Original Research Article

PHYSICAL-CHEMICAL AND SENSORY CHARACTERISTICS OF BREAM FISH MEAT FLOUR

ABSTRACT

This research is to analyze the characteristics of bream fish meat flour obtained from different heating methods on fish meat before the drying process. The research method used was experimental with different heating method treatments given to bream fish meat before the drying process. The treatments were steaming, boiling and no heating (control). The research was conducted from March 5, 2023 to April 10, 2023. The research location was at the Fishery Product Processing Technology Laboratory, Faculty of Fisheries and Marine Sciences, Padjadjaran University, Jalan Raya Jatinangor KM 21, Sumedang-Indonesia. Parameters observed included organoleptic (appearance, aroma, and texture), yield, moisture content, water absorption and pH. Data was analyzed descriptively. Based on the research results, the characteristics of bream fish meat flour obtained from the process without heating (control) on fish meat before drying are as follows: flour yield 15.24%, moisture content 19.21%, water absorption 2.22% pH 5.85 and organoleptic description of bright yellow color, very strong fishy aroma, and rough texture. The characteristics of bream fish meat flour obtained from the boiling process on fish meat before drying are as follows: flour yield of 17.07%, moisture content of 17.11%, water absorption of 2.01% pH 6 and organoleptic description of pale-yellow color, slightly pungent fishy aroma, and slightly fine texture. The characteristics of bream fish meat flour obtained from the steaming process on fish meat before drying are as follows: flour yield 18.17%, moisture content 12.89%, water absorption 1.76% pH 5.85 and organoleptic description of slightly dull yellow color, slightly pungent fishy aroma, and fine texture.

Keywords: Absorbency, Boiling, Demersal, Quality, Steaming.

1. INTRODUCTION

Fish is a source of animal protein with high protein content, cheap, and easy to obtain [29]. Bream fish (*Nemipterus* sp.), which is commonly found on the north coast of the Java sea, belongs to the demersal marine fish group with soft, delicious, and nutritious meat texture [12]. The nutritional content of bream fish is quite high, especially protein which is around 16.85% and low fat content which is around 2.2% [6]. In addition to its high protein, the water content in fish is also relatively high, which is one of the causes of the vulnerability of spoilage in fish commodities [13]. Therefore, innovation is needed as an effort to diversify processing so that the utilization of fishery resources is more optimal and increase public interest in consuming fish [28].

Processing is one way to maintain durability and increase the economic value of fish. Processing fish into flour is an effort to diversify fishery products that are expected to be accepted by the community as semi-finished products that can become raw materials for making other preparations [8]. Fish meat flour is a dry solid product made from fish meat [21]. The utilization of fish meat for flour is intended to maximize the diversity of processed fish. Fish meat meal can be used as an ingredient to increase the protein content of a particular product.

The quality of fish meat meal varies depending on the freshness of the fish meat, fish species and processing techniques used. There are several techniques for making fish meat meals that can be done including steaming and boiling. Steaming is one way of processing in an airtight container that relies on water vapor to prevent food from coming into direct contact with water, thereby minimizing nutrient loss, while boiling is a processing process that interacts directly with boiling water [18]. This study aims to analyze the characteristics of bream fish meat flour obtained from different heating methods on fish meat before the drying process.

2. MATERIAL AND METHODS / EXPERIMENTAL DETAILS / METHODOLOGY

The research used was experimental with different heating method treatments given to bream fish meat before the drying process. The treatments were steaming, boiling and no heating (control). The research was conducted from March 5, 2023 to April 10, 2023. The research was located at the Fishery Product Processing Technology Laboratory, Faculty of Fisheries and Marine Science, Padjadjaran University, Jalan Raya Jatinangor KM 21, Sumedang-Indonesia.

The equipments used during the research are: basin, tray, digital scale, analog scale, cutting board, food tongs, sieve, ziplock plastic, steamer pan, knife, label, oven, chopper, small plate, small bowl, cup, beaker glass, tube, centrifuge, desiccator, pH meter. The materials used are bream fish (*Nemipterus* sp.), water, ice cubes, and distilled water.

Comment [WM1]: This means many species, please specify the exact species used.

2.1 Bream Fish Meat Flour Preparation

2.1.1 No-steaming method (control)

1) Weigh the weight of each bream fish. Then clean the bream fish from the scales. Then the fish are fileted.
2) Fish fileting is done by taking only the meat without the skin and bones of the fish.
3) Bream fish meat that has been successfully fileted is then weighed first to determine its weight, after which it is put into a small basin that already contains water and ice cubes after soaking for a few seconds, removed and drained. Do the same for each bream fish meat that has been successfully fileted.
4) Weigh the fish meat that will be taken for the untreated method as much as 200 grams. This weight is for each treatment.
5) Then, the fish meat is squeezed using a cloth or tissue that is thick enough to reduce the water in the filets.
6) Filets are shredded to obtain the smallest possible size.
7) The fish is oven-dried at 60^{o}C for 6 hours.
8) After the fish is in the oven, the fish meat is blended and then filtered to obtain fine fishmeal.
9) Observations were made on yield, moisture content, absorbency, pH, and organoleptic description (color, odor, and texture).

2.1.2Boiling Method

1) Weigh the weight of each bream fish. Then clean the bream fish from the scales. Then the fish are fileted.
2) Fish fileting is done by taking only the meat without the skin and bones of the fish.
3) Bream fish meat that has been successfully fileted is then weighed first to determine its weight, after which it is put into a small basin that already contains water and ice cubes after soaking for a few seconds, removed and drained. Do the same for each bream fish meat that has been successfully fileted.
4) Weigh the fish meat that will be taken for the boiling method as much as 200 grams. This weight is for each treatment.
5) Put the fish meat into a container with holes on the edges to be boiled in boiling water for 10 minutes.
6) After boiling, the fish meat is squeezed using a cloth or tissue thick enough to reduce the water in the filets.
7) Filets are chopped to obtain the smallest possible size.
8) The fish is oven-dried at 60^{o}C for 6 hours.
9) After the fish is in the oven, the fish meat is blended and then filtered to obtain fine fishmeal.
10) Observations were made on yield, moisture content, absorbency, pH, and organoleptic description (color, odor, and texture).

2.1.3Steaming Method

1) Weigh the weight of each bream fish. Then clean the bream fish from the scales. Then the fish are fileted.
2) Fish fileting is done by taking only the meat without the skin and bones of the fish.
3) Bream fish meat that has been successfully fileted is then weighed first to determine its weight, after which it is put into a small basin that already contains water and ice cubes after soaking for a few seconds, removed and drained. Do the same for each bream fish meat that has been successfully fileted
4) Weigh the fish meat that will be taken for the steaming method as much as 200 grams. The weight is for each treatment.
5) Put 200 grams of bream fish meat into a steamer pan for steaming for 10 minutes.
6) After steaming, the fish meat is squeezed using a cloth or tissue thick enough to reduce the water in the filets.
7) Filets are shredded to obtain the smallest possible size.
8) The fish is oven-dried at 60^{o}C for 6 hours.
9) After the fish is in the oven, the fish meat is blended and then filtered to obtain fine fishmeal.
10) Observations were made on yield, moisture content, absorbency, pH, and organoleptic description (color, odor, and texture).

2.1.4Measurement of Yield

1) The flour that has been finished and has passed the screening process, then weighed first.
2) After that, do the calculation with the formula:

$$\frac{Flour\ Weight}{Fillet\ Weight} \text{x } 100\ \%$$

2.1.5Measurement of Fishmeal Moisture Content

1) The empty cup and beaker glass covered with brown paper were dried in an oven at 105^{o}C for 15 minutes and cooled in a desiccator for 10 minutes for the beaker glass and 20 minutes for the porcelain cup.
2) The cup and beaker glass are then weighed. After that, add fish flour as much as approximately 3 grams.
3) Put the cup containing the fishmeal back into the oven to dry at 70^{o}C for 30 minutes..
4) After heating, use tongs to pick up the dish in the oven. Weigh the cup containing the fishmeal. After all is weighed, put the cup back into the oven to be oven again for 30 minutes, then after that weigh. Do this until the cup containing the material has a constant weight.
5) After obtaining a constant weight for each cup, calculate the water content using the formula :

$$\frac{B-C}{B-A} \times 100\ \%$$

Description :
A = Weight of Empty Cup
B = Weight of Cup + Initial Sample
C = Weight of Cup + Final Sample

2.1.6Measurement of Water Absorbency of Fishmeal

1) Weigh the empty weight of the plakon tube.
2) Put fish meat flour into a beaker glass weighing 9.69 grams.
3) Add 10 ml of distilled water to each beaker glass and stir until well mixed then let stand for 30 minutes at room temperature.
4) The mixture is then put into a plakon tube and sealed as tightly as possible.
5) Centrifuge the mixture for 30 minutes at 3,000 rpm at room temperature. The water phase obtained was measured using a measuring cup as the volume of unabsorbed water.
6) Input into formula :

$$\frac{(Absorbed\ Sample - Dry\ Sample)}{Weight\ of\ Sample} \times 100\ \%$$

2.1.7Measurement of pH of Fishmeal

1) Fishmeal as much as 4 grams was put into a beaker glass and added 40 ml of distilled water. Next, stir until homogeneous then let it settle at room temperature for 30 minutes.
2) Centrifuge at 3,000 rpm for 10 minutes at 27^{o}C. The supernatant obtained was separated and the pH value was measured using a pH meter.

3. RESULTS AND DISCUSSION

3.1 Yield Of Bream Fish Flour

Which includes weighing the yield on samples without treatment (control), steamed, and boiled, the highest yield was obtained in the steamed treatment which was 18.17%, followed by boiled treatment with a yield of 17.07%, and the lowest yield was in the control treatment of 15.24%. (Fig 1).

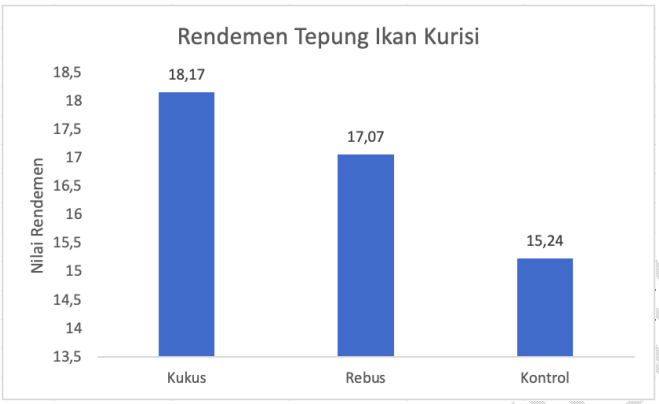

Fig. 1. Yield Test Results of Bream Fish Flour

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Based on the results of the yield test data of bream fish meat flour (*Nemipterusjaponicus*) with three treatments which include control, boiling and steaming treatments, there are differences in yield results. This is influenced by several factors, one of which is temperature where the increase in temperature in steaming affects the decrease in yield because the higher the temperature, the water content in the sample will decrease. This statement is supported by [30], the smaller the water content produced causes a decrease in the water weight of the material, because water in the material is the main component that affects the weight of the material. If water is removed, the material will be lighter so that it will affect the product yield.

The low yield is also due to the effect of drying. In addition to preserving, drying also aims to reduce the volume and weight of the product. Through this drying method, the moisture content can usually decrease to 60-70%, resulting in a low yield valueand many factors affect the yield in maceration and Socletation, namely the temperature used for the extraction process, the length of time of extraction, the presence of solvent circulation and part of the simplisia.

3.2Water Content of Bream Fish Flour

Based on the results (Figure 2.) the water content of bream fish flour (*Nemipterusjaponicus*) with steamed, boiled and control treatments has an average in the steamed treatment of 12.89%, the average in the boiled treatment of 17.11%, and the average in the control treatment of 19.21%. So that the highest average water content was obtained in the control treatment at 19.21%, followed by the boiled treatment at 17.11%. While the lowest water content was obtained in the steamed treatment at 12.89%.

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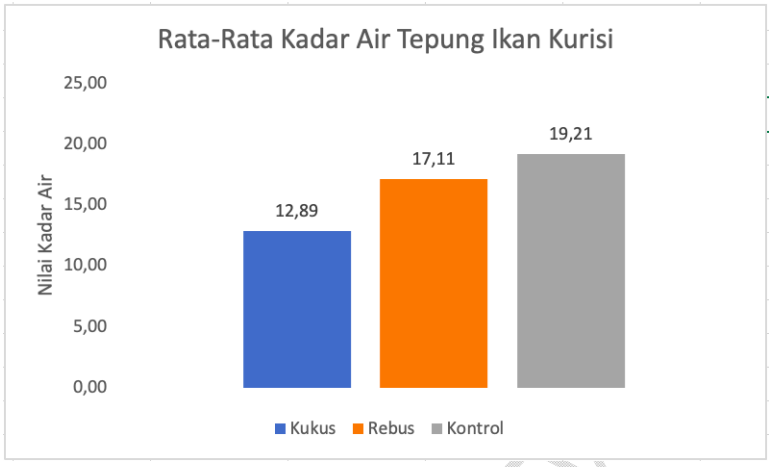

Fig. 2. Water Content of Bream Fish Flour

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Based on the results (Fig. 2.) there is a difference between the water content of flour in each treatment. This is supported by the statement mentioned that raw materials and processing can affect the water content in food ingredients itself (25). The steaming process with hot steam tends to increase the water content of food ingredients. Whereas in the heating process there tends to be water loss in food ingredients due to the evaporation of water when the surface temperature of the material increases rapidly so that the food becomes dry. Each different type of fish has a different water content so that it can produce products that have different water content [24]. As known in KKP (2015), fresh bream fish has a water content of 79.55%.

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The high water content in the control treatment can be caused by the unprocessed fish meat. This can occur due to the presence of myofibril proteins in fish meat that have the ability to trap water [25]. The higher the amount of myofibril protein (actin and myosin) in fish meat, the stronger the water binding capacity will be. This is in line with [26] statement, that the amount of water content of a product can be influenced by the protein content of the raw materials used.

The results in the steaming treatment of bream fish flour were obtained with low water content. This could happen because the fish meat during the heating process will release a certain amount of water so that the water content in the resulting product will be reduced[1]. As stated by [23] that the water content in a material will decrease after the cooking process. This process of decreasing water content happens when the water vapor pressure increases. It is caused by hot steam flowing on the surface of the material so that there is diffusion movement of water from the material to its surface. And after the water content in the material decreases, the water vapor pressure will decrease again until a balance occurs with the surrounding air. Fish flour that has a low water content at the time of baking can produce a dry and non-clumpy texture.

The results of the analysis of the water content of bream fish flour(*Nemipterusjaponicus*) as a whole have not met the national quality standards. Based on the Indonesian National Standard (SNI) No.01-2175-1992 on standard quality requirements for fish flour, the maximum water content of fish flour is 10%. This is supported by a statement according to [16], that the water content of fish flour ranges from 6 - 10%. Fish flour with a water content less than 6% is rarely found because at this level fish flour is hygroscopic or absorbs water. If the water content of fish flour is very low, there will be a

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balance with the humidity of the place where it is stored. And instead, if the water content of fish flour is more than 10% (>10%), there will be a decrease in the quality of fish flour due to increased activity of microorganisms, namely Salmonella bacteria [8].

3.3 Water Absorbency of Bream Fish Flour

Analysis of water absorption of bream fishmeal with different treatment methods, namely steamed, boiled and control treatments in three replicates, can be seen in the figure below.

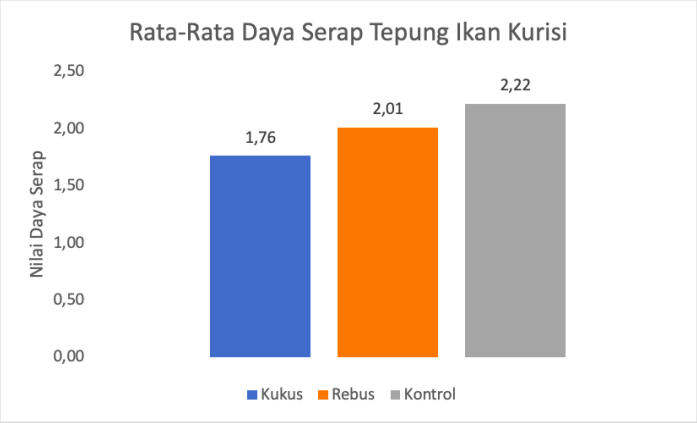

Fig. 3. Absorbency of Bream Fish Flour

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From the above results, it is found that the highest water absorption value is found in flour from Bream fish with control treatment with a value of 2.2%, followed by bream fish flour with boiled treatment with a value of 2% and the lowest water absorption value is found in bream fish flour with steamed treatment with a value of 1.8% (fig. 3). The high water absorption of flour from bream fish with the control treatment is thought to be due to the low water content contained in the flour. Water absorption is inversely proportional to moisture content. The lower the moisture content, the higher the water absorption.The ability of flour to absorb water is highly dependent on the product to be produced. The high water absorption is due to the water absorbed in the molecules thus increasing the water absorption of fishmeal and the breaking of hydrogen bonds between molecules so that water enters the flour more easily [2].

3.4 pH Levels of Bream Fish Flour

Based on the results of the study, the pH value of bream fish flour was obtained in three treatments, namely steamed, boiled and control treatments with three repetitions. The average value of steamed pH is 5.85%, in the boiled treatment 6% and in the control treatment 5.85%.

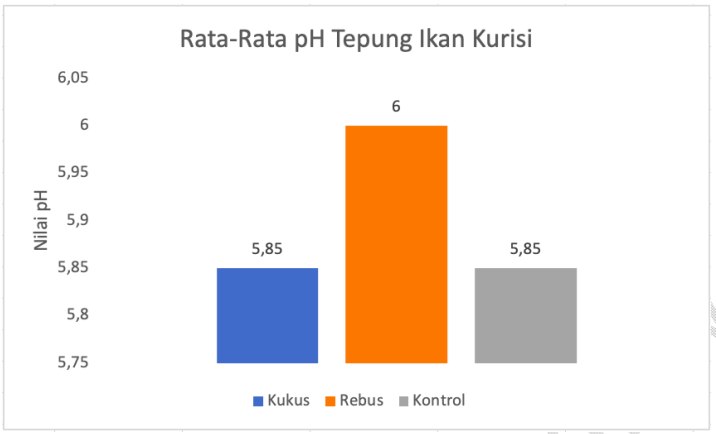

Fig. 4. Table pH of Bream Fish Flour

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From the results shown in the figure above, it can be seen that the pH value of boiled bream fishmeal is stable and remains at 6, and the pH value of steamed bream fishmeal and the control tends to be the same and increases in the second replication. According to [9] fish meat that has a high pH is due to the generation of alkaline compounds such as ammonia, trimethylamine, and other volatile compounds, which can also reduce the organoleptic value of the product.In the process of glycolysis, enzymes play a major role until the formation of lactic acid. This causes the accumulation of lactic acid to run slower so that the decrease in fish pH also takes place more slowly [17].

States that during the storage of fishmeal, protein decomposition occurs into basic compounds, including ammonia [5]. The pH value of food during storage can change due to the presence of proteins that are broken down by proteolytic enzymes and bacterial assistance into carboxylic acids, sulfide acids, ammonia and other types of acids. Therefore, the pH value of boiled bream fish and the resulting control, although increased, is still in an acidic condition. The pH value is one of the indicators used to determine the freshness of fish.In the process of fish spoilage, changes in the pH of the meat play a major role because it affects the process of autolysis and bacterial attack.

According to [7], a good pH for preserved fish is between 2.0-5.5 while pH 6.0-8.0 is a good medium for the growth of microorganisms. The pH value obtained in this study on boiled, steamed, and control bream fish with three treatments is still included in the good criteria.

3.5 Organoleptic Characteristics of Bream Fish Meat Flour

The results of the analysis of organoleptic characteristics of bream fish flour with different processing methods by 10 panelists obtained an average which can be seen in Table 1. The organoleptic characteristics analyzed were color, aroma and texture. Sensory analysis of organoleptic characteristics is carried out to determine the response or impression obtained by the five human senses to a stimulus caused by bream fishmeal produced from different processing methods [22].The processing of bream fish meat flour with various methods, namely boiling, steaming and without treatment, can cause differences in the organoleptic characteristics of the resulting bream fish flour.

Table 1. Organoleptic characteristics of bream fish meal with different processing methods

Organoleptic Characteristics	Processing Method		
	No Heating (Control)	Boiling	Steaming
Color	Bright Yellow	Pale Yellow	Slightly Dull Yellow
Aroma	Very Fishy	Slightly Fishy	Not Fishy
Texture	Rough	Slightly Smooth	Smooth

3.5.1 Color Characteristics

Analysis of the color characteristics of bream fishmeal was carried out using the sense of sight. Based on the analysis of organoleptic characteristics of the color of curry fishmeal produced by different processing methods (Table 1), the color of curry fishmeal as a whole shows that the color of curry fishmeal produced is not much different, namely yellow, only different in appearance. The difference in the appearance of the bream fishmeal produced is due to the different treatments given. Processing with the boiling method produces pale yellow fishmeal and processing with the steaming method produces slightly dull yellow fishmeal, while fishmeal without treatment produces bright yellow fishmeal.

The color change occurs due to the heating process of fish meat at high temperatures in the manufacture of fishmeal [20]. According to [14], the occurrence of color changes to become darker/somewhat duller is caused by a non-enzymatic reaction (Maillard reaction). The Maillard reaction can be triggered by heating at high temperatures, such as roasting, frying, grilling, steaming and cooking. Fishmeal that has a slightly dull appearance is a good fishmeal texture. Good fishmeal has a fine texture, uniform particle size, brown color, fishy aroma typical of fishmeal, no mold, free of bone debris and foreign objects [31]. Based on the analysis of organoleptic characteristics, the color of bream fishmeal is good, namely fishmeal that is given a steaming treatment.

3.5.2 Aroma Characteristics

Analysis of aroma characteristics in bream fishmeal was carried out using the sense of smell. Based on the analysis of organoleptic characteristics of the aroma of bream fishmeal produced by different processing methods (Table 1), the overall aroma of bream fishmeal showed different results. Processing with the boiling method produces a fishy fishmeal aroma that is slightly pungent, and processing with the steaming method produces a fishy fishmeal aroma that is not pungent, while untreated fishmeal produces a very pungent fishy aroma.

Comment [WM9]: You mention in Table (1) Not Fishy (Aroma), please chick.

According to the National Standardisation Agency, a good fishmeal aroma is fragrant and specific to fishmeal. The specific aroma of fishmeal shows a distinctive fishy aroma [1]. The fishy aroma of fishmeal comes from nitrogen components, namely guanidine,

trimethylamine oxide (TMAO) and imidazole derivatives. Untreated bream fishmeal produces a fishy odor that is quite high and very pungent compared to fishmeal treated with both boiling and steaming. This is according to [19], stated that the aroma of fishmeal has a fishy odor. Based on the analysis of organoleptic characteristics, the aroma of bream fishmeal is good, namely fishmeal given the steaming treatment.

3.5.3 Texture Characteristics

Texture is a sensation of pressure that can be observed using the mouth or sense of touch using fingers [10]. Based on the analysis of organoleptic characteristics of the texture of bream fishmeal produced by different processing methods (tTable 1), there are differences in texture from the three treatments given. Processing with the boiling method produces a rather fine fishmeal texture, and processing with the steaming method produces a fine fishmeal texture, while untreated fishmeal produces a rather coarse fishmeal texture.

Fish meat that is given high temperature processing has a low water content so that when an oven is carried out, it can produce a dry and non-clumpy flour texture. In contrast, fish meat with the control treatment produces a texture that is rather rough like flakes and rather wet because it has a higher water content. According to [15], said that the texture of fishmeal is influenced by the heating process of fish meat so that the resulting fishmeal has a dry texture, uniform and rather fine particles. Fishmeal that has a dry texture is a good fishmeal texture. This is according to [27] which states that the texture of good fishmeal, which has a texture that is not lumpy, dry and smooth. Based on the analysis of organoleptic characteristics, the texture of bream fishmeal is good, namely fishmeal given steaming treatment.

4. CONCLUSION

Based on the results of research on the characteristics of bream fish meat meal obtained from the process without heating (control) on fish meat before drying are as follows: flour yield 15.24%, moisture content 12.88%, water absorption 2.2% pH 5.85 and organoleptic description bright yellow color, the fishy aroma that is very pungent, and coarser texture. The characteristics of bream fish meat meal obtained from the boiling process of fish meat before drying are as follows: flour yield 17.07%, moisture content 17.1%, water absorption 2% pH 6, and organoleptic description pale yellow color, fishy aroma but not too pungent, and smoother texture compared to the control treatment.The characteristics of bream fish meat meal obtained from the steaming process on fish meat before drying are as follows: flour yield 18.17%, moisture content 19.2%, water absorption 1.8% pH 5.85 and organoleptic description yellow but slightly dull, fishy aroma but not pungent, and smooth texture.

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