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Amino acid profile and chemical characteristics by-product process wet rendering of fish lele (*Clarias* Sp.) and tuna (*Euthynnus* Spp.)

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ABSTRACT

This study was conducted to determine the amino acids profile and chemicals content (moisture content, protein, and fat) catfish and tuna products. Wet rendering process, each sample is steamed at 150°C for 30 minutes, after the sample is pressed with the aim of removing fluid from the fish's body. The liquid is centrifuged to separate the layers of oil and air. After obtaining fish oil, the byproducts are liquid / broth and solids (fish dregs). The byproducts (fish pulp and broth) were analyzed for amino acid profiles using High Performance Liquid Chromatography (HPLC) (AOAC, 2005). Chemical characteristics (air content, protein, fat) were analyzed using the AOAC (2005). The results showed that glutamic acid was higher in tuna pulp which was 11.83% and catfish 8.85%, while tuna broth contained amino acid histidine which was quite high at 10.49%, and 11.53% glycine in fish broth catfish. Furthermore, the levels of pulp and fish stock are 12.63% and 78.28% respectively, catfish 11.58%; and 83.45%. The fat content of catfish is higher that is 1.84% and 3.26% compared to tuna which is 1.57% and 2.74% tuna protein is 81.16% higher than catfish which is 75.46%, but the protein content of tuna broth is 56.84% lower than that of catfish broth which is 69.16%.

Introduction

Research results have been reported that marine fish oils such as tuna and freshwater catfish were very rich in omega 3, 6 and 9 which was very good for healthy (Minarny *et al.*, 2014). This has caused world market demand for fish oil to increase.

There was several methods of extracting fish oil such as wet rendering, dry rendering, using chemical solvents, and the most frequently used was the rendering method due to low-cost economy, the volume of oil obtained was more, safe for health and easy to made. The process of extracting fish oil using the wet rendering method will produce many by-products such as fish solids and broths.

This by-product could still be further processed into other products such as fish meal and others. On average in 1 kg of fish meat will produce an average of 30% by-product of fish meat and 65%. Other than

that tuna waste in an empty state when in the form of loin was 37.89% consisting of head, bones, stomach contents, tunings, fins, and skin. Tuna waste in the form of head, gelatins, entrails, bones and others has the potential as a raw material source of carbohydrates, fats, and proteins (Kantun *et al.*, 2015). Fish waste contains protein, oil, minerals, enzymes, bioactive peptides, collagen and gelatin (Ghaly *et al.*, 2013).

Waste obtained from fish processing has been processed into animal feed or fish oil. The processing of fish oil is often done using the wet rendering method. Wet rendering is a way of extracting oil by adding some water during the process. In this study the wet rendering method uses distilled water. There are three important processes when doing the wet rendering method, namely the destruction of material, cooking with hot water vapor, and the

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separation of oil by pressure (Kiple & Ornelas, 2000). The advantage of this method is the lack of use of chemicals and can be applied in almost all materials (Febrianto *et al.*, 2011). Bimbo. (1998) explained that fish oil production using the wet rendering method produces a by-product in the form of liquid (broth) and solids that were sufficiently large portion so that it could be utilized further.

Information about the composition of nutritional by-products the wet rendering methods includes liquids (broth) and solids from catfish (*Clarias* sp.) and tuna fish (*Euthynnus* spp.) have not been reported, so this research is important to do. This research is expected to provide contribution to the optimal utilization of the by-products so as to increased the economic value by product. The purpose of this study was to determine the chemical characteristics (water content, protein, and fat) and the amino acid profile of the by-product wet rendering process of catfish and tuna fish.

Materials and Methods

The main raw materials used in this study were catfish (*Clarias* sp.) obtained from traditional markets in the city of Palu and Tuna fish (*Euthynnus* spp.) obtained from the waters of Makassar and Tomini Bay. The study was conducted by extracting each catfish and tuna fish using the wet rendering method with a 1: 2 distillation aquades solvent, then obtained by products in the form of liquid/broth and solids. Liquids and solids are then analyzed for water content (AOAC 2005, No. 934.01), protein (AOAC, 2005 No. 976.05), fats (AOAC, 2005 No. 954.02) and amino acids using High Performance Liquid Chromatography (AOAC, 2005).

Results and Discussion

Profile of Solid Amino Acids and Catfish and Tuna fish Broth

The results of the analysis of the solid amino acid profiles catfish and tuna fish obtained fifteen amino acids consisting of eight essential amino acids and seven non-essential amino acids. The amino acid profiles of catfish and tuna fish (solids and broth) using HPLC were presented in Table 1.

Table 1 showed the total amino acids of solids and broth of catfish tend to be higher than tuna fish, which is 78.02%: 76.65% and 53.12%: 15.24%, which is dominated by essential amino acids that is 45.89%: 16.79% and non-essential amino acids namely 33.13%: 14.73%. Lysine essential amino acid content is quite high in solids and broths of catfish and tuna, respectively 6.85% and 3.68%; 7.17% and 1.26%, followed by leucine amino acids 5.30% and 2.06%;

6.57% and 1.22%; valines 4.21% and 1.83%; 4.74% and 0.89%; isoleucine 4.01% and 1.39%; 4.37% and 0.68%; threonine 3.75% and 1.82%; 3.68% and 0.98%, but the amino acid histidine tends to be higher in tuna broths which are 10.49% and 5.44% compared to catfish solids which are 0.87% and 5.52%.

The content of non-essential amino acid glutamate tends to be higher in solids and broth of tuna than catfish, namely 11.88% and 2.84%: 8.84% and 7.98%, then aspartate 8.39% and 1.64% ; 5.57% and 5.04%; arginine 4.80% and 1.39%; 4.92% and 3.75%; alanine 4.67% and 2.19%; 4.63% and 5.93%.

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The essential amino acids detected were threonine, methionine, valine, phenylalanine, isoleucine, leucine and lysine but tryptophan amino acids in both study samples were not detected while the non essential amino acids detected were glutamate acid, aspartate, arginine, alanine, glycine, serine, histidine, and tyrosine. Lack of one type of amino acid in a material can be covered with similar amino acids from other food ingredients to improve protein quality. Each type of amino acid has its own function. Leucine reduces muscle breakdown. Isoleucine provides energy for muscles and is involved in forming hemoglobin. Glycine binds and changes toxic substances so that they are not harmful (Almatsier, 2006). Tryptophan as a precursor of niacin vitamin and an introduction to the serotonin nerve. Arginine plays a role in the process of ureum synthesis. Phenylalanine as a precursor of tyrosine and forms the hormone thyroxine. Tyrosine is a precursor of skin and hair pigment. Cysteine against free radicals. Lysine plays a role in the growth and formation of collagen (Fitri, 2012).

Glutamic acid is the most dominant amino acid in the two study samples. This is in accordance with research Suseno *et al.* (2015) states that glutamate acid is the dominant amino acid in tuna (*Thunnus* sp.). The content of solid glutamic acid is greater when compared to the broth in both types of fish. This showed that glutamic acid dissolves in water in small amounts. Antonie *et al.* (2011) states that there were differences in the content of glutamate acid in white meat and red meat in yellow fin tuna. Glutamic acid is a non-essential amino acid that can give a special/natural flavor in the form of sodium salt (Uju *et al.* 2009).

Table 1. Profiles of solid amino acids and wet rendering broths by catfish and tuna amino catfish amino acids (%).

Amino Acids	Catfish		Tuna Fish	
	Solids (%)	Broth (%)	Solids (%)	Broth (%)
Metionin	2.50± 0.05	0.80 ± 0.09	2.22± 0.26	0.56 ± 0.02
Valine	4.21 ± 0.06	1.83 ± 0.05	4.74 ± 0.13	0.89 ± 0.03
Fenilalanin	3.53 ± 0.11	2.06 ± 0.04	3.48± 0.12	0.72 ± 0.02
Isoleusin	4.01 ± 0.07	1.39 ± 0.02	4.37 ± 0.13	0.67 ± 0.03
Threonine	3.75 ± 0.11	1.82 ± 0.03	3.68 ± 0.10	0.983 ± 0.01
Leusin	5.30 ± 0.06	2.78 ± 0.04	6.57± 0.26	1.22 ± 0.05
Lysine	6.85 ± 0.26	3.68 ± 0.05	7.17 ± 0.13	1.25± 0.02
Histidin	5.52 ± 0.117	0.87 ± 0.04	5.44 ± 0.21	10.49 ± 0.09
Amount essensial amino acids	45.89	15.23	37.68	16.79
Glycine	3.28 ± 0.11	11.53 ± 0.14	3.43 ± 0.06	5.46 ± 0.23
Aspartat	5.57 ± 0.10	5.04 ± 0.10	8.38 ± 0.65	1.64 ± 0.02
Glutamic acid	8.84 ± 0.11	7.98 ± 0.16	11.88 ± 0.03	2.84 ± 0.01
Alanine	4.62± 0.12	5.95 ± 0.14	4.67 ± 0.16	2.19 ± 0.06
Serine	3.00 ± 0.10	2.03 ± 0.05	2.94 ± 0.06	0.84 ± 0.02
Tyrosine	2.88 ± 0.14	0.59 ± 0.04	2.86± 0.06	0.35 ± 0.03
Arginine	4.91 ± 0.16	3.74 ± 0.06	4.80± 0.10	1.39 ± 0.03
Amount non essensial amino acids	33.13	36.88	38.96	14.73
Total acids	78.02	53.12	76.65	31.53

The highest amino acids in catfish broth is glycine by 11.53%, while in tuna broth is histidine by 10.49%. Different results were stated by Wijayanti *et al.*, (2013) which stated that the amino acid content in catfish was dominated by the amino acid lysine. This difference is thought to occur because some of the dissolved proteins are still in the form of peptides. The same thing was stated by Nurhayati *et*

al., (2007) that dissolved protein, which is still partially in the form of peptides, caused amino acid levels in protein hydrolyzate to be low.

The results of the analysis of protein content, fat and water content by wet product rendering of catfish and tuna (broth and solids) are presented in Table 2 as follows.

Table 2. Content of protein, fat and water (%) broth and solid by-product wet rendering of catfish and tuna

Nutrient	Catfish		Tuna Fish	
	Solids (%)	Broth (%)	Solids (%)	Broth (%)
Protein	75.46 ± 0.02	69.16 ± 0.11	81.16 ± 0.65	56.84 ± 0.03
Fat	1.84 ± 0.02	3.26 ± 0.06	1.57 ± 0.08	2.74 ± 0.01
Moisture Content	11.58 ± 0.14	83.45 ± 0.03	12.63 ± 0.04	78.28 ± 0.08

All values are mean three replication (average ± standard deviation)

Table 2 showed the protein content of tuna solids is higher with catfish, on the contrary tuna broth is smaller than catfish. This shows that dissolved protein in catfish is greater than in tuna. Nurjanah *et al.* (2013) suggested that the protein in pelagic fish or marine fish is stronger because of the osmotic pressure that occurs in the ocean. High protein content is influenced by food factors, fish movement

and seasonality, while low protein content is caused by the influence of environment, temperature, and age of fish (Kantun *et al.* 2015). Research conducted by Rahayu *et al.* (2019) also states that protein content is influenced by water content and fat content. Protein content has an inverse relationship with water content. The higher the water content, the lower the protein content.

The fat content of solids and catfish broth tend to be higher at 1.26% and 3.26% when compared to tuna which is 1.57% and 2.74%, presumably caused by different types of fish and environment. This is consistent with the results of research Ersoy *et al.*, (2009) states that the fat content of catfish is 5.02% higher when compared to the fat content of tuna which is 1.6%. Furthermore, the fat content in fish meat varies because it is influenced by species, age, feed, and conditions before and after breeding (laying) (Effiong & Mohammed, 2008; Wellyalina *et al.*, (2013).

Table 2 showed the solid water content of tuna tends to be higher 12.63% compared to catfish 11.58%, conversely the broth is lower ie 78.28% and 83.45%. The occurrence of this difference is presumably due to differences in species, size of fish and evaporation of free water during the cooking process. Erkan *et al.*, (2010) that water content can be influenced by temperature, drying time, type and size of fish. Water content has the opposite relationship to fat content. The higher the water content, the lower the fat content.

Conclusion

Profile of solid amino acids and catfish and tuna broths consisting of 8 types of essential amino acids namely methionine, valine, phenylalanine, isoleucine, threonine, leucine, lysine, and histidine, while non-essential amino acids consist of 7 types of amino acids namely glycine, aspartate, glutamate, alanine, serine, tyrosine and arginine.

The highest lysine amino acids in tuna solids were 7.11%, followed by leucine 6.57% and histidine 5.44%, tending to be the same amount in catfish solids of 6.84%, 5.29% and 5.52%. The highest total amino acids in catfish solids were 45.89% and tuna solids 37.68%. Overall protein content of solids and tuna broth are 81.16% and 56.84%, catfish 75.46% and 69.16%.

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