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Article

Nutritional Profile of Fish Powder Made from Tuna By-Products: Establishment and Evaluation

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A B S T R A C T

Indonesia is a major exporter of tuna, both fresh and frozen, as well as processed tuna. The bones are not appropriately utilised because they are generally discarded during tuna production and only the meat is consumed. Another method to utilize it is by turning it into flour, which may then be transformed into a variety of processed goods. The objective of this research is to create tuna fish powder from fish skeletons and head bones, assess the viability of using tuna fish bone waste by analyzing its nutritional value and level of microbial contamination, and then offer a substitute for enhancing community nutrition. The nutritional analysis component of the study's findings revealed that the ash content of tuna flour was 57.63%, the protein content was 26.13, the water content was 5.20%, and the carbohydrate content was 6.89%. The results of all microbiological tests for the total number of bacteria are safe. In order to meet their daily nutritional needs, it is advised that the community and associated companies create tuna fish powder, which is ideal as a food additive.

I. INTRODUCTION

Indonesia has extensive territorial seas and substantial fisheries resources. However, the Archipelago's marine richness has not been fully utilized due to a variety of obstacles such as illegal, unreported, and unregulated fishing. In general, marine and fishing enterprises generate solid waste in the form of fish bones, shells, skins, and heads, as well as feed trash. However, marine and fishing enterprises generate liquid waste, such as liquid waste that is not used in salt ponds (Luhur, Zulham, & Haryadi, 2016).

Approximately 34% of the entire weight of the fish is waste (Koli, et al., 2012). One of the most serious issues in the fish processing sector is fish waste. Both on land and in the sea, fish waste can harm the ecosystem. In fact, fish waste still has a significant protein content. The waste is made up of heads (12.0%), bones (11.7%), fins (3.4%), skin (4.0%), spines (2.0%), and entrails/offal (4.8%) and is thought to make up between 30 and 40% of the total weight of fish, mollusks, and

crustaceans (Nurhayati & Peranginangin, 2009). As a result, incorporating fish waste into products will reduce environmental pollution while increasing the added value of fishery goods. Fish powder can be used as an alternative to provide vital marine-derived nutrients. These fish products can be developed from underutilized byproducts as well as nutritionally adequate byproducts from fish processing factories (Abbey, Amengor, Atikpo, Atter, & Toppe, 2016). Given its marine resources and the enormous number of marine by-products produced annually (1.8 million tons), the processing of fish waste into fish powder will be acceptable (Putranto, Asikin, & Kusumaningrum, 2015). Unfortunately, the preparation of fish powder with intended applications for human consumption has not yet been explored in Indonesia. Fish powder is a byproduct of the fish processing industry that can be a low-cost source of protein with a simple processing method.

II. METHODS

This study was divided into two stages: the preparation of the tuna fish powder and the analysis of the fish powder, which included measurements of its proximate components (water content, ash, fat, protein, carbohydrates, energy, and calories) as well as its microbial composition (*Aerobic Plate Count, Mold Yeast, Coliform, Enterococci, S. aureus, Clostrdium perfringens, Vibrio cholera, Salmonella typosa*).

Fish head bones and tuna skeletons were used in this investigation as by-products of fish processing. The dry product from these ingredients can be dried and processed to produce the final fish powder product. Fish powder's nutritional profile, microbes, and heavy metal concentration will be evaluated.

Material

Waste tuna fish bones, specifically head bones and skeletons, are utilised. Pressure cookers, drying ovens, grinding/blenders, moisture meters, and stoves are among the tools utilized.

Pre-Treatment

The process of separating the bones from the meat begins with the pouring of hot/boiling water (100°C) to make the separation of the bones and the meat easier, and is followed by the process of cutting the bones of small fish to make the bones softer during the presto and miling processes.

Fig 1: Tuna Fish Bones Pre-Treatment Results

Fish Powder Treatment

According to figure 2, a pressure cooker is used to soften the fish bones. Fish bones are softened to make grinding easier and to hasten the drying process. Fish bones are softened throughout the course of two processes. After 45 minutes of softening, the first stage was mashed with a blender, and the second stage was once more softened and mashed with a blender.

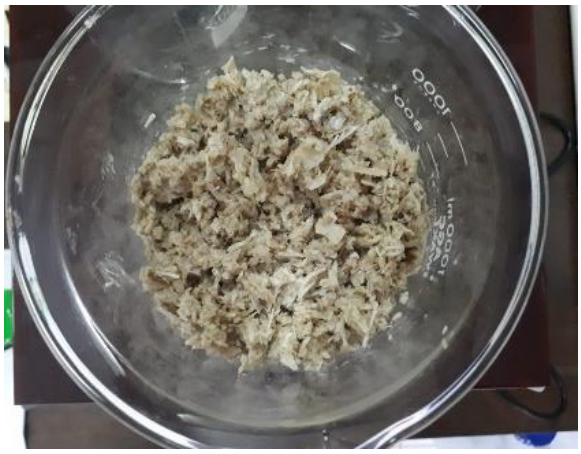

Fig 2: Results of Softening and Smoothing Stage 1

The samples were thoroughly washed before being dried at 70°C for more than 7 hours. To create powder made from tuna byproducts, the dried samples were crushed.

Fig 3: Results of Softening and Smoothing Stage 1

III. RESULT AND DISCUSSION

Fish Powder Nutrition

No.	Parameter	Unit	Hasil
1	Proteins	%	26.44 - 26.13
2	Ash Content	%	58.22 - 57.63
3	Energy from Fat	Kcal/100 g	39.06 - 37.80
4	Total Fat	%	4.34 - 4.20
5	Water Content	%	5.20 - 5.15
6	Energy Total	Kcal/100 g	168.02 - 169.88
7	Carbohydrate	%	5.80 - 6.89

Table 1. The Nutrient Analysis of 300 grams of Tuna Fish Powder

In 300 grams of fish powder, the resulting tuna fish powder has an average moisture content of 5.15 – 5.20%. This amount is higher than the fish powder water content made by Hilman Fadhli (Putranto, Asikin, & Kusumaningrum, 2015), but it is still within the standard range established by SNI (SNI 01-3158-1992) for fish powder moisture content (maximum 8%).

In this study, the ash percentage in 300 grams of fish powder ranged from 58.22 to 57.63%. This number is higher than the ash content of ISA's commercial bone powder but lower than the figures reported by Elfauziah (Elfauziah, 2003), Hilman (Putranto, Asikin, & Kusumaningrum, 2015), and Mulia (Mulia, 2004). The ash content of fish powder generated by the 2002 ISA was only 33.0%, whereas it was 79.14%, 88.13%, and 63.5% in studies by Elfauziah (Elfauziah, 2003), Hilman (Putranto, Asikin, & Kusumaningrum, 2015), and Mulia (Mulia, 2004). The length of the pressure cooker's boiling time has a significant effect on the ash, protein, and fat content of fish powder.

Bones contain living cells and intracellular matrix in the form of mineral salts. The high ash content in fish powder is due to the fact that the main components of bone are minerals and protein hydrolysis has occurred during the manufacturing process.

In this study, the range of the average protein content of fish powder derived

from various treatment combinations was 26.44 – 26.13%. The obtained fish powder's protein content, at 34.20, 16.9, and 11.08%, was higher and closer to that of fish powder protein generated by ISA, Elfauziah (Elfauziah, 2003), and Mulia (Mulia, 2004). However, the protein level in this investigation was substantially lower than the 82.86% obtained by Christina and Joko (Litaay & Santoso, 2013).

The average fat content obtained is approximately 4.34 - 4.20%. This figure falls within the standard fat content range established by SNI (1992), as well as the fat content derived from ISA's fish powder. The Indonesian National Standard (1992) for the fat content of fish powder is set at 3 and 6%, respectively, while the fat content of ISA's fish powder is 5.6% and Christina and Joko's fish powder is 1.10%.

The average value of carbohydrate content in this study was 5.80 - 6.89%. According to the findings of the study, the average carbohydrate content of fish powder. In this investigation, the carbohydrate content of fish powder was higher than that of Kantun (Kantun, Malik, & Harianti, 2015).

Total Microbes of Tuna Fish Powder

The total amount of tuna fish powder bacteria, as determined by laboratory tests, is shown in table 2 below :

Total microbial bacteria from tuna fish powder processed at 70°C were still less than 10,000 colonies/gram. The total microbiological contamination does not exceed the maximum limit set by Indonesian National Standard No. 7388:2009 for flour, which is 1,000,000 colonies/gram. Tuna fish powder is classified as safe by SNI for flour.

	Parameter	Unit	Hasil
1	Aerobic Plate Count	colony / g	1.4×10^3 - 1.5×10^3
2	Yeast mold	colony / g	<10
3	Coliform	MPN / g	9.2
4	Escherichia coli	MPN / g	<3
5	Enterococci	colony / g	<10
6	Staphylococcus aureus	colony / g	<10
7	Clostridium perfringens	colony / g	<10
8	Vibrio cholerae	/ 25 g	Negative
9	Salmonella typhosa	/ 25 g	Negative
10	Bacillus cereus	colony / g	<10

Table 2. Results of Bacterial Microbial Examination in 300 gr of Tuna Fish Powder

Bacteria require water to survive. This approach is used to prevent the formation of germs in food by limiting the amount of water in the fish powder, preventing bacteria from growing in it (Purnawijayanti & Hiasinta, 2001).

The main objective of drying is to lower the water content to an amount where bacteria cannot grow. This is due to the oven drying process of high temperature, continuous temperature and controlled sanitation, which makes it difficult for germs to grow and die.

IV. CONCLUSION

Finally, this study demonstrates that tuna (Thunnus sp.) powder can be a healthy source of dietary protein and fat. The process of powdering and drying employing oven drying at 70°C for 7 hours demonstrates an efficient fish processing approach in terms of protein retention and water content decrease. Microbiological

investigations suggest that the fish powder is safe to consume after softening and drying.

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