Characteristic of fortified crackers with largehead hairtail fish flour

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Abstract. Crackers is very popular food product. In general, crackers are made from wheat flour, margarine and flavors, so they contain more carbohydrates, fat and sugar than protein. Therefore it is necessary to increase the nutritional content of crackers with the addition of nutrients, especially protein and minerals. Fish is a source of high protein and mineral content. This research was conducted to determine the chemical, physical, and organoleptic qualities of fortified crackers using Largehead hairtail fish flour. Largehead hairtail fish flour is fortified in crackers by 0, 10, 20 and 30%. The method used was an experimental method (completely randomized design with 4 treatments and 3 replications). Crackers were analyzed for proximate, aW, hardness, sensory, amino acid content, calcium and phosphorus. The results of sensory analysis was showed that the panelists like crackers with the addition of 10% Largehead hairtail fish flour and have 7.6% moisture content; 3.53% ash content; 14.6% fat content; 12.33% protein content, 61.97% carbohydrate content, 3.48 g / kg calcium content, 2.96 g / kg phosphorus content.

1. Introduction
Largehead hairtail fish are included in the Trichiuridae family, which consists of 10 genera. Three genera of fish caught in Indonesian waters, namely Eupluerogrammus, Trichiurus and Lepturacanthus, with the species being Eupluerogrammus musmuticus (Eupleurogrammus glosodon), Trichiurus lepturus and Lepturacanthus savala (Trichiurus savala). In some literature, the three genera are included in one genus, namely Trichiurus, with the species being T. muticus, T. savala and T. lepturus or T. haumela [1].

Fish is important food component in the diet, not only as a source of protein but also a significant supply to the need of polyunsaturated fatty acids or omega-3. These nutrition are very beneficial to human health and stamina. Fish is consumed at several place of the world because of its high contents of protein, amino acid and saturated fatty acid. Because of the nutrition content of fish, the utilization of marine fish and its products increased significantly [2]. The chemical composition of fish species is the basic importance to be applied in process production [3]. The information of the nutrient composition of some important foods is important to understand the correlation between food productions, access, nutrient intakes and innovation of production technologies to guarantee that food supply population fulfils nutrient requirements optimally [4].
Crackers is one of the popular snack foods in Southeast Asian countries include Indonesia. Cracker is a snack food commonly made from starch, such as sago starch which is high in carbohydrate content. In order to increase the protein content in crackers, it can be add fish flour. This research was conducted to determine the chemical, physical, microbiological and organoleptic qualities of fortified crackers using Largehead hairtail fish flour.

2. Material and Methods

*Tritichurus lepturus* were purchased from Pelabuhan Ratu, West Java. The size was 150-250g/fish. The process of making fish flour begins with removing the head and stomach contents, then washing and reducing the size of the fish. The cooking process used an autoclave at a temperature of 121°C for 1 hour, then pressing and drying it with an oven at 70-80°C for 5 hours and crushing using a hammer mill.

The fish flour obtained was then fortified into the crackers product by formulation treatment in the manufacture of crackers with concentrations of 0, 10, 20 and 30%. The manufacture of pelagic fish based crackers snacks refers to the modification of Kaewmanee *et al* method [5] with the ingredients used are whole wheat flour, butter, sugar, salt, baking soda and fish flour (0, 10, 20 and 30% by weight. wheat flour (w / w)). The process of making crackers involves mixing all the ingredients until they are homogeneous. The resulting mixture of crackers is then made into sheets with a thickness of 0.4 mm and cut to size (2.4 × 7.3 cm), then in the oven at 170 °C for 20 minutes. The resulting crackers were cooled at room temperature for 1 hour before testing. Crackers were analyzed for proximate, aW, hardness, sensory, amino acid content, calcium and phosphorus.

3. Results and Discussion

The research on making crackers with the fortification of *tritichurus lepturus* fish flour was carried out with the aim of overcoming the problem of malnutrition in the community, especially children and supporting food security programs by providing high nutritious snacks for people of all ages. This is due to the fact that most of the crackers on the market have high carbohydrate content and low protein content. In addition, it is also hoped that these crackers can become one of the diversified products of processed fish. The moisture content of crackers can be seen in the image below.

![Figure 1. Moisture content of crackers.](image_url)

The results of statistical analysis showed that the addition of fish flour had a significant effect on the moisture content of crackers. The resulting crackers have moisture content ranging from 6.04-8.71% (Figure 1), it still did not fill the Indonesian crackers standard which has a maximum limit of 5%. Baking time can be added so the crackers had a moisture content of less than 5%. Based on the graphic image, it can be seen that the water content of crackers tends to decreased, this is due to the
addition of the higher concentration of fish flour on the crackers. Mohamed et al. in 1988 [6] concluded that insufficient water may lead to incomplete gelatinization of starch during the steaming process. Thus, fish crackers do not expand well. Furthermore, excess water causes a decrease in expansion and results in thinner fish crackers after drying. In addition, too much moisture also results in dough that is too soft and difficult to slice.

Ash is an inorganic residue that is obtained by furnacing the components in food. The amount and composition of ash in minerals depends on the type of foodstuff and the analytical method used. Ash and minerals in foodstuffs generally come from the food itself (indigenous). The crackers ash content was ranging from 2.62-4.61%. Only crackers without fish flour that fill the Indonesian standard and the other crackers did not fill the Indonesian crackers standard which has a maximum limit of 5%.

Based on the graphic image (Figure 2), it can be seen that the ash content of the crackers tends to increase, the high ash content in the crackers is thought to be due to the high mineral content in the added layur fish flour and wheat flour containing minerals. The additional of fish flour gave significant effect to the crackers ash content. According to Hemung [7], the main part of fish flour is bone where the ash content is found around 40%. The ash in fish flour is obtained from the parts of the fish bones. Research on the chemical characteristics of salmon and cod flour shows that the ash content ranges from 43-67% [8].

Protein is a food substance that is important for the human body because it functions as a building block. Protein content in food is one of the factors that can be used as a consideration for consumers. Protein content in foodstuffs determines the quality of the foodstuff itself. The results of statistical analysis showed that the addition of fish flour had a significant effect on the protein content of crackers.
Based on the graphic image (Figure 3), it can be seen that the level of protein crackers tends to increase. From these results, it can be seen that the higher the concentration of layur fish flour added, the higher the protein content of the crackers. The high or low value of the measured protein can be influenced by the amount of dehydration value of the material. The measured protein value will be greater if the amount of water lost is greater, the measured protein content depends on the amount of ingredients added and is mostly influenced by water content [9].

Fatty fish has a high content of saturated fatty acids. Factors that can accelerate the oxidation of fat are the presence of heat, light, heavy metals or the enzyme lipoxidase. Chemical changes or the breakdown of fat can affect the taste of a food ingredient, whether beneficial or not. The results of statistical analysis showed that the addition of fish flour had a significant effect on the fat content of crackers.

**Figure 4.** Fat content of crackers.

Based on the graphic image (Figure 4), it can be seen that the crackers fat content tends to increase. From these results, it can be seen that the higher the concentration of fish flour added, the higher the fat content in the crackers. This is also thought to be due to the addition of butter and cheese where the ingredients contain 25-30% fat respectively. According to Passos [10] the fat content of some commercial biscuits and crackers can reach 11.1-29%.

**Figure 5.** Carbohydrate content of crackers.

Based on the graphic image (Figure 5), it can be seen that the carbohydrate content of the crackers is different in each treatment. The results of statistical analysis showed that the addition of fish flour
had a significant effect on the carbohydrate content of crackers. The carbohydrate content in fishery products will be influenced by the processing process as well as the initial content in the fish. Carbohydrates can break down into simpler forms of compounds. Its decomposition products include glucose, phosphate sugar, pyruvic acid and lactic acid [11]. The reduction in water content that occurs can affect the results of measuring the carbohydrate value as well as the other proximate content values. Both of these could explain the increase and decrease in the carbohydrate value of the crackers tested.

The results of statistical analysis showed that the addition of fish flour had a significant effect on the water content of crackers. In the research of making crackers, the average aW analysis results for all the crackers treatment ranged from 0.529 to 0.608 (Figure 6). The water content in food ingredients affects the resistance of food to microbial attack which is expressed by aW, which is the amount of free water that can be used by microorganisms for their growth.

![Figure 6](image)

**Figure 6.** Aw crackers.

Hardness is the maximum peak on the first pressure or on the first bite. The units used are kg, g or N. In the hardness test, the highest results were obtained in the sample with the addition of 30% fish flour. The results of statistical analysis showed that the addition of fish flour had a significant effect on the crackers hardness (Figure 7).

![Figure 7](image)

**Figure 7.** Crackers hardness.

A high water absorption index can reduce the level of hardness, because the more water is absorbed, the softer the product will be. This also happens to crackers with the addition of fish flour where the higher the addition, the lower the water content of the crackers and it can be interpreted that
the higher the hardness value [12]. The results of sensory analysis were carried out to see the level of panelist acceptance of crackers with the addition of fish flour. The parameters observed were appearance, aroma, taste, texture and hedonic test. The analysis results can be seen in the graphic image below (Figure 8).

![Figure 8. Sensori evaluation.](image-url)

Appearance is one of the factors for testing the quality of the product which is important for the acceptability of the food product. Good appearance will determine panelist acceptance. The results of the organoleptic test using the score test on the appearance of crackers with fortification of layur fish flour, all treatments had an average value of 3.00 - 4.20. The results of the organoleptic test using a score test on aroma crackers with fortification of fish flour, all treatments have an average value of 2.30 - 4.50. The results of the organoleptic test using the score test on the texture of crackers with fortification of layur fish flour, all treatments had an average value of 2.90 - 4.00. The results of the organoleptic test using the score test on the taste of crackers with fortification of layur fish flour, all treatments had an average value of 2.90 - 4.45.

Based on the above analysis data, it is known that the crackers that can be accepted by the panelists are crackers without the addition of fish flour and crackers with 10% fish flour added. The crackers treatment then analyzed the levels of calcium, phosphorus and amino acids and the value of protein digestibility. The results of the analysis can be seen in the table 1 below.

| Parameter       | Unit  | Crackers without fish flour | Crackers with fish flour 10% |
|-----------------|-------|-----------------------------|-------------------------------|
| Fosfor          | Ppm   | 2297.42                     | 2960.47                       |
| Kalsium         | ppm   | 1728.40                     | 3486.66                       |
| Aspartic acid   | %w/w  | 0.88                        | 0.95                          |
| Thereconine     | %w/w  | 0.37                        | 0.48                          |
| Serine          | %w/w  | 0.51                        | 0.63                          |
| Glutamic acid   | %w/w  | 3.07                        | 3.65                          |
| Glysine         | %w/w  | 0.32                        | 0.49                          |
| Alanine         | %w/w  | 0.35                        | 0.56                          |
| Valine          | %w/w  | 0.58                        | 0.69                          |
| Methionine      | %w/w  | 0.14                        | 0.24                          |
| Ileusine        | %w/w  | 0.47                        | 0.59                          |
Leucine \%w/w 0.91 1.14 
Tyrosine \%w/w 0.28 0.34 
Phenylalanine \%w/w 0.51 0.57 
Histidine \%w/w 0.43 0.43 
Lysine \%w/w 0.34 0.54 
Arginine \%w/w 0.51 0.70 

4. Conclusion
According to the result, crackers can be fortified using fish flour. Sensory analysis showed that the panelists like crackers with the addition of 10% Largehead hairtail fish flour and have 7.6% moisture content; 3.53% ash content; 14.6% fat content; 12.33% protein content, 61.97% carbohydrate content, 3.48 g / kg calcium content, 2.96 g /kg phosphorus content.

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