

## The nutrient content of *Plecostomus (Pterygoplichthys pardalis)* flesh from Ciliwung River Jakarta, Indonesia

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**Abstract.** Elfidasari D, Shabira AP, Sugoro I, Ismi LN. 2019. The nutrient content of *Plecostomus (Pterygoplichthys pardalis)* flesh from Ciliwung River Jakarta, Indonesia. *Nusantara Bioscience* 11: 30-34. One of the rivers in Jakarta, Indonesia that becomes the habitat of fish is Ciliwung River with *Plecostomus* as the dominant fish. The abundant number of *Plecostomus* in the Ciliwung river is utilized by the people living near the river basin area of Ciliwung River Jakarta as the main to produce food. As a source of animal nutrients, the contents of protein, fats, and carbohydrate in *Plecostomus* from Ciliwung River Jakarta has not been identified. The aforementioned condition has been the trigger to conduct this research aiming at identifying the contents of protein, fats, and carbohydrate in *Plecostomus* flesh from Ciliwung River Jakarta. The methods employed were Kjeldahl method to find out protein content, extraction method to test the fats, and by difference method to test carbohydrate with prior test of ashes using ash-drying method. The result shows that the smaller-sized *Plecostomus* with 18-23 cm in length had the highest contents of protein, fats, and ashes (50.0517%; 1.1261%; 1.1446%). Meanwhile, the medium-sized *Plecostomus* with 24-28.5 cm in length had the highest carbohydrate content (52.9905%). Statistical test using ANOVA with Duncan's multiple range test shows that the contents of protein, fats, and carbohydrate in smaller, medium, and larger-sized *Plecostomus* do not show significant difference. The body length of *Plecostomus* from Ciliwung River Jakarta does not give significant effect on the contents of protein, fats, and carbohydrate in its flesh.

**Keywords:** Carbohydrate, Ciliwung River, *Plecostomus*, protein fats

### INTRODUCTION

*Plecostomus* is an introduced fish from South America originating from Argentina and Brazil. This fish was brought by fish collectors and put in Ciliwung River (Sugianti et al. 2014). Morphologically, this fish has an arrow-like body and covered with black, hard scales (Armbruster and Page 2006). *Plecostomus* is regarded as an introduced fish as this is brought from another place or country (Armbruster and Page 2006). This species has a good adaptation ability and spread all over areas including Indonesia's freshwater. One of the freshwater areas that become the habitat for the fish population is the Ciliwung River.

Fish is a type of healthy food with high protein levels, but low in fat. Fish also have other nutrients such as carbohydrates that the human body needs to stay healthy (Pang et al. 2001). Protein acts as a building material or material for the formation of new tissues in the body. The protein content in 100 g of dried fish is around 40%. Fat in fish meat is lower compared to other animal food commodities. Most of the fat in fish is unsaturated fat. The function of fats and carbohydrates contained in the body of the fish is as excessive energy storage (Ciptanto 2010). Generally, the fat content in 100 g of fish is around 1-3% and the carbohydrate content is around 1-20%.

Ciliwung River is one of the rivers flowing in the special region of Jakarta province with its length from

upstream to downstream for about 117 km and its source comes from the spring of Pangrango Mountain, West Java. Before finishing its flow in Jakarta Bay, the river passes through Bogor Regency, Bogor City, Depok City, and Jakarta City. Research conducted by (Hadiati 2011) showed a total of 20 species of freshwater fish in Ciliwung River, and one of the mostly found is *Plecostomus (Pterygoplichthys pardalis)*. Base on early observation, the utilization of *Plecostomus* in Ciliwung River by some people living near the river is as a fish substitution in dim sum, *otak-otak*, and chips. This fish is mostly used because of its relatively cheap price and easy to get. Until now, there is relatively little information about nutrition content of *Plecostomus* from Ciliwung River. Therefore, It is necessary to analyze the nutritional content of *Plecostomus* in order to know the protein, fats and carbohydrate contents. It's expected that the results will be useful as a source of information regarding *Plecostomus* flesh feasibility for the people.

### MATERIALS AND METHODS

#### Study area

The samples were collected along Ciliwung River, starting from Rindam Jaya (Gedong) [6°17'45.4" S, 106°51'11.4" E] until Kampung Melayu [6°13'53.4" S, 106°51'49.4" E]. The exact location was at Jln. Inpeksi

Ciliwung Letjen MT. Haryono Gg. Ciliwung, Cawang, East Jakarta (Figure 1).

The samples collection were conducted from 26th August to 22nd September 2017. *Plecostomus* were caught using nets and put into containers.

### Materials

The instruments employed during the sampling were containers and nets. The instruments used in the laboratory were knife, scissors, 1 mm precision ruler, blender,  $\pm 100$  mesh sieve, microwave oven, analytical balance with 0.0001 g precision, Ziploc plastic bag 6x8 cm, desiccator, spatula, crucible, crucible brace, Kjeldahl flask, burette, beaker glass, Erlenmeyer, soxhlet, filter papers, and microwave oven. The research materials were 18 *Plecostomus* fish, divided into three groups and three based on their body size, namely smaller-sized fish weighed < 115 g (18-23 cm), medium-sized fish weighed 140-180 g (24-28.5 cm), and large-sized fish weighed > 215-310 g (29-33 cm).

### Procedures

#### Preparation of *Plecostomus* samples

The research was conducted at the Biology Laboratory and PTBGN Laboratory, National Nuclear Energy Agency. Morphometric measurements of the fish including the total length and weight of *Plecostomus* were done. The samples that were not yet identified were preserved in the freezer.

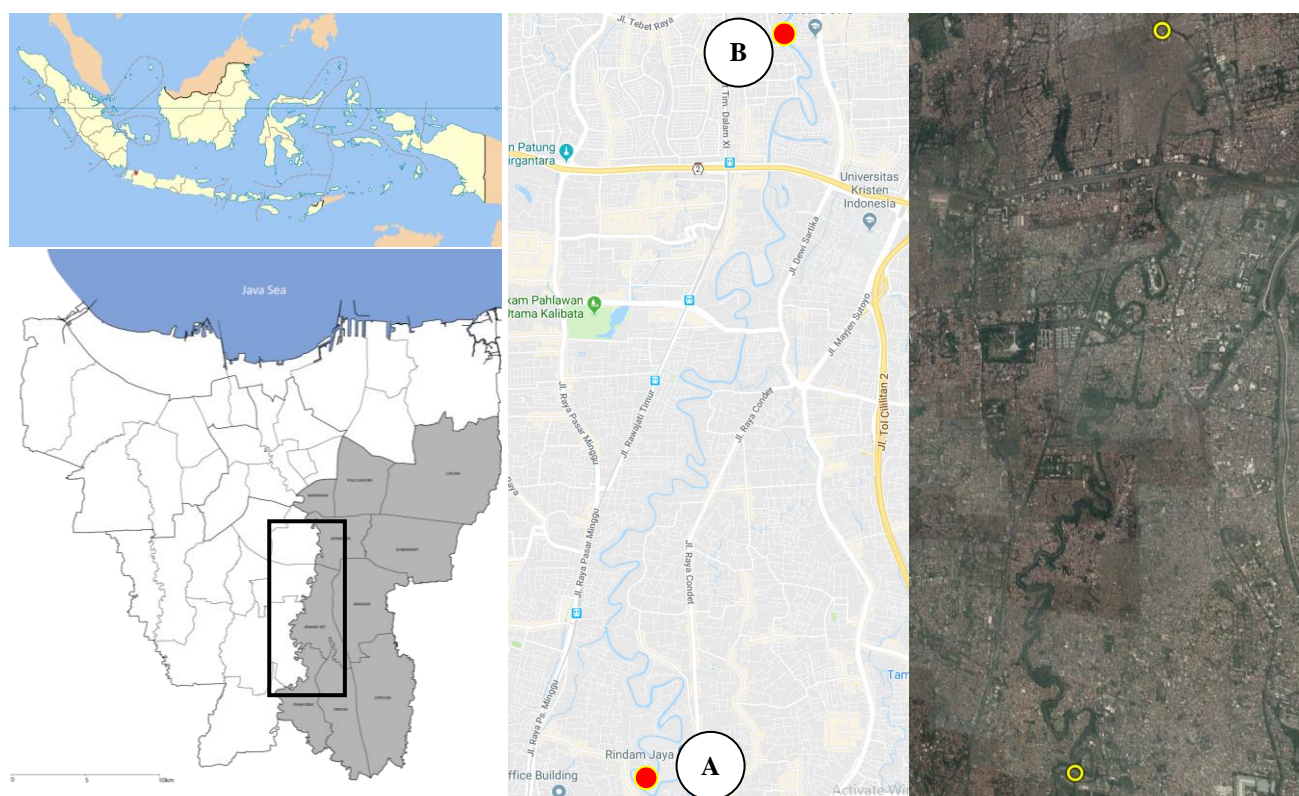
The fish was dissected and its flesh was separated from its skin using fillet technique. After that, the flesh was weighed using an analytic scale. Then, the flesh was put into crucibles and dried in the 60°C microwave for five days. The dried *Plecostomus* flesh was then weighed using a digital scale and crushed using a blender and put into Ziploc bag. Each bag was labeled according to the size of the fish.

#### Analysis of protein content

The protein content of *Plecostomus* from Ciliwung River was analyzed using Kjeldahl method as follow: 0,5 g of the sample was put into Kjeldahl flask and added with concentrated H<sub>2</sub>SO<sub>4</sub> and selenium. After that, it was heated until the color turns greenish clear. When the sample cools down, it was homogenized in distilled water, put in a distillation flask, and distilled using NaOH 15%. The distillation was put into Erlenmeyer containing HCl and methyl red and titrated with NaOH. The endpoint of distillation was shown by the change in color to yellowish. The protein content was calculated using the following equation:

$$\% N = \frac{(\text{ml HCl titration sample}) - (\text{ml NaOH titration sample})}{\text{g sample}} \times 0.1 \times 1.4$$

$$\text{Protein content (\%)} = \% N \times 4.2 \text{ (Conversion factor)}$$



**Figure 1.** The Map of Samples Collection in Ciliwung River (A) sampling initial point [Rindam Jaya] (B) sampling final point [Kampung Melayu]

### Analysis of fat content

The *Plecostomus* flesh from Ciliwung River was tested for fat content using extraction method as follows: 0,2 g (w2) of the samples were wrapped using filter paper that has been weighed (w) and extracted with soxhlet for 3 hours using petroleum ether as a solvent. The extract was weighed (w1). The fat content was calculated using the following equation:

$$\text{Fat content (\%)} = 100 - \left( \frac{W_1 - W}{W_2} \times 100\% \right)$$

Where:

W = weight of filter paper (g)

W1 = weight of filter paper – fat extracts (g)

W2 = weight of sample (g)

### Analysis of carbohydrate content

The *Plecostomus* flesh from Ciliwung River was tested for carbohydrate content using *by difference* method. Before calculating its carbohydrate content, the ash content was first identified. The ash identification was administered using dry ash method as follows: porcelain cup was put into the oven at 105°C for 30 minutes, and then weighed (w1). 0.2 g (w) of the samples were put into porcelain cup which has been weighed and then put into muffle furnace at 600°C temperature for five hours. The furnace was turned off, and waited for its temperature to decrease at < 25°C, then the porcelain cup on the furnace was weighed using analytical balance (w2). The ash content was calculated using the following equation:

$$\text{Ash content (\%)} = \frac{w_2 - w_1}{w} \times 100\%$$

Where:

W = samples' weight (g)

W1 = weight of empty cup (g)

W2 = weight of ash result (g)

The carbohydrate content in the samples was calculated by adding the total of protein, fats, and ash contents. The carbohydrate content was calculated using the following equation:

$$\text{Carbohydrate content (\%)} = 100\% - (\text{protein} + \text{fats} + \text{ash})\%$$

### Data analysis

Data were analyzed statistically with ANOVA using SPSS 17<sup>th</sup> version.

## RESULTS AND DISCUSSIONS

### Protein content in *Plecostomus* flesh

The results showed the highest content of protein was found in the smaller-sized *Plecostomus* (50.0517%) while the medium-sized *Plecostomus* had the lowest protein content (45.0959%) (Table 1). The protein content of the flesh depends on the physiology ability of the fish to

synthesize protein. Biological factors such as age, body length, fish species, and fish gender can influence the protein content of the flesh (Badal & Mihir 2015). Generally, fish is categorized as low-protein when it has the protein content <15%, moderate-protein fish when it has the protein content in the range of 15%-20% and high-protein fish when it has the protein content >20 %.

Based on the result of ANOVA analysis with Duncan's multiple range test, the significant value was gained for  $p = 0.544$ . This shows the protein value in smaller-sized *Plecostomus* is not significantly different from the protein value in larger-sized and medium-sized *Plecostomus* because its significant value was  $p > 0.05$ . The main function of protein for the body is to construct body tissues, repair damaged body cells, create antibody, and also plays the role to create enzymes and hormones. The protein composition in fish generally is for 15%-24% (Ciptanto 2010). Protein belongs to the main nutrient substance that is composed of carbon, hydrogen, oxygen, nitrogen, and mostly contains sulfur and phosphor. Nitrogen is only found in protein so that it can be used to analyze protein content with Kjeldahl method. Protein content in food can be identified by estimating the number of nitrogen that is linear towards protein content in the tested food (AOAC 2005).

### Fat content in *Plecostomus*

The highest fats content is found in smaller-sized *Plecostomus* (1.1261%). The lowest is found in medium-sized *Plecostomus* for 1.1165% (Table 1). According to Murray and Burt (2001), fish is categorized as the low-fat fish if the fat content for 1%. Fish is categorized as high-fat if the fat content more than >5%. *Plecostomus* categorized as low-fat since its fat content < 2%. Generally, fish that has low fats content has high protein content. The function of fat in fish is to help metabolism processes, maintain the ability to float on the water, and preserve membrane functions (AOAC 2005). Meanwhile, the function of fat in human is the energy storage, protect internal organs such as heart, maintain body temperature balance, and help increase cognitive function for children's brains (Pang et al. 2014).

The result of Duncan's multiple range test shows that there is no significant difference between fat content in large-, medium-, and small-sized *Plecostomus*. The body size does not influence the fat content in its flesh. The body shape of *Plecostomus* which is flat causes the additional growth to become faster compared to its flesh weight. *Plecostomus* with longer body length does not always have heavier and more flesh. Causes the fats content in *Plecostomus* from Ciliwung River Jakarta is not affected by its body length (Samat et al. 2008).

The highest level of fats content in *Plecostomus* from Ciliwung River Jakarta comes from the smaller-sized *Plecostomus*. The medium-sized is decreasing compared to the smaller-sized. The fats content then increases again among larger-sized *Plecostomus* from Ciliwung River Jakarta. The result in Table 1 shows that body size did not affect the fat content.

**Table 1.** The nutrient content of *Plecostomus* flesh from Ciliwung River Jakarta, Indonesia

No.	Size	Protein (%)	Fats (%)	Ash (%)	Carbohydrate (%)
1	Small	50.0517±4.6583 <sup>a</sup>	1.1261 ± 0.0363 <sup>a</sup>	1.1446 ± 1.4684 <sup>a</sup>	47.3753 ± 4.2347 <sup>a</sup>
2	Medium	45.0959± 9.0089 <sup>a</sup>	1.1165 ± 0.5399 <sup>a</sup>	0.7971 ± 0.5985 <sup>a</sup>	52.9905 ± 9.3599 <sup>a</sup>
3	Large	47.7146±1.9086 <sup>a</sup>	1.1207 ± 0.6328 <sup>a</sup>	0.2251 ± 0.3859 <sup>a</sup>	50.9410 ± 1.4776 <sup>a</sup>

### Ash content in *Plecostomus*

Based on the test of ash content in *Plecostomus* flesh, it shows that the small-sized *Plecostomus* has the highest ash content (1.4469%). The lowest ash content is in large-sized *Plecostomus* (0.2251%) (Table 1). Small sized *Plecostomus* needs many minerals to support its body tissues construction (Rasmussen and Ostenfeld 2000).

The result of Duncan's multiple range test shows there is no significant difference in ash content amongst body size (Table 1). This means that the different body length has relatively similar to ash content. There is no significant difference between ash content in each fish group. When the growth rate is fast, fish needs many minerals to grow optimally. The ability of the fish to absorb mineral is influenced by several factors such as body size, species, and pH of the fish habitat environment. *Plecostomus* is a predator for other fish eggs at the bottom of the river. This fish can adapt to every condition. Besides, *Plecostomus* is omnivorous. It is suspected that this fish is able to hybridize and inherit its genetic characteristics. Enables *Plecostomus* to be categorized in strange-invasive species if they have such characters as competitor, predator, fast reproduction process, bring infectious diseases, omnivorous, fast growth, fast to hybridize and inherit genetic characteristics, fast sexual growth, negative impact on human's health. *Plecostomus* as an invasive fish enters the area of Ciliwung River unintentionally. There are some steps of invasive fish to enter certain water area, such as: spread unintentionally with certain purposes, released from their cultivation, brought in ballast water spilt onto the ocean water, brought as the biological pollutant (*biofouling*) in the hull of a ship, released in new water, fish from aquarium that is released unintentionally by the owners to the water (Sugianti et al. 2014).

### Carbohydrate content in *Plecostomus* flesh

Carbohydrate content test using *by difference* method shows a dissimilar result in each group of body size. The highest was found in medium-sized fish for 52.9905% (Table 1). Meanwhile, the lowest was found in smaller-sized fish for 47.3753%. The statistical analysis with ANOVA test at the trust rate of 95% it was gained the significant value of  $p = 0.619$  showing that there is no significant difference between carbohydrate value in each *Plecostomus* body size because the significant value is  $p > 0.05$ . The body size of *Plecostomus* from Ciliwung River Jakarta does not affect the carbohydrate content in its flesh. Longer size *Plecostomus* does not always have heavier flesh. The flat body shape causes an increase in body length to be faster compared to body weight inclination (Samat et al. 2008).

The method employed in testing carbohydrate content in this study was *by difference*, in which this method is the total addition of protein, fats, and ash contents gained in the previous tests. The gained data will influence the final value of carbohydrate content in the flesh. The result of carbohydrate content test in *Plecostomus* from Ciliwung River Jakarta is increasing in medium-sized *Plecostomus* and is decreasing in larger-sized *Plecostomus*. For the time being, to differ male and female *Plecostomus* is by massaging its cloaca during the breeding season. If the cloaca releases yellow eggs, then it is a female.

The conclusion from this study is that *Plecostomus* tends to have a high level of protein and a low level of fats so that it is feasible to consume. From the statistical test conducted, the body size does not influence significantly towards the contents of protein, fats, and carbohydrate in *Plecostomus* from Ciliwung River Jakarta. *Plecostomus* from Ciliwung River Jakarta with larger size does not always have larger flesh as well. This is related to the body shape of the fish that is flat, so that the increase of length in the fish is faster than its weight growth.

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