.2	2.7	2.5

Source: Primary data.

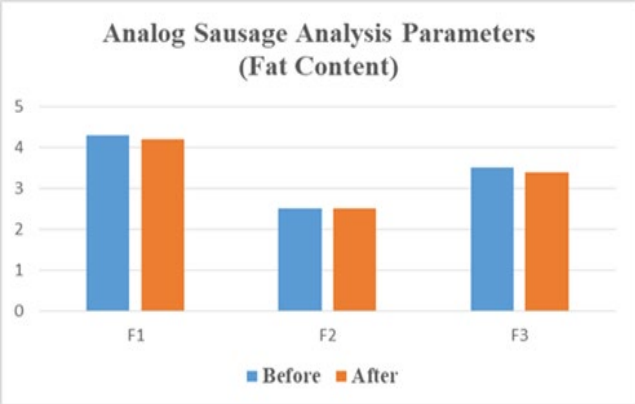

Figure 5. Analog sausage analysis parameters of fat content

Figure 5 shows a decrease in fat content after storage of the two treatments, namely F1 and F3, while F2 did not experience an increase or decrease. Where the treatment is F1 before 4.3 after 4.2, F2 before 2.5 after 2.5, and F3 before 3.5 after 3.4.

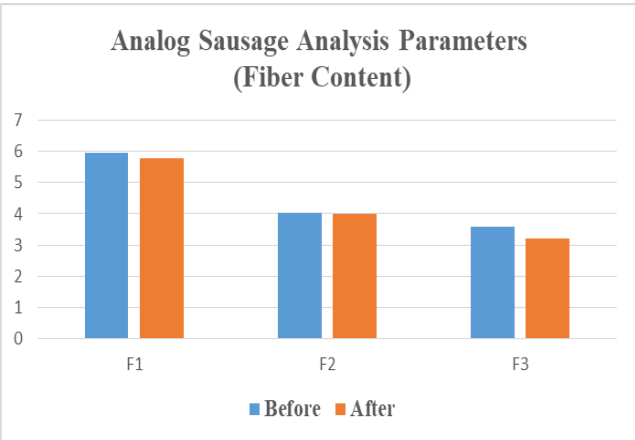

Figure 6. Analog sausage analysis parameters of fiber content

Figure 6 shows a decrease in fiber content after storage of the three treatments, namely F1 before 5.95 after 5.8, F2 before 4.03 after 4.0, and F3 before 3.6 after 3.2.

3.1.3 Shelf life of fish-based semi-finished food products (Analog Sausages)

Sausages have different shelf lives, depending on how they are processed. Raw sausages must be stored in the refrigerator or stored frozen with the package intact and can be cooked completely before consumption. Cooked sausages can be stored in the refrigerator for seven days after opening the package, or stored frozen. Dried sausages can be stored at room temperature until. three weeks. Semi-dry sausage can last up to three weeks (whole packaging) by storing it in the refrigerator. If the package has been opened, store it in the refrigerator and use it within three days or store it frozen [21]. Requirements for good quality of meat sausage according to SNI 01-3820-1995.

Product shelf life test in the quality endurance test or shelf life test for analog sausage products stored in the freezer at 10°C, 0°C and -5°C, the results obtained were that analog sausage products could last for 30-90 days. The results of the shelf life test using organoleptic tests on sausage products with.

Determination of the expiration date by storing a series of products under normal daily conditions while observing the decline in quality (usable quality) until it reaches the expiration quality level [22], then the next step is to prove the presence or absence of bacteria in analog sausage products.

Similar research on beef sausage storage in traditional markets was conducted without ice and did not use ice flasks as a storage tool. This is certainly not safe for consumers. Calculating total bacteria to see the effect of temperature and length of storage of beef sausages stored at 10°C-15°C and room temperature 27°C-30°C. There is an effect of temperature and storage duration on total bacteria, there is an interaction of temperature and storage duration on total bacteria and there is an effect of temperature and storage on organoleptic assessment [20].

3.1.4 Microbial testing on storage of fish-based semi-finished food products (analog sausages)

Based on the results of the analog sausage sample test conducted at the BPOM, it shows:

Conclusion: Qualified (MS).

Based on Table 2, it shows that the microbial tests carried out on analogue sausages with a shelf life of 0, 30, 60 and 90 days at 0°C with the ALT test parameters found that all met the requirements of the ISO 4833-1: 2013 standard.

Table 2. Test results of analog sausage samples F1, F2, F3, and F4

No.	Test Parameters	Results	Condition	References
		n1	M	
F1	ALT	< 40 kol/g	10^6 kol/g	ISO 4833-1 :2013(Tuang)
F2	ALT	3.0×10^2 kol/g	10^6 kol/g	ISO 4833-1: 2013 (Tuang)
F3	ALT	1.7×10^3 kol/g	10^6 kol/g	ISO 4833-1: 2013 (Tuang)
F4	ALT	8.0×10^1 kol/g	10^6 kol/g	ISO 4833-1: 2013 (Tuang)

3.2 Discussion

3.2.1 Physical testing of storage of fish-based semi-finished food products (analog sausages)

a. Moisture content

The moisture content of F1 before 68.66 after 69.89, F2 before 72.02 after 73.9 and F3 before 72.85 after 73.76. Based on research by Ambari et al. [23], it shows that the maximum SNI 01-3820-1995 is 67%, this does not meet the ISN requirements. There are two treatments where there is an increase in water content because the water content of the sausage is more influenced by processing factors, namely boiling and storage which can cause. food evaporation. This is also in line with the research of Rahma and Sutrisno [24]. The principle of measuring the water content in analog sausages is by evaporating the water contained in the sausage using a dry oven at a temperature of 100-105°C, then the weight loss of the material is weighed from the difference between the initial weight and the weight end. In the analog sausage, the water content can affect the chewy texture and cooking shrinkage of the food product.

Water affects palatability because water contributes to the tenderness and "juiciness" of the final sausage product. Research by Mustika et al. [25] stated that differences in water content can also be affected by the protein content of the sausages produced. The amount of water lost is greater if the protein content is higher. The more protein content will bind the water content which makes the texture of the sausage chewy.

Chemical Quality Testing Chemical quality testing was carried out including testing for water content, ash content using the gravimetric method and protein content using Kjeldahl. The chemical quality of the sausages was analyzed according to the method of the Association of Official Analytical Chemist (AOAC) (1995). Testing the Physical Quality of Sausage pH Measurement, the pH value was tested using a glass pH meter electrode following the method that has been carried out [26]. Sausage Cooking Loss Calculation of cooking losses by looking at the weight loss during cooking in units of % and determined by the combination of each repetition according to the method [27].

Water Holding Capacity (DIA), the water binding capacity test was carried out according to the Hamm method (1972). Testing the water holding capacity of the sausage begins with preparing a sample weighing 0.3 g. The 0.3 g sausage was placed between two Whatman filter papers, then pressed in a corper press to a pressure of 35 kg/m^2 for 5 minutes. After the sausages in the stack of filter paper have become molds like plates, measure the area using a planimeter. The water content of the sausage is determined by weighing 5 g of the sausage, then placing it in a porcelain cup and weighing it again. The porcelain cup containing the sample was dried in an oven at 105°C for 16 hours until a constant dry weight was obtained.

b. Ash content

Analysis of analog sausage ash content showed that the three treatments, namely F1, F2 and F3, decreased. Where the ash content before F1 was 5.29, after 5.26, F2 before 1.33 and after 1.02, then F3 before 1.22 and after 1.1 there was an increase that was higher than the maximum value, namely in the F1 treatment. Then in treatment F2 and F3 these values still meet the standard ash content according to SNI 01-3820-1995, which is a maximum of 3%. This indicates that the addition of oyster mushrooms can significantly reduce the ash content in the final sausage product (in 20% added oyster mushrooms there are 19.50 g of organic matter). This is supported by the results, namely an increase in treated organic matter can reduce the ash content proportionately [24]. Ash content is a mixture of inorganic or mineral components found in a food ingredient [28].

c. Carbohydrate levels

According to research by Ambari et al. [23], decreased carbohydrate content after storage of the three treatments, namely F1 before 6.41 after 6.31, F2 before 10.57 after 10.17, and F3 before 9.46 after 9.45. The carbohydrate content of the selected sausages is F1 and F2 and F3, these values do not meet the requirements for carbohydrate content according to SNI 01-3820-1995, which is a maximum of 8%. This is presumably due to the carbohydrate content in the sausage, the lack of nutrients in each treatment.

d. Protein content

Decreased protein levels after storage of the three treatments, namely F1 before 4.4 after 4.3, F2 before 4.4 after 2.5 and F3 before 3.5 after 1.8 Protein is a very important food substance for the body because This substance functions as a source of energy in the body as well as a developmental and regulatory substance. In addition, the protein contained in black soybean tempeh is easily digested and more water soluble.

This black soybean tempeh analog sausage also does not contain anti-nutrients. Protein levels can be affected through the cooking process. Based on the research by Achmadi [29], processing with heat causes a decrease in nutrition compared to fresh ingredients. These changes depend on time, cooking and temperature conditions [30]. Heating above 60°C causes nutrient molecules such as proteins, carbohydrates, fats and nucleic acids to become unstable [31] In addition, the use of salt in each treatment provides the protein's ability to bind water and fat.

An increase in the water content in the product can cause the protein to decrease. In a previous study conducted by

Kawahara et al. [32], the treatment of adding transglutaminase enzymes to chicken and pork sausages, the results obtained were that the protein content of sausages that received transglutaminase enzyme treatment decreased compared to sausages without transglutaminase enzyme treatment. Protein also acts as a binder, this is supported by Khasrad et al. [33] high protein content in meat causes an increase in the ability to hold water in the meat thereby reducing the free water content, and vice versa. The minimum standard for protein content in chicken sausage according to BSN (2015) is 13%. This can be interpreted that the protein content of the research results is in a good category.

e. Fat content

The decrease in fat content after storage was carried out by the two treatments, namely F1 and F3, while F2 did not experience an increase or decrease. Where the treatment is F1 before 4.3 after 4.2, F2 before 2.5 after 2.5, and F3 before 3.5 after 3.4. This value still meets the standard for fat content according to SNI 01-3820-1995, which is a maximum of 25%.

Amany et al. [34] stated that the higher the cooking temperature will cause a product to become more porous and the emulsion can break, this causes the water content and fat content to decrease. Lengkey et al. [35] argued that the fat content of sausages needs to be considered, because high fat content can be a problem, if the fat content is too high, the appearance of the sausage will be unfavorable because the fat in the sausage emulsion will separate.

f. Fiber content

Based on the sausage quality standards (SNI 01-3820-1995) there is no standard for fiber content in analog sausages which is considered as added value to analog sausages. Dajarot [36] explained that fiber affects food ingredients, because fiber levels can affect the appearance, taste and texture of food ingredients. In the proximate analysis of the component fibers observed were cellulose, hemicellulose and some lignin. Hemiselulosa mempertahankan air dalam feses dan meningkatkan volume. This is in accordance with the opinion of Kusharto [37] which states that the type of fiber contained in rice bran is cellulose. In the digestive process, cellulose is not digested. Cellulose provides an essential ingredient and a coarse material in food which helps maintain mobility and the health of the digestive tract [38].

Measurement of fiber content in analog sausages was carried out by proximate test. Fiber content after storage of the three treatments was F1 before 5.95 after 5.8, F2 before 4.03 after 4.0, and F3 before 3.6 after 3.2. The results of fiber content during storage decreased due to the hydrolysis process by enzymes. The addition of oyster mushrooms and egg whites in analog sausages gives an increase in fiber content [39].

3.2.2 Shelf life of fish-based semi-finished food products (analog sausages)

Sausages have different shelf lives, depending on how they are processed. Raw sausages must be stored in the refrigerator or stored frozen with the package intact and can be cooked completely before consumption. Cooked sausages can be stored in the refrigerator for seven days after opening the package, or stored frozen. Dried sausages can be stored at room temperature until. three weeks. Semi-dry sausage can last up to three weeks (whole packaging) by storing it in the refrigerator. If the package has been opened, store it in the refrigerator and use it within three days or store it frozen [21]. Requirements for good quality of meat sausage according to SNI 01-3820-1995.

Product shelf life test in the quality endurance test or shelf life test for analog sausage products stored in the freezer at 10℃, 0℃ and -5℃, the results obtained were that analog sausage products could last for 30-90 days. The results of the shelf life test using the organoleptic test on sausage products using the ESS (Extended Storage Study) method where the ESS method is to determine the expiration date by storing a series of products under normal daily conditions while observing the decline in quality (usable quality). until it reaches the expiration quality level [22], then the next step is to prove the presence or absence of bacteria in Analog sausage products.

3.2.3 Organoleptic test on the storage age of fish-based semi-finished food products (analog sausages)

Based on the results of the analog sausage sample test on the 16th day, it showed that there were bacteria in the analog sausage product samples. The growth of Total Microbial Colonies in analog sausages on day 16 can be influenced by factors such as the supply of nutrients (food), pH, temperature, time and availability of oxygen [40]. Microbial test results show the physical condition of the analog sausage after more than 30 days has changed, this is due to microbial activity and increased water content in the product, causing the analog sausage product to experience changes in taste, aroma, color and texture. According to Mansauda [41], an increase in the number of microorganisms that. Growth during the storage period can be caused by an increase in the water content of the product. The increase in water content will increase the water activity (aw) of the product. These changes can also be proven by carrying out a bacterial test on fruit sausage products by carrying out microbial tests on fruit sausage products that have undergone physical changes, after carrying out the microorganism test the results obtained, namely the presence of gram-positive bacteria. Gram positive bacteria. are bacteria that retain the methyl purple dye during the gram staining process. There are ± 30 colonies in each sample cup of fruit sausage products, where the maximum limit for microbial contamination based on BPOM (2009) for types of processed basah food is ALT (300C for 72 hours) 1×104 colonies/gram or ml.

The porcelain cup containing the sample was then cooled in a desiccator and then Hedonic and Hedonic Quality Testing of Sausages Panelists were semi-trained panelists, consisting of level 4 students of D4 Nutrition study program at the Bengkulu Ministry of Health Polytechnic with an undetermined gender. Recruitment, selection and training are carried out based on sensory evaluation procedures [42]. Fifty panelists were selected from 30 potential panelists using a basic taste identification test.

Sausage samples are cooked in the oven as described before, then cut into pieces and served warm. The hedonic quality scores were color (1-5: brown - white), aroma (1-5: very fish and oyster mushroom flavor - very fish and oyster mushroom flavorless), texture (1-5: coarse - smooth) and taste (1-5: very bitter - not very bitter). Hedonic test assessment for all parameters (1-5: really dislike - really like). The organoleptic test was carried out on 30 panelists. Organoleptic tests in the form of hedonic, related to color, aroma, texture and appearance in general [43].

3.2.4 Microbial tests on storage of fish-based semi-finished food products (analog sausages)

Based on Table 2, it shows that the microbial tests carried

out on analogue sausages with a shelf life of 0, 30, 60 and 90 days at 0℃ with the ALT test parameters found that all met the requirements with the ISO 4833-1: 2013 standard. Microbiological Test Results with the results of the preparation plastic, colorless, tasteless and odorless. The microbial counts of the four analog sausage formulas with the specified temperature and shelf life all met the requirements. The table shows that the total microbial contamination does not exceed the permitted amount, namely 10^6 col/g.

4. CONCLUSIONS

Standardization of storage of fish-based semi-finished food products (Analog Sausage) at 10℃, 0℃ and -5℃ for 30-90 days. Physical tests on the storage of fish-based semi-finished food products (Analog Sausage). Shelf life before and after there are changes that can affect water content, ash content, carbohydrate content, protein content, fat content, fiber content in analog sausages. Organoleptic tests are hedonic, related to color, aroma, texture and general appearance. Microbial tests are all qualified by the ISO 4833-1 standard: 2013.

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