Characteristics of Composite Flour (Biang fish *Ilisha elongata* and Sago) For the Development of Good Nutritional Food Products

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**Abstract.** Composite flour is a mixture of fish flour and sago flour to increase nutrition in food products. This study aims to increase the nutritional value of food products with sago flour as raw material. Composite flour from fish and sago flour were 0%, 2%, 4%, 6%, 8%, and 10% Biang fish to the amount of sago flour. The results of the research on fish flour *Ilisha elongata* showed a yellowish-white color with a whiteness degree of 75.8%. Fish flour has a yield of 28.9% with a fineness level on a 100-mesh sieve. The results show the characteristics of the composite flour of Biang fish and sago, respectively, the color of the flour was white-gray to cream color; having nutritional characteristics, respectively, the moisture content is 9.62%; 9.57%; 9.55%; 9.42%; 9.26%, and 9.20%. The protein content was 0.25%; 3.58%; 4.09%; 4.99%; 5.98%, and 6.39%. The fat content was 0.41%, 0.24%, 0.29%; 0.37%; 0.40%; 0.42%. The ash contained 0.27%, 0.34%, 0.50%, 0.57%; 0.69%, and 0.76%. The carbohydrates were 89.45%; 86.27%; 85.57%; 84.65%; 83.67%, and 83.23%. The calcium content was 1130 mg/kg; 1901 mg/kg; 2687 mg/kg; 2770 mg/kg; 2827 mg/kg and 2869 mg/kg. The addition of fish flour can increase the nutritional value of composite flour made from sago flour and has the potential to develop nutritious food products.

1. Introduction

The marine fisheries potential of Riau Province is quite large, especially capture fisheries, reaching 119,274 tons in 2019 [1]. The Meranti Islands Regency is a coastal area that has important resource potential for increasing regional income, especially through capture fisheries. For the last three years, it has continued to increase in 2017 (1545 tons), 2018 (1986 tons), and in 2019, it reached 2696 tons [2]. Meranti Islands Regency also has huge sago potential in Riau Province and even nationally [1]. The potential for sago in the Meranti Islands in 2019 reached 243.71 thousand tons [2].

The potential of large natural resources for the Meranti Islands Regency in marine fisheries commodities and sago plantations can be developed into competitive regional superior products. A fishery commodity that has a high potential to be further developed is Biang fish (*Ilisha elongata*) into a more highly competitive product. Therefore, technology and innovation are needed to turn the pike fish into a dry product in the form of the best quality fish flour with the advantage of having a fairly high protein content of 68% (wet bases) [3].

The potential for fisheries and sago has not been maximally developed into competitive superior products in the era of food product globalization. The problems faced at this time are that the fish product of the fish commodity is still limited to fresh consumption and is only used as salted fish, even though the production of the fish is quite high. Another problem is that the prickly fish has a lot of spines, so that the level of consumption is very limited even though this fish has a delicious and savory taste, rich in calcium and phosphorus. In general, it is necessary to increase the added value of sago and sago fish products into composite flour so that they become intermediate raw materials in ready-to-eat products that have functional value.
The results of other studies indicate that the manufacture of composite flour can increase diversification and consumers of the resulting products, such as biscuit products from anchovy composite flour [4] and wet noodle products [5]. This study aims to determine the characteristics of composite flour (fish and sago) as the main raw material for the diversification of nutritious food processing.

2. Materials and Methods

2.1. Material
The research materials in this study were the Biang fish and sago flour obtained from Selatpanjang, Meranti Islands Regency, Riau Province, Indonesia. Other supporting materials were materials for analysis of moisture, protein, fat, ash, carbohydrates (by difference), and calcium mineral. The research method experimental research by processing composite flour (Biang fish and sago) with different concentrations of fish flour, namely 0%, 2%, 4%, 6%, 8%, and 10%. The concentration of fish meal was calculated against the amount of sago flour used.

2.2. Research Procedure
The stages of the research are:
1) Procedure for making fish meal starter [3].
   a. Fish is weeded by separating the flesh, head and gills, entrails, and scales.
   b. Fish is washed with water then drained
   c. Spinach is cooked using a pressure cooker (Merk Pincook) for 60 minutes
   d. Fish is finely ground using a meat blender (Merk Wilman MG301).
   e. The crushed meat is dried in the oven at 45-50°C for 24 hours
   f. Fish meat is mashed using a flour machine until it becomes a smooth and homogeneous flour
   g. Fish flour is sifted with 100 mesh.
   h. Spinach fish flour is packaged and stored in glass bottles.

2) Making composite flour from sago flour and fish flour
   a. The ingredients for making composite flour are prepared according to different concentration formulations, namely: 0% (1000 g sago), 2% (20 g fish flour/1000 g sago), 4% (40 g fish flour/1000 g sago), 6% (60 g fish flour/1000 g sago), 8% (80 g fish flour/1000 g sago), and 10% (100 g fish flour/1000 g sago).
   b. The sago flour and fish flour are mixed until homogeneous using a mixer.
   c. The composite flour is gelatinized by adding water so that the flour becomes moist, then the flour is sifted, then roasted to dry for 10 minutes.
   d. The composite flour of sago and Biang fish is packed and stored in an airtight container.

2.3. Observation Analysis
The analytical parameters observed were the color of the flour, determining the white degree of fish flour was conducted by using KETT Digital Whiteness Meter for Powder model C-100-3 (KETT Electric Laboratory). Samples were alternately put in measurement dishes until they were full and solid. Value indicated by the monitor referred to the white degree of observed sample (A), by which it was compared to a standardized whiteness value (110.8) [6], the yield of the fish flour [7], the proximate analysis (moisture, protein, fat, ash, carbohydrates)[8], and the mineral content of calcium with Atomic Absorption Spectrophotometry (Merk AA 6300 Shimadzu; Jerman)[9]. Data were analyzed using statistical analysis (ANOVA) using SPSS 26.0 software at a 95% confidence level.

3. Results and Discussion

3.1. Characteristics of Biang Fish Flour
The results of the research on fish flour showed a yellowish-white color with a whiteness degree of 75.8%. Fish flour has a yield of 28.9% with a fineness level on a 100-mesh sieve. Fish flour chemical
composition contains 7.88% moisture, 71.87% (wb) protein, 5.96% (wb) fat, 12.97 (wb) ash, and 1.33% carbohydrate (difference) and 8398 mg/kg calcium from fish flour. The high yield of Biang fish meal with a small fineness level of flour particle size is an important part of the quality characteristics of the flour of a material. The results of this study are relevant to the research [10] stating that the flour quality of a material is influenced by the moisture of the flour material, the level of yield, the level of fineness, and the appearance of the dominant white color in flour. The yield of Biang fish flour (28.9%) was still higher than that of cat fish flour (Paraplotosus albilibris) which only reached 14.13% [11]. This shows that the difference in the yield of fish flour obtained is influenced by the type of fish flour.

The physical characteristics of the whiteness of the lead fish flour from the research results are in line with the research [10], which explains the appearance of color in a flour product can be seen from the white degree value. Flour with a high whiteness value is considered to be of better quality than flour with a lower whiteness rating. Visually, consumers prefer the dominant flour to be bright white and clean as the whiteness value increases. In the research [12], it was stated that the dominant white flour is one of the important physical factors in determining the level of consumer attractiveness in a processed product fortified with the flour.

Characteristics of changes in the whiteness of flour are caused by the changes in the chemical composition of the material due to being heated in the drying process. The results of this study are supported by [13], explaining that the effect of heat during drying causes various reactions to the material, including browning reactions and other chemical reactions. The browning process forms melanoind compounds (brown colored polymers) from the reaction of amino compounds and reducing sugars so that it affects the color change of the product.

The results of the research of fish meal based on the chemical characteristics of the moisture test were found to be 7.88%. Another study on snakehead fish flour contains a water content of 2.94% [14], the moisture of this fish flour is still high compared to other types of fish flour. However, the water content of the fish flour has met the standards set by the Food and Drug Administration Agriculture Organization (FAO) at maximum 10%. This shows that the fish flour has met the requirements that have been set. The moisture of food aims to improve the quality of the product so that the ingredients used are kept moist. Thus, consumers can use fish meal in a longer time and easily apply it in food products.

The protein and fat content of the fish meal meet the first quality standard for food, which is a minimum of 65% protein, and below 8% fat. The results show that the fish meal contained a lot of important minerals for the growth and development of the body, including the mineral calcium (Ca) of 8398 mg/kg, phosphorus (P) of 169 mg/kg, Iodine (I) of 189.44 mg/kg, magnesium (Mg) of 141.32 mg/kg, zinc (Zn) of 152.07 mg/kg, and iron (Fe) of 15.76 mg/kg.

3.2. Characteristics of Composite Flour (Sago and Biang Fish)

The results of the research on the proximate nutritional composition of sago flour, fish flour, and composite flour (a mixture of sago and fish) in detail can be seen in Table 1.

The results show that the composite flour was white slightly gray, with the nutritional composition of sago flour, fish flour and composite flour (mixture) show changes and differences. Sago flour had 9.62% moisture, 0.25% protein, 0.21% fat, 0.27% ash and 89.65% carbohydrates (by difference). Fish flour has a moisture of 7.88%, protein of 71.87%, fat of 5.95%, fat of 5.96%, ash of 12.97%, and carbohydrates of 1.33%.
The results of the process of making composite flour (a mixture of sago and Biang fish) experienced a change in the moisture of the composite flour. The results of making composite flour with the addition of lead fish flour show that the higher the percentage indicates the decreased water content while the carbohydrate content was decreased. For composite flour, the higher the percentage of fish flour indicates an increase in the nutritional content of the protein, fat, and ash components. The composition of fish meal composite flour with a concentration of 2%-10% in the composite flour product has a moisture content of 9.20-9.57%, protein of 3.58-6.39%, fat of 0.24-0.42%, ash of 0.34-0.76%, and carbohydrates of 83.23-86.27%. The mineral composition of calcium ranges from 1901 mg/kg to 2869 mg/kg. Increasing the use of fish flour to 10% in the formulation of composite flour can increase the amount of calcium which is greater than the use of fish flour using Biang fish flour below 10%. This is due to the high amount of lead fish flour in composite flour processing. The results of the study showed that the calcium content in the Biang fish flour was relatively high, reaching 8398 mg/kg.

Composite flour (sago and Biang fish) has a high nutritional content, so it has a good opportunity for the development of diversification of advanced composite flour-based snacks. Other studies have shown that composite flour using anchovies can be developed into biscuit products. The results of research [4] showed that biscuits with anchovy composite obtained good sensory characteristics at the concentration of 70% sago flour, 10% anchovy flour, and 20% wheat flour. Based on the potential development of the use of sago and sago fish composite flour, it can be applied to sago noodle products and sago crackers as special food for the Meranti Islands Regency, Riau Province.

### 4. Conclusion

Based on the research result, it can be concluded that the composite flour was white and slightly gray, the nutritional composite flour (sago and Biang fish) had a moisture content of 9.20%-9.57%; protein of 3.58%-6.39%; fat of 0.24%-0.42%; ash of 0.34%-0.76%; carbohydrates of 83.23%-86.27% and calcium of 1901 mg/kg-2869 mg/kg. The addition of fish flour can increase the nutritional value of composite flour made from sago flour and has the potential for the development of nutritious food products.

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Table 1. Nutrient content of sago flour, fish flour, and composite flour

| Parameter          | Sago flour | Fish flour | Composite Flour (sago and Biang fish) |
|--------------------|------------|------------|---------------------------------------|
|                    |            |            | CF2% | CF4% | CF6% | CF8% | CF10% |
| Moisture (%)       | 9.62       | 7.88       | 9.57<sup>a</sup> | 9.55<sup>c</sup> | 9.42<sup>b</sup> | 9.26<sup>g</sup> | 9.20<sup>h</sup> |
| Proteins (%)       | 0.25       | 71.87      | 3.58<sup>a</sup> | 4.09<sup>c</sup> | 4.99<sup>b</sup> | 5.98<sup>c</sup> | 6.39<sup>c</sup> |
| Fat (%)            | 0.41       | 5.96       | 0.24<sup>a</sup> | 0.29<sup>a</sup> | 0.37<sup>b</sup> | 0.40<sup>b</sup> | 0.42<sup>b</sup> |
| Ash (%)            | 0.27       | 12.97      | 0.34<sup>a</sup> | 0.50<sup>b</sup> | 0.57<sup>b</sup> | 0.69<sup>c</sup> | 0.76<sup>d</sup> |
| Carbohydrates (%)  | 89.45      | 1.33       | 68.8<sup>c</sup> | 88.9<sup>d</sup> | 83.6<sup>e</sup> | 83.2<sup>e</sup> | 83.23<sup>e</sup> |
| Calcium (mg/kg)    | 1131       | 8398       | 1901<sup>a</sup> | 2687<sup>b</sup> | 2770<sup>b</sup> | 2827.53<sup>d</sup> | 2869<sup>c</sup> |

CF= Composite Flour (0, 2, 4, 6, 8, 10%)
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