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Yield And Quality Of Flour From Peperek Fish (Leiognatus Equulus) In West Sumatera Waters

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Abstract – One type of trash fish that has potential in the waters of West Sumatra is peperek fish, but most of it is still not used. To increase the economic value of the peperek fish, one of them can be processed into fish meal. The problem that is often encountered is the quality of fishmeal that is not uniform and does not meet SNI Number 2715: 2013. This study aims to determine the differences in yield of peperek flour and quality of peperek fish meal processed using conventional pans, pressure cookers and microwave ovens. The research began with a study of the availability of peperek fish and continued with the manufacture of fish meal. Furthermore, an analysis of the fish meal obtained was carried out. The results showed that peperek fish accounted for 58.82% of the total trash fish. The yields of trash fish meal obtained from the use of conventional pans, pressure cookers and microwave ovens were 19.04%, 20.04% and 22.03%, respectively. The chemical analysis results of peperek fish meal were also obtained successively from the three treatments, namely the moisture content of 9.03%, 8.08% and 7.02%; ash content 5.68%, 5.46% and 6.16%; protein content of 71.35%, 69.88% and 68.80%; fat content 14.61%, 14.22% and 17.09%. The results showed that the use of a microwave oven could produce peperek fish meal with the highest yield with a slightly lower protein content compared to other boiling methods, but still included in A quality fish meal based on SNI Number 2715: 2013.

Keywords – Trash Fish, Peperek, Boiling Method, Fish Meal.

I. INTRODUCTION

Marine fishery production In West Sumatra it is a tropical fishery where there are many kinds of fish, but the average population is small and generally includes many bony fish. Generally, many bony fish caught by fishermen in the waters of West Sumatra are peperek or maco trash fish. Utilization of peperek fish in West Sumatra is still not optimal, namely for salted fish, rickets, and most of which are thrown away, especially during the main harvest. Fish have high water content as well as peperek fish or maco fish which contain 77.07% water content [1]. The high water content contained in the fish body is a good medium for microbial growth, this causes fishery products to spoil easily, therefore processing and preservation is necessary. To increase the economic value of peperek fish, one of them is processing it into fish meal.

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Based on the description above, it is necessary to have knowledge about engineering technological processes in the manufacture of fish meal to get the best quality peperek fish meal. In connection with this, a study entitled "Yield and Quality of Peperek Fish Meal (*Leiognathus equulus*) was Conducted in the Waters of West Sumatra." This study aims to determine the potential of peperek fish, yield and quality of peperek fish meal processed using different boilers, namely conventional pans, pressure cookers and microwave ovens.

II. Materials And Methods

A. Material

The main ingredient used in this study is the trash fish type of peperek obtained from Pasie Nan Tigo beach, Padang City, West Sumatra.

B. Chemicals and Equipment

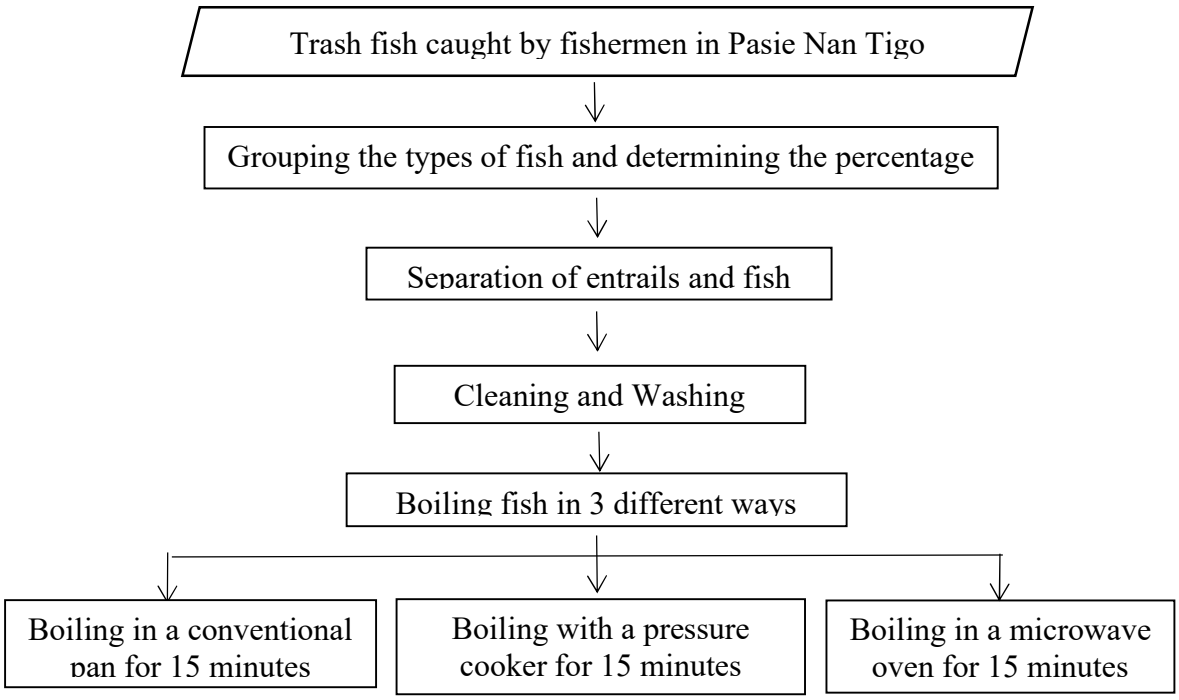
The equipment used in this study were conventional pans, pressure cookers, microwave ovens, knives, scoops, stoves, blenders, wood sieves and presses, buckets, trays, and thermometers. Other materials and equipment used are materials and equipment for chemical analysis which includes moisture content, ash content, protein content and fat content according to SNI number 2715; 2013.

C. Research Stages

This research was conducted in three stages. The first stage is separating the peperek fish from trash fish to calculate the percentage of peperek fish in the whole trash fish for one trash fishing period, the second stage is making peperek fish meal using three different boiling tools and the third stage is the chemical analysis of fish meal.

In the first stage, a study of fish species in trash fish populations in fishermen's catches is carried out. The trash fish population weighs 850 grams per one time. Furthermore, the fish were sorted by species to calculate the percentage of each fish species. Preliminary observations show that peperek fish are relatively more abundant than other species.

The second stage is making fish meal. The fish is cleaned by removing the stomach contents and fish head and then washing it with clean running water. Furthermore, the fish is boiled for 15 minutes using three different boiling tools, namely boiling using a conventional pan, boiling using a pressure cooker and boiling using a microwave oven. Then do the draining and pressing to separate the boiled water. Furthermore, it is dried in the sun for 3-4 days to dry (estimated moisture content <10%). The dried fishes are then carried out in a blender process. In the final stage, weighing is carried out to determine the weight and yield. The working procedure for making peperek fish meal is presented in the form of a flow chart as shown in Figure 1.



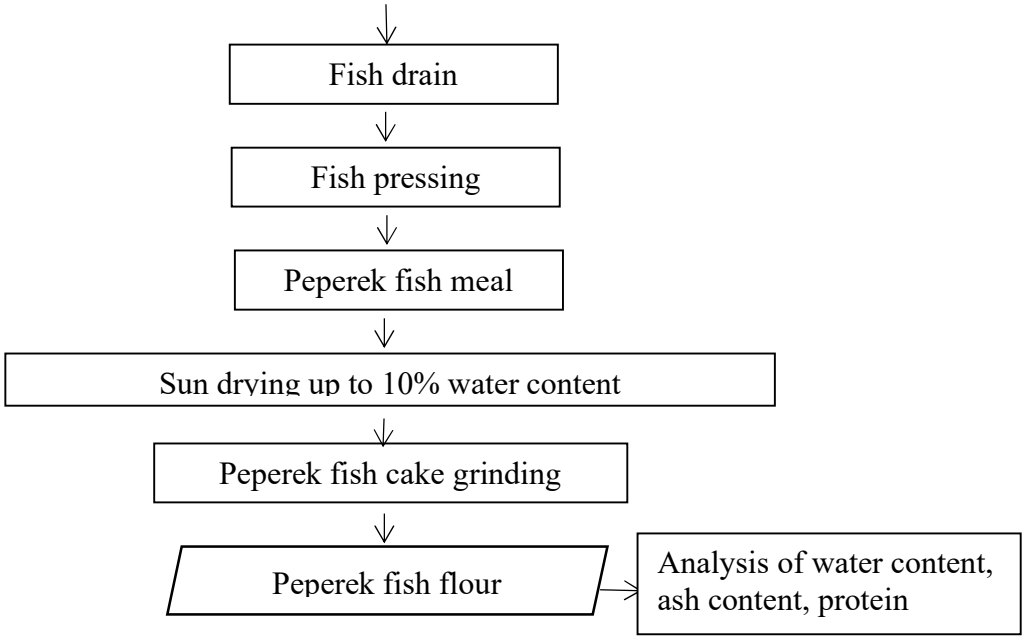


Figure 1.The process of making peperek fish meal (modified from Assadad, 2015)

In the third stage, the yield is calculated and then the peperek fish meal is chemically analyzed based on SNI number 2715: 2013 [5].

III. Results And Discussion

A. Percentage of Each Fish Species in Trash Fish Populations.

Peperek or maco fish is a type of trash fish that has low economic value. Generally, trash fish is used as fish meal [4]. Based on the results of grouping fish by species and then percentage, the percentage of each is obtained as shown in Table 1 and Figure 2.

Table 1. The Average percentage of each species of fish in the trash fish population of Pasia Nan Tigo fishermen

No	Types of Fish	Percentage (%)
1	Anchovy *(Stolephorus sp)*	5,88
2	Peperek atau maco *(Leiognathus equulus)*	58,82
3	Kase *(Thryssa dussumieri Valenciennes)*	2,35
4	Nine coral *(Plotosus lineatus)*	3,53
5	Child crab *(Callinectes sapidus)*	4,70
6	Tembang *(Sardinella gibbosa)*	0,94
7	Terapon *(Terpon jarbua)*	1,76
8	Other types of fish	22

From Table 1 and Figure 2 it can be seen that the percentage of each fish species in the trash fish population in Pasia Nan Tigo waters, West Sumatra, namely anchovies 5.88%, peperek fish 58.82%, kase fish 2.35%, Sembilang fish. Coral 3.53%, baby crab 4.70%, tembang fish 0.94%, terapon fish 1.76% and other types of trash fish whose names are not known about 22%. This indicates that peperek fish dominate fish species in trash fish populations where more than half of them. In this connection, further processing of peperek fish is needed, such as for making peperek fish meal which can provide added value for fishermen.

Prayanda in his research stated that the number of peperek fish caught by fishermen in October 2018 in the waters of Pasir Jambak was 24% of the total trash fish population, while the percentage of anchovy was 15% and kase fish 61% [6].

In Rifqi's research, the number of peperek fish caught by fishermen's trawlers on the white sand beach of South Bungus Village was 53,300 grams of the total fish amount of 82,518.95 grams or 29.20%, anchovies as much as 124,800 grams or 68.38% and swordfish 2,684. 47 grams or 1.47% [7].

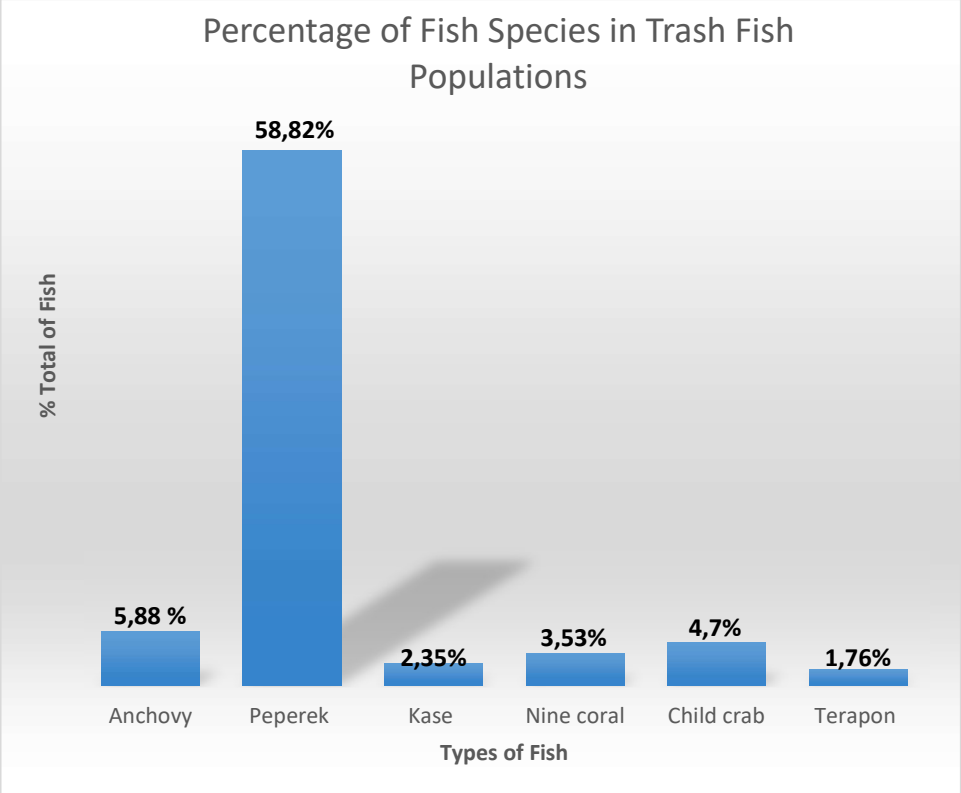


Figure 2. The Average percentage of fish species in trash fish populations

According to Ihwan, the results of fishing in Mandeh waters of Pesisir Selatan Regency in 2019 for anchovy amounted to 67.9%, peperek fish 15%, fish sponge fish 0.04%, mackerel fish 16.9%, terapon fish 0.09% [8]. The data shows that anchovy has the highest number of trash fish in Pesisir Selatan waters. However, according to the research that has been conducted, for the waters of Pasie Nan Tigo, Padang City, West Sumatra, the type of fish caught is mostly peperek fish, 58.82% of the total trash fish population.

B. Yield of Peperek Fish Flour from 3 Boiling Methods

The data on the yield calculation of peperek fish using the boiling method using different tools can be seen in Table 2 and Figure 3.

Table 2. Yield of peperek fish meal (Leiognatus equulus)

Treatment	Fraction		
	Fresh Fish	Fish Flour	Processing yield
T_1	1000 g	190,41g	19,04 %
T_2	1000 g	200,35g	20,04 %
T_3	1000 g`	220,32g	22,03 %

Note :

T_1 : boiling with a conventional pan

T_2 : boiling with a pressure cooker

T_3 : boiling with a microwave oven

The yield is calculated based on the weight of the initial fish that have not been cleaned. The results obtained were that the highest yield of fish meal was found in fish with boiling treatment with a microwave oven, namely 22.03%, because it is estimated that there are not many water-soluble materials. This can also be seen from the higher fat content of fish by boiling using a microwave oven compared to the boiling treatment with pressure cookers and conventional pans as shown in Table 6.

According to Khalil, the yield of peperek fish meal using the steaming method was 19.10% while the non-cooking method (directly dried) was 22.20% [9]. Steamed fish meal that has gone through several stages of processing such as chopping, steaming and pressing and causing a shrinkage of product weight. Sipayung stated that as the water content decreases, the yield produced is also decreasing [10].

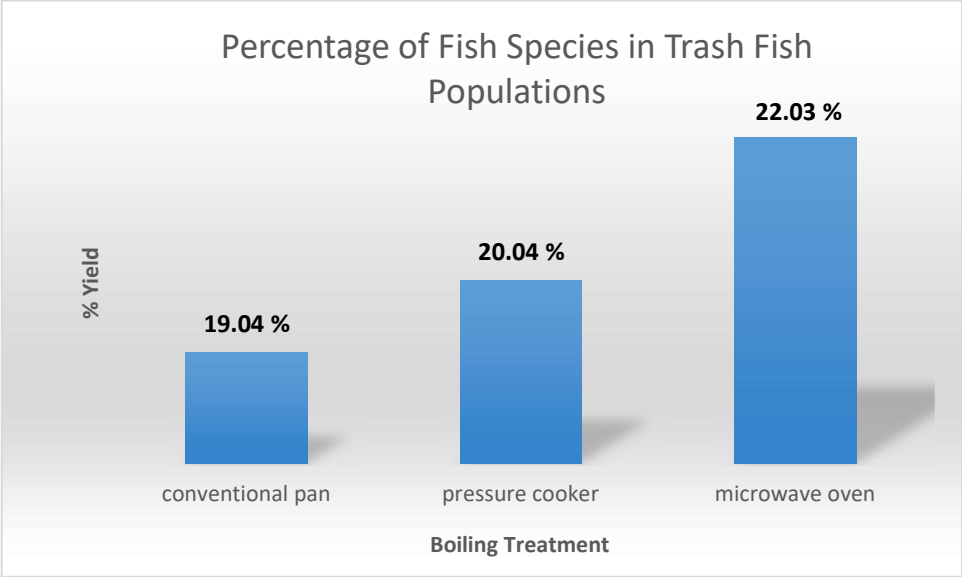


Figure 3. Yield of Peperek Fish Meal from 3 Boiling Methods

Based on the comparison of previous research results, it can be seen that fish meal boiled in a microwave oven has the same yield as the fish meal without cooking treatment (directly in the sun), this indicates that, microwave cooking does not experience much weight loss.

C. Results of Chemical Analysis of Peperek Fish Flour from 3 Boiling Methods

The composition contained in fish meal varies. This is influenced by the boiling method with different tools. Chemical analysis carried out on peperek fish meal is testing water content, ash content, protein content and fat content.

1. Water Content

In this research it is known that the highest water content is in the boiling method using a conventional pan (T_1) with a value of 9.03% then the boiling method uses a pressure cooker (T_2) with a value of 8.08% and the method of boiling with a microwave oven (T_3) 7.02. %, each treatment was significantly different. The high water content using conventional pans (T_1) is thought to be because with conventional pans the temperature rises slowly so that the texture of the fish is less cooked than that of a pressure cooker boiler and a microwave oven, resulting in fish meat containing higher water.

Table 3. Water content of peperek fish meal

Treatment	Water Content (%)
T_1 (boiling with a conventional pan)	9,03 a
T_2 (boiling with a pressure cooker)	8,08 b
T_3 (boiling with a microwave oven)	7,02 c

Note: Numbers followed by different letters indicate a significant difference based on Duncan's Multiple Range Test (DMRT) at the level of 5% (P≤0.05)

According to Khalil, the water content of steaming peperek fish meal is 3.62% lower than the water content without cooking, namely 7.80%, because each stage of the steaming process causes more water to come out [9]. According to Sipayung's opinion, the highest water content of steaming trash fish meal is at 80°C of 7.51% and the lowest is at 100°C of 5.31%, so the higher the steaming temperature the water content is lower [10].

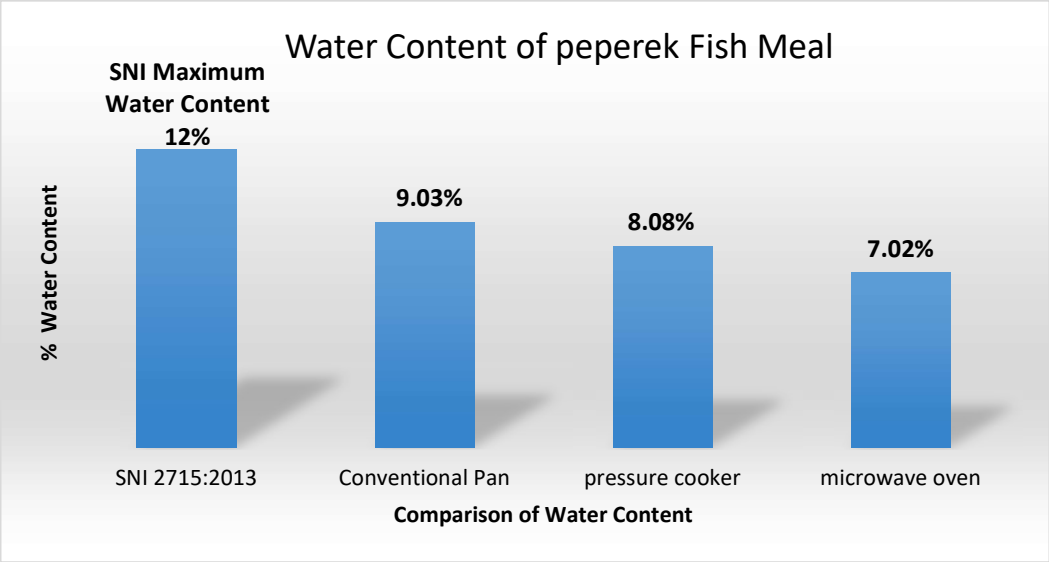


Figure 4. Graph of Comparison of Water Content of Peperek Fish Meal with SNI 2715: 2013

Based on the graph, it is known that the peperek fish flour boiled with a conventional pan, pressure cooker, or microwave oven has a moisture content in accordance with the SNI fish meal quality standard number 2715: 2013 [5], ranging from 6-10%, this shows the quality of the flour. Peperek fish is included in quality class A with a water content of 6-10%.

2. Ash Content

The results showed that the highest ash content of peperek fish meal was in the microwave oven boiling method with a value of 6.16%, then the boiling method used a conventional pan with a value of 5.68% and the lowest ash content was using the pressure cooker boiling method with a value of 5.46%. From the results of the study it can be seen that the ash content of peperek fish meal using a conventional pan boiler, pressure cooker and conventional oven is classified as quality A according to SNI number 2715: 2013, namely the maximum ash content of fish meal is 20%. Sipayung stated that the ash content of trash fish meal was about 17.72% on average [10].

Table 4. Ash content of peperek fish meal

Perlakuan	Kadar abu (%)
T_2 (boiling with a pressure cooker)	5,46 a
T_1 (boiling with a conventional pan)	5,68 a b
T_3 (boiling with a microwave oven)	6,16 b

Note: Numbers followed by different letters indicate a significant difference based on Duncan's Multiple Range Test (DMRT) at the level of 5% (P≤0.05)

According to Khalil, the ash content of peperek fish meal by steaming was 24.12% [9]. Mean while, according to Sipayung, peperek fish has a fairly high ratio of bone and meat which results in a high ash content of 34.35% [10].

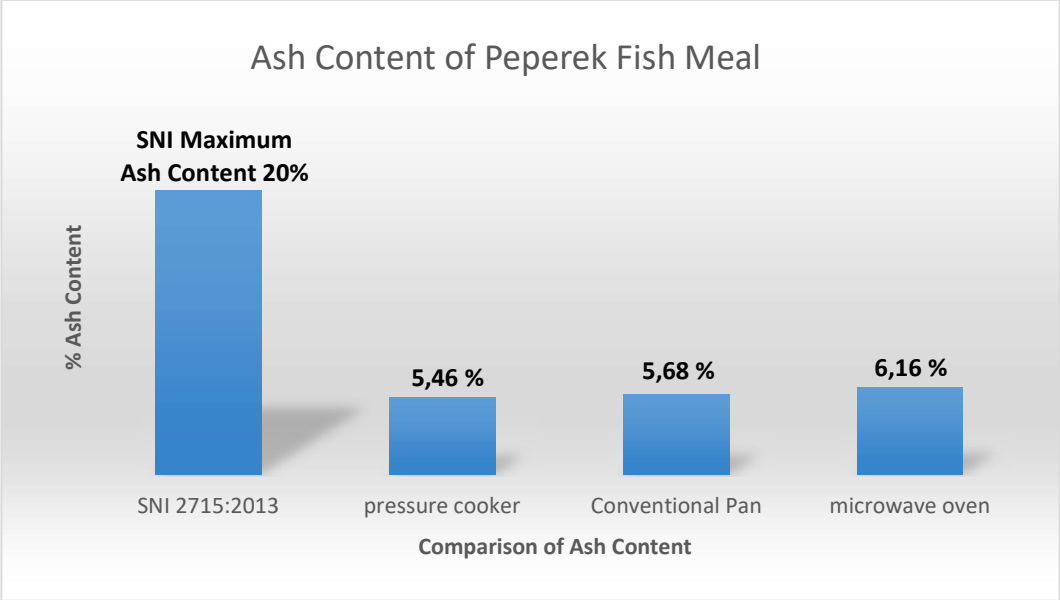


Figure 5.Graph of Comparison of Ash Content of Peperek Fish with SNI 2715: 2013

The ash content of the peperek fish meal using the pressure cooker boiling method is the lowest compared to other boiling methods, this is because boiling the pressure cooker uses high temperature and pressure, causing the fish bones to become soft and the mineral content in the fish body dissolves during the cooking process. This opinion is in accordance with Zahroh's research, the higher the temperature used, the more minerals that dissolve during the cooking process [11]. In line with Apriyanto's opinion, ash content indicates the large amount of minerals contained in foodstuffs [12].

3. Protein Content

The results showed that the peperek fish meal had significantly different protein content in each boiling method with different tools. The highest protein content was found in the boiling method using a conventional pan (T_1) with a value of 71.35% then followed by the boiling method using a pressure cooker (T_2) 69.88% and the lowest protein content using the boiling method using a microwave oven (T_3), namely 68,80%, low levels of protein by boiling using a microwave oven are due to the high breakdown of protein into amino acids, the decomposed amino acids are damaged due to high heating temperatures in the microwave oven and result in decreased protein levels. According to Ito that amino acids will suffer damage if heated more than 100^{o}C [13]. The higher the boiling temperature, the lower the amount of protein will be, because the protein content in the material is denatured and the grade loose occurs. Heat-induced denaturation is due to the formation or change of functional properties of proteins [14].

Table 5. Protein content of peperek fish meal

Treatment	Protein Content (%)
T_1 (boiling with a conventional pan)	71,35 a
T_2 (boiling with a pressure cooker)	69,88 b
T_3 (boiling with a microwave oven)	68,80 c

Note: Numbers followed by different letters indicate a significant difference based on Duncan's Multiple Range Test (DMRT) at the level of 5% ($P \leq 0.05$)

According to Khalil, the protein content of peperek fish meal which goes through the steaming stage is 70.17% while without cooking it is 70.10%, numerically it can be seen that the protein of peperek fish meal by steaming is higher than that of direct drying [9]. This is because steaming causes low fat levels so that protein increases. This data is supported in research by Devi et al. in fresh amblypharyngodon mola fish meat had a protein content of 3.56% to 5.28% after steaming [14].

From the results of research that has been done it is known that the protein content of peperek fish meal boiled in a microwave oven is lower than other treatments, this is also due to the high fat content so that the protein content is reduced in portions.

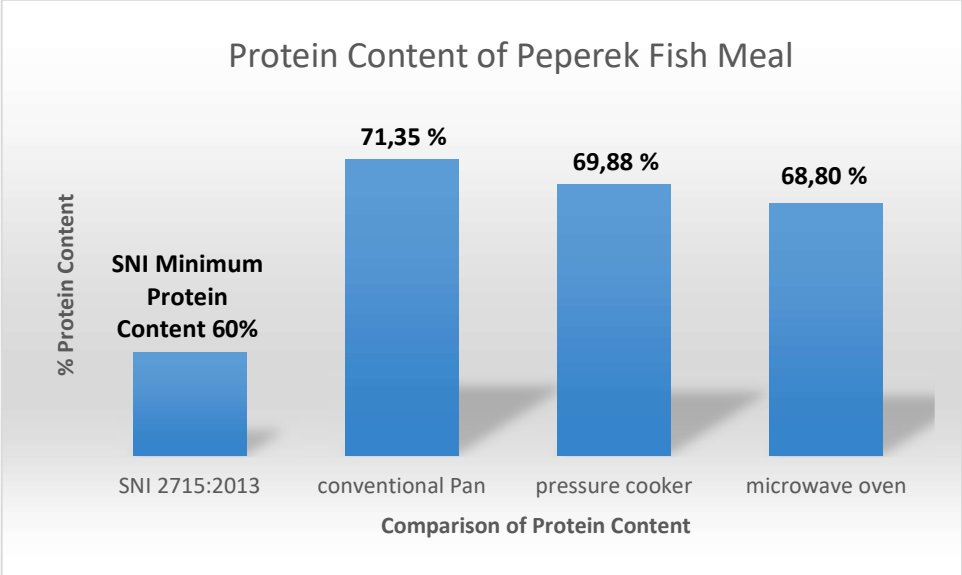


Figure 6. Graph of Comparison of Protein Content of Peperek Fish Meal with SNI 2715: 2013

Based on the graph, it is known that the peperek fish flour boiled with a conventional pan, pressure cooker, or microwave oven has protein content in accordance with the SNI fish meal quality standard number 2715: 2013 [5], ranging from 68.80 % - 71.35%, p. This shows that the quality of the peperek fish meal is included in quality standard A (minimum protein content of 60%).

4. Fat Content

Based on the research results, it can be seen that the highest fat content of peperek fish meal in the boiling method using a microwave oven (T_3) is 17.09%, followed by the fat content in the conventional pan boiling method (T_1) 14.61% and the lowest fat content at the method of boiling using a pressure cooker (T_2) is 14.22%. The fat content of peperek fishmeal boiled with a conventional pan and a pressure cooker was not significantly different, but significantly different from boiling using a microwave oven.

Table 6. Fat content of peperek fish meal

Treatment	Fat Content (%)
T_1 (boiling with a conventional pan)	14,61 a
T_2 (boiling with a pressure cooker)	14,22 a
T_3 (boiling with a microwave oven)	17,09 b

Note: Numbers followed by different letters indicate a significant difference based on Duncan's Multiple Range Test (DMRT) at the level of 5% ($P \leq 0.05$)

The low fat content in the boiling method using the pressure cooker is due to the breakdown of fat into fatty acids due to the very high temperature and pressure of the pressure cooker, so that many fatty acids and volatile fatty compounds are dissolved in the peperek fish cooking water. This is in line with Putri's opinion which states that the food processing process is thought to cause the breakdown of compounds such as fat into fatty acids and protein into amino acids [15]. Winarno added that heating at high temperatures will accelerate the movements of fat molecules so that the distance between the molecules becomes large thereby facilitating the removal of fat from the material [16].

According to Khalil, the fat content of peperek fish meal using the steaming method is 2.64%, the steaming process at high temperature followed by the pressing process causes the fat to separate with water [9]. Sipayung stated that the highest fat content of steaming trash fish meal was at 80°C of 7.70 and the lowest was at 100°C of 5.38 [10].

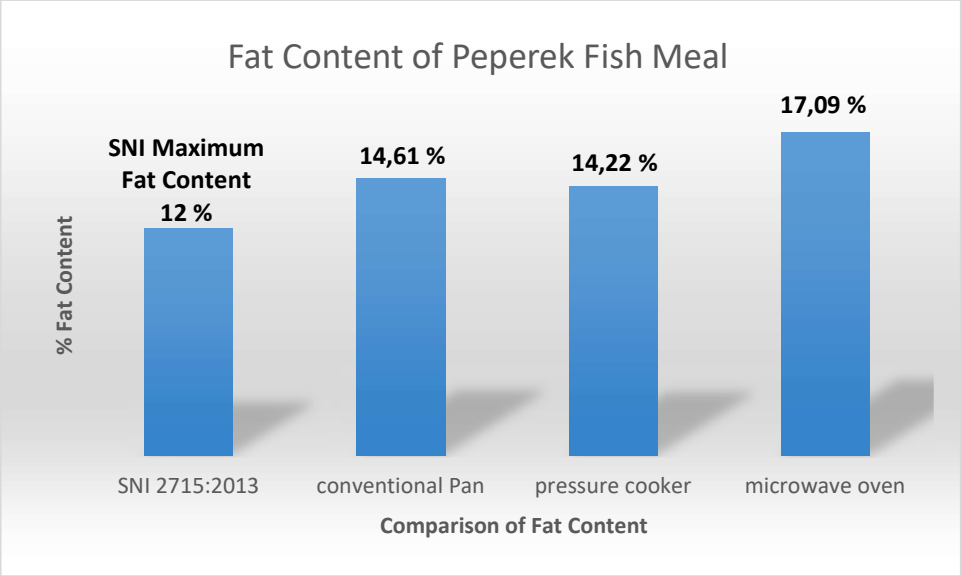


Figure 7. Graph of Comparison of Fat Content of Peperek Fish Meal with SNI 2715: 2013

For the fat testing parameters, the peperek fish meal produced in various treatments has a fat content ranging from 14.61-17.09%, so it does not meet the SNI standards, where according to SNI standard number 2715: 2013 the maximum fat content of fish meal is 12%.

IV. Conclusion

From the research results it can be concluded that:

1. Peperek fish dominates the percentage of fish species in trash fish population, namely 58.82%.
2. The yield of fish meal produced was 19.04%, 20.04% and 22.03% by boiling fish in a conventional pan, pressure cooker and microwave oven, respectively.
3. The three ways of boiling peperek fish can produce fish meal that meets the A quality of fish meal based on SNI number 2715: 2013, for protein content, water content and ash content but the fat content of fish meal for the three processing methods has not met SNI number 2715: 2013.

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