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Nutritional Characteristics of Lempuk (*Gobiopterus* sp.) Endemic Fish, at Ranu Grati Lake, Pasuruan, Indonesia

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Abstract Exploration of natural resources from the Lake of Ranu Grati was carried out on Lempuk fish (*Gobiepterus* sp). This study aimed to investigate the nutritional value of Lempuk fish (*Gobiepterus* sp.) consisting of proximate content, amino acids, and fatty acids. The fish sample was collected in July 2021. Standard proxymate analysis was used for protein, fat, moisture, and ash. The results showed that Lempuk fish had relatively similar proximate content to other freshwater fish and seawater fish. The proximate content of the fish is protein (14 %), lipid (7.08 %), moisture (79.27%), and dry base ash (10.67%). Glutamic acid in Lempuk fish is high. It is a medium-fat fish. Fatty acid results showed that Lempuk fish contains a large amount of unsaturated fatty acids. Hence, it is suitable for food and also reduces human cardiovascular diseases. This study concludes that the Lempuk fish (*Gobiepterus* sp.) has good nutritional value and is ideal for human consumption.

Keywords Endemic, Lempuk, Nutrition, Proximate, Ranu Grati

1. Introduction

The lempuk fish (*Gobiopterus* sp.) is one of the endemic fish in Indonesia. In the territory of Indonesia, this endemic fish only lives in Ranu Grati, Pasuruan, East Java. However, lempuk fish population is widely distributed in the middle of the lake. This indicates that ecologically, Lempuk fish has an important position in the community surrounding Ranu Grati Lake. Furthermore, the lempuk fish is small (total length 3-4 cm) that some people believe it has high nutritional value. Therefore, lempuk fish in the Ranu Grati area is a strategic value of Indonesia. Moreover, it is a part of biodiversity not found in places other than Ranu Grati Lake, Pasuruan.

Internal factors, such as species, sex, age, and reproductive phase of fish, affect the nutritional value of the fish. External factors, namely the environment of fish in the form of habitat, availability of feed, and quality of the water where fish lives, affect the nutritional value [1]. Aziz [2] suggested that the habitat of the fish affects the chemical content of the fish meat properties and characteristics, such as the proximate, amino acids, and fatty acids. Furthermore, the biochemical composition of fish is influenced by several factors, such as biological variation (species, sex, size and age), diet, and environmental conditions (temperature, pH, and salinity).

Fish plays a vital role in fulfilling nutritional and life security for humans in many developing countries [1]. Fish also serves as a source of unsaturated fatty acids (PUFA),

proteins, minerals, and vitamins. Fish is rich in nutrients, but fish is a fast rotting ingredient with short shelf life. Therefore, the nutritional content of each fish will vary depending on internal and external factors. This fish has economic potential and good nutritional potential, but there is still no data related to the proximal content and nutritional content of Lempuk fish. Therefore, it is crucial to investigate the proximal and nutritional content of Lempuk fish.

Research on the Lempuk fish composition of amino acids and fatty acids of in Indonesia has not yet been reported. Hence, research is needed on the characterization of this fish. This objective of this research is determining for the first time the nutritional (proximate, amino acid, and fatty acid) value of Lempuk fish.

2. Materials and Methods

2.1. Lempuk Fish (*Gobiopterus* sp.)

About one kg Lempuk fish with an approximate 3-4 cm length was obtained from Ranu Grati Lake. Sampling location is at 7°43'50.8"S 113°00'30.2"E. The fish samples were quickly taken to the laboratory using a cool box where the temperature stabilized at 4 °C. The fish's whole body was used as the sample for further analysis.

2.2. Proximate Analysis

Proximate analysis was conducted based on AOAC methods [3], which consisted of testing ash levels (dry ash), water content (gravimetry methods), fat content (soxhlet method), protein (Kjeldahl method), and ash (gravimetry methods). The proximate analysis was conducted at the Laboratory of Fishery Product Sciences, Faculty of Fisheries and Marine Science, Universitas Brawijaya.

2.3. Amino Acids

The amino acid composition analysis was performed using Ultra Performance Liquid Chromatography (UPLC) with the thermo-scientific ODS-2 Hyersil column based on AOAC [3]. The first step done with the UPLC method is to take 0.50 mL of liquid sample to be tested. Then it is placed in a 100 ml measuring pumpkin and 2.0 ml of AABA 10 mM internal standard solution is added. Dilute gently to a limit mark with HCl 0.1N and then homogenize it. Then the solution is filtered with a 0.22 m filter membrane of 0.22 µm, then 10 µl of the solution is taken and placed in a vial insert. AccQ-Fluor Borate was added as much as 70 µl and then vortexed. Reagent fluor A as much as 20 µl was added, and vortexed. The aliquot waslet to stand for 1 minute. It was then incedated for 10 minutes at 55°C. The solution has been incedated, then injected into the UPLC system.

2.4. Fatty Acids

The composition of fatty acids was identified using *Gas Chromatography Fatty Acid Methyl Ester* (GC-FAME). The analysis uses GC-MS analysis, with GC Agilent 6890N with autosampler. Capillary column, HP5 5% phenyl methyl siloxane length 30 m x 320 µm, with a stationary phase layer thickness of 0.25 µm was used for analysis. The detector using MS, Agilent 6971 inert mass selective detector (Agilent Tech. Palo Alto, California, USA). The injector temperature is set at 250 °C. Temperature raised 2 °C/minute to 100°C is then raised to 5°C/minute to 290°C, kept at 290°C for 10 minutes. The gases used are Helium and Alphagaz. Transfer line with a temperature of 280°C, MS Quadrupole 150°C, MS Source 230°C. Use an injection volume of 1 µm, a 1:10 split inlet model with 1.3 ml/min column flow rate.

2.5. Data Analysis

Data was analyzed using Microsoft Excel 2013. Each data is from two repetitions.

3. Result and Discussion

The proximate analysis consists of water content, protein, fat, ash, and carbohydrates. The proximal chemical composition of the Lempuk fish with some comparison fish is shown in Table 1.

Data from Catfish *(Clarias gariepenus*), Nile tilapia fish (*Oreochromis niloticus*), Redbelly tilapia (*Tilapia zilili*), and Sardines (*Sardinella maderensis*) are used as a comparison. Lempuk fish nutritional value was compared to freshwater and seawater fish. Those compared fish are Catfish *(Clarias gariepenus*), Nile tilapia fish (*Oreochromis niloticus*), Redbelly tilapia (*Tilapia zilili*) represent freshwater fish, while Sardines (Sardinella maderensis) represent seawater fish.

3.1. Protein

The protein content of Lempuk fish *(Gobiepterus* sp) is about 14%. The highest protein levels from the comparison of freshwater fish and marine fish are obtained in sardines (*S. maderensis*) (Table 1). Based on Table 1, it is found that the protein level of Lempuk fish is lower than that of other types of fish. The difference in results is due to exogenous and endogenous factors. Those factors are different types of fish, the environment in which the fish lived, and the level of freshness at the time of preparation and testing of samples [9]. The fish in this study came from Ranu Grati lake, Pasuruan regency, East Java, Indonesia.

In this study, marine fish tend to have higher levels of protein. However, according to Masitoh et al. [4], the protein content is strongly influenced by the type of fish, age, size of fish, quality of feed protein, digestibility of

feed and environmental conditions. Furthermore, Aziz et al. [2] explain that the protein composition and amino acids of fish differ in brackish and freshwater habitats.

The protein composition in fish meat ranges from 16-21% [5]. Lempuk fish protein levels are relatively lower and affected by the sample type tested. All fish part was used as a sample, hence the whole fish was a sample for proxymate, amino acid, and fatty acid analysis. This is confirmed in the results of ash levels. Ash levels tests showed that the Lempuk fish had a large content. This is because testing thorns from fish is also calculated in the percentage of proximal levels. This high ash content is due to the bones contained in the sample. Therefore, if we compare the proximal levels of grilled fish meat, the protein yield must be greater than that supported in this study.

3.2. Fat

The fat content in Lempuk fish is lower than that of catfish. The fat content of Lempuk fish was detected higher when compared to redbelly tilapia and sardines. The lipid content of fish varies depending on the species. Generally, fish have less fat than red meat [8]. The fat content was affected by endogenous and exogenous factors. Gehring et al. [10] state that the fat content in fish muscles varies depending on species, age, spawning, and feed.

Based on fat content, fish can be classified into lean fish (fat content below 5%), medium fish (5 -10%), and fat fish (>10%) [11]. Other classification according to Ackman [12], fish are classified into four types, namely lean fish (< 2% fat), low fat fish (2–4% fat), medium fat fish (4-8% fat), and high fat fish (> 8% fat). Hence, Lempuk fish belongs to the category of medium-fat fish.

3.3. Amino Acids

The results of amino acid testing are presented in Table 2. The amino acid testing of both essential and non-essential amino acids from Lempuk fish can also be found in other fish (Table 2). This is thought to be due to different types of fish, environmental conditions, and feed. Litaay [13], states that differences in amino acid content can be caused by age, catch season, and stages in an organism's life cycle.

Fish is considered an excellent source of high-quality protein, especially the essential amino acids lysine and methionine. The highest essential amino acids in this study were leucine and lysine. Freshwater fish seem to have higher values than other essential amino acids. Lempuk fish glutamic acid has high levels of amino acids. This is the reason why the community really likes this fish. Glutamic acid is a precursor to flavoring. The taste of food is strongly influenced by several factors, one of which is the composition of amino acids, glutamic acid [14]. The highest non-essential amino acid is glutamate, glutamic acid can stimulate muscle protein formation and is an important substrate for fish energy. Mutamimah et al. [14] state that the high content of amino acids glutamate and aspartic can occur due to the analysis process using acid analysis methods with a higher degree of hydrolysis amino acid content.

Leucine is the most abundant amino acid in high-protein foods [16, 17]. Leucine is the only amino acid that can slow muscle tissue degradation by increasing muscle protein synthesis. Lysine is an essential amino acid needed to optimize immune growth and deficiency. Lysine can also be used to prevent and treat wounds [18]. Arginine, lysine, and leucine are essential amino acids from aquatic animals, therefore known as high protein sources [19].

The high amino acid content in fish in this study can be used as a potential animal protein food source for the community as an ingredient for nutritional fulfillment according to the needs. Aziz et al. [2] explain that the amino acid composition of fish differs in the brackish and freshwater habitats. The composition of the highest non-essential amino acids is glutamic acid by 1.368% (freshwater) and 1.268% (brackish water). Bandeng fish also contains the highest essential amino acids, namely leucine 0.782% (freshwater fish) and 0.671% (brackish water).

Table 1. Proximate composition of Lempuk fish (*Gobiepterus* sp.)

Parameters	Unit	Lempuk (*Gobiepterus* sp.)	Catfish (*C. gariepinus*) [6]	Nile tilapia (*O. niloticus*) [6]	Redbelly tilapia (*T. zilli*) [7]	Sarden (*S. maderensis*) [8]
Protein	%	14	18.48	15.83	19.00	22.23
Fat	%	7.081	11.00	7.80	1.10	6.15
Water/Moisture	%	79.276	76.27	79.97	80.40	69.40
Ash	%	10.67	8.03	9.16	1.20	2.09

3.4. Fatty Acids

Fish is a natural source of omega 3, eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA) [20, 21]. The composition of the fish is detected better when compared to some comparison fish (Table 3.). Omega 3 and omega 9 were detected in Lempuk fish at 2.86% and 1.44%, respectively. The presence of omega 3 indicates that this fish is suitable for consumption because it can reduce the risk of cardiovascular disease [22, 23]. These results show that Lempuk fish contain high unsaturated fatty acids, although there are reports that marine fish should have a higher EPA and DHA content [24].

The levels of fats and fatty acids in fish vary depending on the season, species, geographical location, age, sex, and sex maturity [25]. The location of life can also be used as a factor that gives variations in fatty acids. Different living environments can result in different food diets. Diatoms in different waters can cause a shift in fatty acid components [26].

Lempuk fish is superior in DHA content, furthermore Omega 3 is also higher compared to the Bluefin leather jacket fish. Since the Lempuk is in the freshwater habitat, it is usually the reason in the relatively low fatty acid content [27].

Table 2. Amino acid composition of Lempuk fish (*Gobiepterus* sp.)

No	Amino acid	Unit	Lempuk (*Gobiepterus* sp.)	Catfish (*C. gariepinus*) [6]	Nile tilapia (*O. niloticus*) [6]	Red belly tilapia (*T. zilli*) [7]	Sarden (*S. maderensis*) [8]
1	L-Histidine	mg / kg	4.73	2.21	2.21	-	1.41
2	L-Threonine	mg / kg	2.50	3.26	3.01	4.80	1.04
3	L-Proline	mg / kg	3.49	4.69	3.26	3.95	0.79
4	L-Tyrosine	mg / kg	2.81	3.02	3.17	1.47	0.70
5	L-Leucine	mg / kg	1.72	5.95	6.53	9.49	1.58
6	L-Aspartic acid	mg / kg	1.58	23.26	10.08	11.17	0.37
7	L-Lysine	mg / kg	2.09	5.00	5.21	10.37	1.71
8	Glycine	mg / kg	2.26	4.18	4.90	5.20	0.09
9	L-Arginine	mg / kg	1.85	5.26	5.35	11.66	0.84
10	L-Alanine	mg / kg	2.44	5.05	5.51	6.77	1.38
11	L-Valine	mg / kg	2.78	3.82	3.18	5.18	1.12
12	L-Isoleucine	mg / kg	3.33	3.17	3.20	5.04	0.93
13	L-Thenilalanine	mg / kg	2.18	4.05	4.22	4.06	0.85
14	L-glutamic acid	mg / kg	9.97	15.98	12.72	18.16	1.74
15	L-Serine	mg / kg	2.67	4.26	3.42	4.47	0.77

Table 3. Comparison of Important fatty acid composition of fish (% of Total fatty acids)

No	Parameter	Lempuk	White herring [27]	Bluefin Leather Jacket [27]	Common carp [27]	Swamp eel [27]
1	Saturated fatty acid (SAFA)	6.1	35.3	34.5	35.6	27.9
2	Mono unsaturated fatty acid (MUFA)	1.9	28.8	27.6	42.0	34.7
3	Polyunsaturated Fatty acid (PUFA)	4.4	31.2	30.7	17.7	32.4
4	Eicosapentaenoic acid (EPA)	0.9	7.4	9.4	0.8	1.9
5	Linolenic acid/Omega 3	2.9	3.6	0.3	3.3	3.7
6	Linoleic acid/Omega 6	1.5	1.2	0.4	6.3	13.7
7	Oleic acid/Omega 9	1.5	19.9	21.4	24.7	20.5
8	Docosahexaenoic acid (DHA)	13.8	11.8	15.2	1.8	5.3

4. Conclusion

Lempuk fish (*Gobiepterus* sp.) is a good source of nutrients. The protein component is high and is a good source of essential fatty acid components. This fish is also known to be included in the medium-fat fish group. This fish is also a good source of omega 3, omega 6, and omega 9 and has high EPA and DHA.

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