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CHEMICAL CHARACTERISTICS OF *Sardinella lemuru* HEAD MEAL AS A RAW MATERIAL FOR MAKING PROCESSED FOOD

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ABSTRACT

Lemuru is one of the abundant marine food in Banyuwangi and is used as raw material for canned fish. The production of lemuru (Sardinella lemuru) catches reaches 160 tons in 2023 based on data obtained from UPT PPP Muncar. and produces about 30-40% of the total weight of fish waste, which is around 48-64 Tons which has not been utilized optimally.head of fish is one of waste and can use as material in making food products. This research aimed to determine the chemical characteristics of Sardinella lemuru head meal. The research method of chemical characteristics used was proximate analysis including moisture content by gravimetric method, protein conten by kjeldhal methodt, fat content by soxhlet method, ash content by dry ashing method and carbohydrate by different. The proximate content of lemuru head meal was 3,34% of moisture content, 19,76% of protein, 34,86% of fat, 17,85% of ash and 24,19% of carbohydrate content.

Keywords: **:** lemuru head meal; chemical characteristics; processed food

INTRODUCTION

Lemuru is a marine fish often found in the coastal areas of Banyuwangi. Lemuru is a type of fish economically important small pelagic of Clupeidae (Pertami *et al.*, 2020). lemuru is quite popular with the local community and is usually processed as fried fish, salted fish and boiled fish. Additionally, lemuru fish is used in the manufacture of canned sardines which are often found in canning companies, especially in Banyuwangi district. Canned fish usually has unused parts of fish such as tail, bones and head.

Processing of fishery products aside from producing value-added products, fulfilling industrial needs as a source of income and products used as food needs also produces waste or processed by-products in the form of liquid, gas and solid waste. according to UPT PPP Muncar data in 2023, total production lemuru fish reached 160 tons in a period of 3 months. The waste generated from the total production of lemuru fish is around 30-40%, which reaches 48-64 tons with the proportion of lemuru fish head waste ranging from 12%, which is around 19 tons (Grasela *et al.*, 2022). The higher the production rate and the number of catches that increase each year, it will have an impact on increasing the waste generated by the fishing industry.

There have been many studies on fishery by-products that have potential in the pharmaceutical, bioenergy, cosmetic and functional food fields. Several studies have used fishery waste as an antioxidant (Mutamimah *et al.*, 2018), anti-aging cream preparations (Wahid *et al.*, 2022), chips (Astuti *et al.*, 2022), butter cookies (Diachanty *et al.*, 2021). Other than, In general, fish meal resulting from fish processing waste or by-products is used as an additive for feed due to the low quality of fish meal, judging from the inadequate equipment facilities and the use of very high temperatures in the drying process.

The flour making process is highly depend on the drying process. he drying method often used is by utilizing sunlight. However, sun drying has disadvantages, which are very dependent on weather conditions. In addition, the quality produced cannot be controlled. Sun drying can be overcome by using a cabinet dryer. The advantages of cabinet dryer are the drying time and temperature can be controlled so that the quality of the final product can also be controlled. Drying using a cabinet dryer can run better and faster, and better quality is obtained (Sushanti, 2018).

The use of lemuru head flour is still very limited, especially as an alternative to processed food ingredients. Therefore, need to determine the chemical characteristics of lemuru head meal to know its chemical content and can be used as an alternative to processed food.

RESEARCH METHODS

Production of Lemuru Head

Lemuru head obtained from a canned fish company in Banyuwangi. The sample is cleaned with tap water, then weighed to determine the initial weight. Next, dried in the cabinet dryer for ±12 hours at 55˚C. Removed from the cabinet dryer and weighed for the final weight to determine the yield. Afterwards, put in a flour milling machine to obtain lemuru head flour.

Materials and Tools

The raw material used in this research was lemuru head. The materials for chemical characteristics analysis was distilled water, selenium catalyst, H2SO4 (Merck), H3BO3 (Merck) , filter paper, HCl 0.1 N (Merck), NaOH (Merck), petroleum ether solvent (Merck). The tools used are flour milling machine, laboratory oven (Memmert), furnace, desiccator, Kjeldahl flask, protein distillation apparatus, condenser,

destructor, analytical weighing, volume pipette, 100 ml volumetric flask, 250 ml Erlenmeyer, 50 ml burette, spatula and 10 ml measuring cup, and soxhlet extractor.

Chemical analysis

The chemical analysis carried out in this study were determination of water content, protein content, fat content, ash content and carbohydrate content using by difference method.

Moisture content (AOAC,2005)

The porcelain cup was dried in the oven for 24 hours at the temperature of 105°C and then cooled in a desiccator for 15 minutes. afterwards, the porcelain cup was weighed (A). The sample was weighed as much as 2 grams (B) put into a dried porcelain cup. Next, dried an oven at 105°C for 6 hours then cooled in a desiccator for 15 minutes and weighed as the final sample weight (C). The moisture content of the sample was calculated by the formula:

$$Moisture\ content\ \% = \frac{(a+b)-c}{b}\ x\ 100\% \quad \text{..... (1)}$$

Protein content (Nasution *et al.*, 2020)

2 grams of the sample was weighed and put into the Kjeldahl flask, added 2 grams of mixed catalyst and 25 ml of concentrated H2SO4 until the solution was homogeneous. Then the solution is heated to boiling and the color changes to clear green (destruction stage). The cooled solution is diluted with 100 ml of distilled water in a 100 ml volumetric flask and 5 ml pipette into the distillation flask. 30% NaOH was added. The distillation solution and the distillate were collected in an Erlenmeyer containing 10 ml of 2% boric acid solution and a few drops of mixed indicator (methylene red + bromothymol blue). Distillation for approximately 5-10 minutes (distillation stage).

The distillate results were titrated with a standard solution of 0.01 N hydrochloric acid, the titration point is reached when the color changes from blue to pink. Blanks are made according to the treatment of the sample (titration stage). Protein contents were calculated by the following equation:

$$Protein\% = \frac{(V1-V2)\ x\ HCL\ N\ x\ 0{,}014\ x\ fk\ x\ fpx\ 100\%}{sample\ (g)}$$

..... (2)

Information : V1 = Volume of sample HCl; V2 = Volume of blank HCl. fk = protein conversion factor (6,25); fp = Dilution factor (20);

Fat content (AOAC, 2005)

The fat flask was dried in the oven for 24 hours (T = 100–105 °C). Thereafter, cooled in a desiccator for 15 minutes. As much as 2 g of sample (a) that has been mashed, wrapped in filter paper, and put into Soxhlet extraction tube (b). The fat flask was installed in the extraction tube on the distillation apparatus. Wait for the Soxhlet filled with petroleum ether solvent and dropped into the fat flask, then the cooling water is circulated and the device is turned on. The extraction was carried out for 4–5 hours. The solvent with fat was separated and dried in an oven at (100–105) °C until the solvent has completely evaporated (c). The formula of fat content was:

$$Fat\ content\ \% = \frac{c-b}{a}\ x\ 100\% \quad \text{.....(3)}$$

Ash content (AOAC, 2005)

The porcelain cup is dried in the oven at 100 – 105 °C for 24 hours and then cooled in a desiccator for 15 minutes. The weight of the porcelain cup was weighed and recorded as the weight of the cup. The sample is weighed as much as 2 grams and put into the dried porcelain cup, and recorded as the weight of the material in the cup. Samples were dried in an oven at 100–105 °C for 6 hours. heated the cup containing the sample into the furnace for 5 hours at a temperature of 525 °C until white ash was formed. Whereafter, cool the cup containing the sample into the desiccator for 30 minutes and after that the cup containing the ash is weighed. The ash content was calculated by the formula:

$$Ash\ content\ \% = \frac{(cup\ and\ ashes)\ -\ cup}{sampel}\ x\ 100\% \quad \text{.. (4)}$$

Data analysis

Data analysis used in this study was descriptive statistical analysis. Samples were analyzed with three repetitions for each test. The mean and standard deviation of each analysis were determined using Microsoft Excel. Description of the results were analyzed with descriptive statistics using tables.

RESULT AND DISCUSSION

Yield

Yield is the percentage ratio between the weight of the material that can be utilized to the total weight of the material. The yield of lemuru head meal (Fig 1.) produced by the drying method using a cabinet dryer at 55C was 36,4%. Many variables that can affect the flour yield such as moisture content, temperature and miller. Drying temperature has a highly significant effect on the yield of flour produced.

The higher the drying temperature, the greater the amount of liquid mass evaporated from the surface of the material being dried. This situation will cause the weight of the material to decrease, so that the yield obtained decreases as well (Parrenin *et al.*, 2022).

Figure 1. Lemuru Head Meal

Chemical Characteristics

The chemical properties analyzed were moisture, protein, fat, ash and carbohydrate content. The results of chemical analysis on lemuru head meal can be seen in Table 1.

Table 1. The Chemical Properties of Lemuru Head Meal

Composition	Lemuru head meal (%)
Moisture content	3,34
Protein content	19,76
Fat content	34,86
Ash content	17,85
Carbohydrate content	24,19

Moisture content

The presence of water in raw material is always associated with the quality of food ingredients and as a measure of the dry matter or solids content. Water in the material can be used as an index of stability during storage (Prasetyo *et al.,* 2019). Drying process will preserve the food by avoiding microbial growth and deteriorate due to the chemical reaction. The heat will affect the activity of enzymes and microorganisms in drying of foods (Rahman and Perera, 2020). The result of moisture content of lemuru head meal was 3.34%.

Water activity is closely related to the moisture content in the material on its shelf life. The high or low of water activity value will affect the shelf life and quality of food ingredients. The smaller the water activity value, the longer the shelf life of the food (Dewi *et al.,* 2022).

Protein content

The results of the protein content test for lemuru head flour can be seen in Table 1. The protein content analysis data obtained from the results of the study showed that the protein content value was 19.76% A decrease in moisture content will result in an increase in the protein content in the material. The use of heat in food processing can reduce the percentage of moisture content which results in an increase in the percentage of protein content. The drier a material, the higher the protein content (Bau *et al.,* 2021).

The protein content in fish is complete essential amino acids and easily digested by the body. The essential amino acids contained in fish include methionine, lysine and histidine. This amino acid is barrier amino acids with higher amount compared to protein sources from vegetables (Andhikawati *et al.,* 2021).

Fat content

Another nutritional composition contained in fish is fat. The fat contained in fish is type of unsaturated fatty acids which include the omega-3 group. The fatty acids contained in fish are saturated fatty acids and unsaturated fatty acids. The fatty acids in fish are very beneficial for the body. The results of the analysis of fat content showed that lemuru head meal fat content was 34.86%. The length of drying time and the high temperature used in the drying process will cause the fat content in the material increase while the moisture content is decrease (Bau *et al.,* 2021).

Ash content

Food ingredients besides containing water also contain inorganic compounds which are very important for the human body, namely minerals or ash. Ash content is known as mineral elements or organic substances. Ash is one of the components in raw material, this component consists of minerals such as calcium, phosphorus, sodium, copper (Daeng and Laitupa, 2019). Ash content in lemuru head meal was 17, 85%. The head (skull) of fish can be processed into flour because this part of the fish still contains minerals, such as calcium in fish meal which can be utilized. The presence of calcium in fish head meal has the potential to increase the nutritional content of certain processed food products, so that these products are rich in calcium.

Carbohydrate by difference

The carbohydrate content was estimated by difference, by deducting 100% with the sum of moisture content, ash content, protein content and fat content so that the carbohydrate content depends on the absorption factor. This is because carbohydrates are very influential on the content of other nutritional factors (Daeng and Laitupa, 2019). The carbohydrate content of head lemuru meal was 24,19%. Carbohydrate is important nutritional in food for the body. Carbohydrate is one of a major nutrition beside protein ond others.

CONCLUSION

Lemuru fish head flour has the potential to be used in ingredients for food processing seen from the results of chemical characteristics, namely moisture content, protein, fat, ash and carbohydrates

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