Global Scientific JOURNALS

GSJ: Volume 10, Issue 4, April 2022, Online: ISSN 2320-9186

www.globalscientificjournal.com

# THE PREFERRED LEVEL OF CRACKERS FORTIFIED MACKEREL BONE MEAL AS A SOURCE OF CALCIUM

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## ABSTRACT

*This research was conducted to determine the concentration level of mackerel fish bone meal in crackers. Research activities were carried out at the THP Laboratory of Padjadjaran University. The research method used is an experimental method of 4 treatments with 20 semi-trained panelists. The variations in the bone meal concentrate were 0%, 5%, 10% and 15%. The waste of mackerel fish bones is obtained from the Astana Newer Market, Bandung. The results showed that the 10% rate of adding mackerel fish bone meal resulted in the most preferred cracker with the median value of color and aroma characteristics, namely 6 textures and flavors, namely 7. The crackers had a protein content of 0.40%, an ash content of 2.94%, water content 4.17% and fat content 14.16%.*

*Keywords: Fortification, Mackerel Fish, Calcium, Bone Flour, Crackers*

## INTRODUCTION

Waste is a problem in an industry, especially fisheries processing that is facilitated through the process of fishing, handling, transportation, distribution and marketing (Rijal 2016). The resulting waste can be solid waste or liquid waste (Putra *et al*. 2015). Waste generated in a fish processing industry is usually in the form of fins, bones, head, offal and tail which amounted to 35%. Every component of fish is an organic component that should still be utilized. Offal and fish heads still have a high protein content and also there are still omega 6 and omega 9. Bone waste contains a lot of calcium.

Mackerel fish is usually used as a raw material for making pempek, fish meatballs, siomay and other similar foods that only use the dagingnya (Susanti 2011). As a result of processing products that are more focused on meat, it leaves a lot of waste in the form of scalp, scales, fins and bones (Jaya 2011). Utilization of waste in the form of bone in Indonesia in the form of glue and bone flour. Fish waste in the form of leather has been utilized gelatin. While waste in the form of bones has not been widely used into a product. Though mackerel fish bones have the potential to be processed into products because they have calcium, phosphorus, and carbonate content. One example of the use of mackerel fish bones is the manufacture of fortified fish bone meal into crackers.

Fortification is a deliberate attempt to add important micronutrients of vitamins and minerals to the diet, thereby improving the nutritional quality of the vitamin. food supply dan It is beneficial for public health with at least risk to health. Fortification of important vitamins and minerals include folic acid and Fe-fumarate (WHO 2008 in Surahman 2016). Fortification is usually done on products that are often consumed. The purpose of food fortification is the prevention of deficiencies, thereby avoiding the occurrence of disorders that lead to human suffering and socio-economic harm. However, food fortitcation is also used to remove and control nutritional deficiencies and the resulting disorders.

Fish bone meal is one of the products of fish bone preservation in the form of dry ground into flour. Fish bone meal has a high nutritional value, especially calcium and phosphorus content (Nabil 2005). One of the uses of bone flour is to increase calcium by fortified in the manufacture of biscuits (Maulida 2005), dry noodle making (Mulia 2004), wet noodle making (Susanti *et al*. 2010), pastry making (Darmawangsyah *et al*. 2016) and baked doughnut making (Bakhtiar *et al*., 2019).

Mackerel bone meal can be patched into a product that can increase nutritional value and can be in demand by the people of Indonesia. One form of addition of mackerel bone meal is the manufacture of crackers. Crackers are one of the typical Indonesian snacks that are much loved by people from various layers and all ages. Crackers are often consumed as a snack on the main menu every day.

## RESEARCH METHODS

The method to be used in this research is experimental, consisting of 5 treatments with 20 semi-trained panelists as repeatists. The treatments in this study are:

A. 0% Bone Meal;
B. 5% Bone Meal;
C. 10% Bone Meal; D. 15% Bone meal.

### Research Procedure

The procedure carried out in this study consists of several stages, namely the manufacture of mackerel bone meal, the manufacture of crackers with the addition of mackerel bone flour, sample testing (protein, carbohydrates, ash, fat, moisture content), and organoleptic testing. The procedure of making bone flour according to Asni (2004) is as follows:

Fresh fish bones consisting of part of the backbone to the tailbone that has been cut into pieces, then the bones are washed with running water, then the fish bones are steamed for 10 minutes, the bones are cleaned from the rest of the meat attached and other parts are not needed, then washed with running water. The fish bones that have been cleaned, then put in boiling water and boiled for 120 minutes at a temperature of 100 ° C. Cutting the bone by a size of 5 cm. The pieces of bone are put in a presto pan over a high heat after it sounds, then use a low heat for 180 minutes for the fish bones to become soft. Pieces of bone are dried using an oven with a temperature of 100 °C. Bones that have dried digiling Use a grinder to smooth into bone meal. The flour produced is sedated by using sying so that homogenous fish bone meal is obtained.

How to make crackers refers to the method of Tababaka (2004) which is modified in raw materials as follows: 100 g tapioca flour mixed with 4% iodized salt, 2% sugar, 3% garlic and 40% water. The mixture is heated until it is darkened. Once cold the dough is added fish bone meal and homogenized by stirring.

The donation continues with the addition of the remaining tapioca flour little by little and the addition of water as much as 40% of the total weight of the dough until homogeneous. The dough is put into a baking sheet and steamed for 90 minutes. The dough is cooled and put in the refrigerator for 18 hours or until the dough hardens. The dough is sliced using a knife with a thickness of 1-3 mm and then dried with sunlight for 3 days. Dried raw crackers are fried for 10 seconds and lined.

**Table 1. Formulation of Cracker Making Ingredients with the Addition of Mackerel Bone Meal**

| Treatment (%) | Tapioca flour (g) | Bone meal (g) | Salt (g) | Sugar (g) | Garlic (g) | Air (%) |
|---|---|---|---|---|---|---|
| 0 | 100 | 0 | 4 | 2 | 3 | 40 |
| 5 | 100 | 5 | 4 | 2 | 3 | 40 |
| 10 | 100 | 10 | 4 | 2 | 3 | 40 |
| 15 | 100 | 15 | 4 | 2 | 3 | 40 |

Source: Tababaka (2004)

**Parameter**

Observations are made on organoleptic tests ( favorite tests with observed parameters namely appearance, scent, texture, and taste), water content tests, and calcium tests on crackers that most panelists and crackers prefer without treatment.

**Water Content Test (AOAC 1995)**

The water content analysis is based on differences in the weight of the example before and after it is dried. The goal is to find out the amount of water in a material determined by the weight reduction of a material heated at the test temperature. The working steps in water content testing are as follows:

The empty cup to be used is dried in the oven for 15 minutes then weighed. A total of 2 g of the sample is put in a cup and dried in the oven at a temperature of 105-100 °C for 3-4 hours. The cup is cooled in a decikator. The cup is re-weighed. The percentage of sample water content is calculated by the formula:

$$\textit{Up to air}\ (\%) = \frac{B1-B2}{B}\ X\ 100\ \%$$

Information:
B = Sample weight (g)
B1 = Weight (sample + cup) before drying
B2 = Weight (sample + cup) after drying

**Calcium Level Test (AOAC 2000)**

Calculation of calcium levels is done to find out the percentage of calcium levels contained in the sample, how much increase in calcium levels of crackers after fortification of fish bone meal. The principle of testing calcium by the AAS method is that sample ash dissolved in acid is added with *Lanthanum Oxide* to prevent the formation of ions other than Ca at the time of determination using the *Atomic Absorptoin Spectrophotometer tool.* The results obtained from the sample testing are multiplied by the weight of serving serving crackers. Calcium level testing procedure (AOAC 2000 *in* Ngudiharjo 2011).

Reagent manufacturing:
- HCl 3N 258 ml HCl + aquades up to the limit of 1 liter
- La2O3 5 % 58, 65 g La2O3 + 250 ml HCl + aquades up to the limit of 1 liter
- Determination
- A sample of crackers weighed weighing 2 grams (w), burned in a furnace of 550 °C to become ash for 4 hours
- Manufacture of parentage (dilution results) with the addition of HCL 3 N 10 ml, then boiled for 10 minutes, filtered using paper *Whattman* 41 inside the

pumpkin measure 250 ml, then added with aquades to the limit, then 1 ml of parentage is taken and put into a 50 ml pumpkin

- Sample added 10 ml $La_2O_3$ 5% and added aquades up to the limit of 50 ml. Sample reading with an AAS device with a wavelength of 422.7 nm. Calculation:

$$\%Ca = \frac{CxOxF}{WxAx\,10000}$$

Information:
C = Concentration of titration readings
O = Inducting Dilution (1 ml)
F = Final dilution for reading (250 ml)
W = Sample Weight
A = Solution taken for dilution

**Data Analysis**

Data results in the calculation of water content, and calcium levels and analyzed descriptively comparatively. Comparative descriptive methods, namely the results of research and its analysis are outlined in a scientific paper in the form of a narrative, then generally done with the aim of systematically describing the facts and characteristics of the object or subject being examined appropriately.

Organoleptic test results data were analyzed using non-parametic statistics using a two-way variant analysis of the Friedman test with the Chi-Quadratic test (Siegel 1992). The statistics used in friedman's test are defined by the following formula:

$$X^2 = \frac{12}{bk(k+1)}\sum_{i=1}^{t}(Rj)^2 - 3b\,(k+1)$$

Information:
$X^2$ = Friedman test statistics
b = Repeat
k = Treatment
$R_{j2}$ = Total ranking of each treatment

If there is the same number done the calculation of correction factor (FK) with the following formula:

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

$$X^2 = \frac{X^2}{FK}$$

The significance value of the $X^2$ observation price can be known by using the Chi-Squared price-price table with db = k-1; a = 0.95. The rules of the decision to test the hypothesis are:

$X^2_0$ = treatment does not make a real difference to the level of trust a = 0.95
$X^2_1$ = noticeable difference in trust level a = 0.95

If the price of $X^2 < X^2_{(a(k-1))}$, then $X^2_0$ is accepted and $X^2_1$ is rejected, and if $X^2 > X^2_{(a(k-1))}$, then $X^2_0$ is rejected and $X^2 1$ is accepted. If $X^2_1$ is accepted, then the treatment gives a noticeable difference and the test continues to find out the median value that is not the same or to find out the difference between treatments using *multiple comparison* tests with the following formula:

$$\left|R_i - R_j\right| \geq Z\sqrt{bk(k+1)/6}$$

Information:
| R_i - R_j | = difference in the number of rankings per treatment
$R_i$ = average rating of the ith sample
$R_j$ = average rating of the jth sample
b = many repeats
k =the amount of treatment

## RESULTS AND DISCUSSIONS

### Appearance of Mackerel Bone Meal Crackers

Appearance is the first characteristic that is assessed by consumers because the appearance assessment has the purpose to know the consumer's acceptance of surface appearance, wholeness, and the color of crackers. The results of observations on the level of fondness of appearance of crackers from various treatments of the level of addition of mackerel bone meal are found in Table 2.

**Table 2. The Level of Fondness of Appearance of Crackers In Each Treatment**

| Addition of Mackerel Bone Flour | Median | Average |
|---|---|---|
| 0 | 7 | 6,3a |
| 5 | 5 | 5,5a |
| 10 | 7 | 6,3a |
| 15 | 5 | 5,5a |

Description: The number followed by the same letter shows no real difference according to the double comparison test at the 95% confidence level

The results of the analysis of the appearance of crackers showed that the average value of the fondness rate of cracker appearance ranged between 5.5 and 6.3. This range of values indicates that appearances on crackers are still acceptable or preferred by panelists. The rate of addition of mackerel bone meal by 0% and 10% produces crackers with an average value of the same color preference rate of 6.3 while crackers obtained from the rate of addition of mackerel bone meal by 5% and 15% have an average value of 5.5. Based on Friedman's analysis with a 95% degree of confidence it was seen that the rate of addition of mackerel bone meal had no real effect on the level of fondness of appearance of crackers resulting.

### Scent of Mackerel Bone Meal Crackers

Scent is one of the parameters in testing sensory properties (organoleptic) using the sense of smell. Aroma is acceptable when the resulting material has aroma spesifik (Kusmawati dkk 2000). Furthermore, Scent is a subjective sensation produced by smell (smell). The results of observations on the level of fondness of cracker aroma obtained from various levels of addition of mackerel bone meal are found in Table 6.

**Table 6. The Preferred Level of Aroma Of Crackers In Each Treatment**

| Addition of Mackerel Bone Flour | Median | Average |
|---|---|---|
| 0 | 5 | 5,1a |
| 5 | 5 | 6,1a |
| 10 | 7 | 6,3a |
| 15 | 6 | 6,3a |

Description: The number followed by the same letter shows no real difference according to the double comparison test at the 95% confidence level

Based on Friedman's analysis with a confidence degree of 95% it was seen that the rate of addition of mackerel bone meal had no real effect on the level of fondness of the aroma of crackers produced. This means that the aroma of crackers caused by crackers resulting from the addition rate of bone meal of different mackerel fish gives the same impression, equally preferred.

**Texture of Mackerel Bone Cracker**

Texture is one of the characteristics that can affect the acceptance of a food product. The expected texture of crackers is a cracker with a crunchy texture. Hedonic testing of texture is by biting crackers to find out their crispness. The results of observations on the level of fondness of cracker aroma obtained from various treatments of the level of addition of mackerel bone meal are found in Table 3.

**Table 3. The Preferred Level of Texture of Crackers In Each Treatment**

| Addition of Mackerel Bone Flour | Median | Average |
|---|---|---|
| 0 | 5 | 5,1a |
| 5 | 7 | 6ab |
| 10 | 7 | 7.1b |
| 15 | 7 | 6.9b |

Description: The number followed by the same letter shows no real difference according to the double comparison test at the 95% confidence level

Based on Friedman's analysis with a 95% degree of confidence it was seen that the rate of addition of mackerel bone meal had a real effect on the level of fondness of the texture of the resulting crackers.

**Preferred Level of Mackerel Bone Cracker Flavor**

Taste is one of the criteria that determines a consumer's decision to accept or reject a food. Taste factors play an important role in the selection of products by consumers, because although the nutritional content is good but tastes unacceptable to consumers, the product will not sell (Winarno 1997). The results

of observations of the aroma of crackers obtained from various levels The addition of mackerel bone meal is found in Table 4.

**Table 4. The Level of Fondness of Crackers In Each Treatment**

| Addition of Mackerel Bone Flour | Median | Average |
|---|---|---|
| 0 | 5 | 5.5a |
| 5 | 7 | 6.5ab |
| 10 | 9 | 7.1b |
| 15 | 7 | 7b |

Description: The number followed by the same letter shows no real difference according to the double comparison test at the 95% confidence level

Based on Friedman's analysis with a 95% degree of confidence it was seen that the rate of addition of mackerel bone meal had a real effect on the level of fondness of the taste of crackers produced.

Based on the results of the research concluded that the rate of addition of mackerel bone meal by 10% produces the most preferred crackers with the median value of color and aroma characteristics, namely 6, texture and taste that is 7. The crackers have a protein content of 0.40%, ash content of 2.94%, water content of 4.17% and fat content of 14.16%.

## CONCLUSION



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