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by Dewi Elfidasari

NUSANTARA BIOSCIENCE
Vol. 11, No. 1, pp. 30-34
May 2019

ISSN: 2087-3948
E-ISSN: 2087-3956
DOI: 10.13057/nusbiosci/n110106

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

DEWI ELFIDASARI[1,♥], AFINA PUTRI SHABIRA[1], IRAWAN SUGORO[2], LAKSMI NURUL ISMI[1,♥♥]

[1]Program of Biology (Biotechnology), Faculty of Science and Technology, Universitas Al Azhar Indonesia. Jl. Sisingamangaraja, Jakarta 12110, Indonesia. Tel.: +62-21-72792753, Fax.: +62-21-7244767, ♥email: d_elfidasari@uai.ac.id, ♥♥ laksminrlism@gmail.com

[2]Center of Isotope and Radiation Application (PAIR), National Agency of Nuclear Energy (BATAN). Jl. Lebak Bulus Raya No. 49, Jakarta 12440, Indonesia.

Manuscript received: 28 December 2018. Revision accepted: 10 February 2019.

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, ± 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 60^0C 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_2SO_4 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:

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

Protein content (%) = % N x 4.2 (Conversion factor)

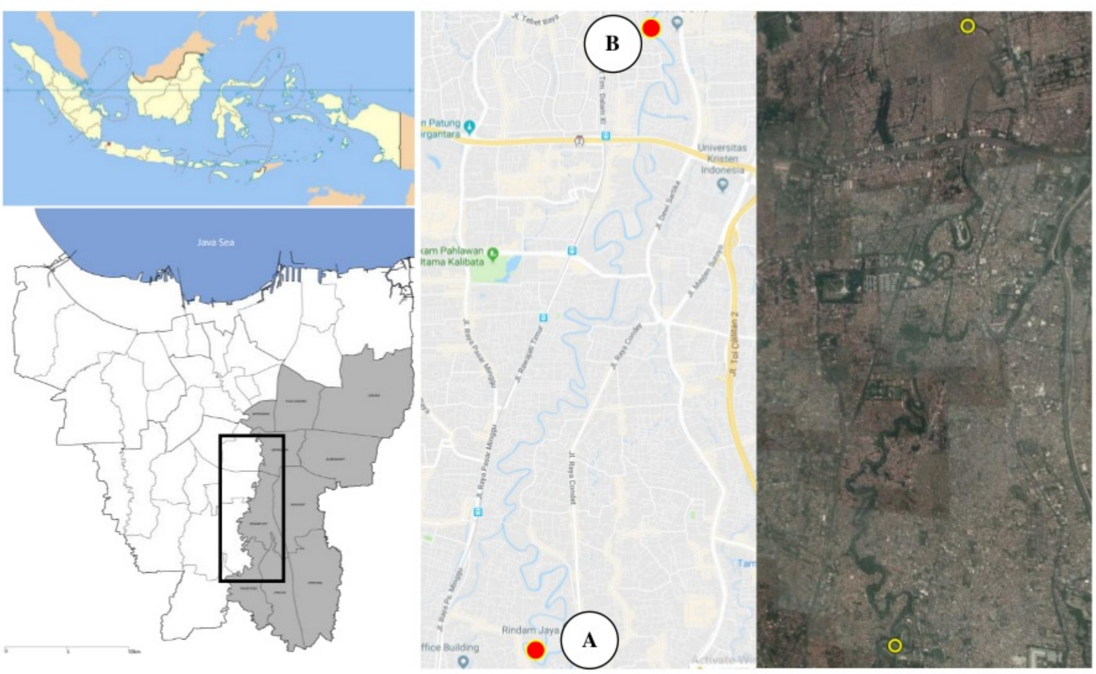

Figure 1. The Map of Samples Collection in Ciliwung River (A) sampling initial point [Rindam Jaya] (B) sampling final point [Kampung Melayu]

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^{0}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^{0}C temperature for five hours. The furnace was turned off, and waited for its temperature to decrease at < 25^{0}C, then the porcelain cup on the furnace was weighed using analytical balance (w2). The ash content was calculated using the following equation:

$$\text{Ash content (\%)} = \frac{w2 - w1}{w} \times 100\%$$

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:

Carbohydrate content (%) = 100% - (protein + fats + ash)%

Data analysis

Data were analyzed statistically with ANOVA using SPSS 17th 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[a]	1.1261 ± 0.0363[a]	1.1446 ± 1.4684a	47.3753 ± 4.2347[a]
2	Medium	45.0959± 9.0089[a]	1.1165 ± 0.5399[a]	0.7971 ± 0.5985a	52.9905 ± 9.3599[a]
3	Large	47.7146±1.9086[a]	1.1207 ± 0.6328[a]	0.2251 ± 0.3859a	50.9410 ± 1.4776[a]

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.

ACKNOWLEDGEMENTS

Gratitude is expressed to the Ministry of Research, Technology and Higher Education for the funding of the University Flagship Research (PUPT) year 2017 which has funded the research. Gratitude is upon Mr. Udin who helped the sampling activity and Mr. Dinardi as the laboratory attendant at the Biology Laboratory of National Agency of Nuclear Agency (BATAN) of Nuclear Area in Pasar Juma'at, South Jakarta.

REFERENCES

Armbruster JW, Page LM. 2006. Redescription of *Pterygoplichthys punctatus* and description of a new species of *Pterygoplichthys* (Siluriformes: Loricariidae). J Neotrop Ichthyol 4 (4): 401-409.

AOAC. 2005. Official Method of Analysis of The Association of Official Analytical of Chemist. The Association of Official Analytical Chemist, Inc., Arlington, USA.

Badal D, Mihir D. 2015. Fat content of an Indian Major Carp, Catla catla, in relation to age and size for optimizing harvesting period. International Journal of Fisheries and Aquatic Studies pp.2(6): 386-390.

Ciptanto S. 2010. Top 10 Ikan Air Tawar. Lily Publisher, Yogyakarta. [Indonesian]

Hadiati RK. 2011. Diversitas dan hilangnya jenis-jenis ikan di Sungai Ciliwung dan Sungai Cisadane. Berita Biologi 10 (4): 491-504. [Indonesian]

Murray J, Burt JR. 2001. The Composition of Fish. FAO, Rome, Italy, in partnership with the support unit for International Fisheries and Aquatic Research.

Pang G, Xie J, Chen Q, Hu Z. 2014. Energy intake, metabolic homeostasis, and human health. J Food Sci Hum Well 3: 89-103.
Rasmussen RS, Ostenfeld TH. 2000. Effect of growth rate on quality traits and feed utilisation of rainbow trout (Oncorhynchus mykiss) and brook trout (*Salvelinus fontinalis*). Aquaculture 184: 327-337.
Samat A, Shukor MN, Mazlan AG, Fatimah MY. 2008. Length-weight relationship and condition factor of *Pterygoplichthys pardalis* (Pisces: Loricariidae) in Malaysia Peninsula. Res J Fish Hydrobiol 3 (2): 48-53.
Sugianti B, Enjang HH, Nuah J, Yeni A. 2014. Daftar Pisces Yang Berpotensi Sebagai Spesies Asing Invasif di Indonesia. Cetakan Ke-2 (Edisi Revisi). Kementerian Kelautan dan Perikanan, Jakarta. [Indonesian]

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N U S A N T A R A B I O S C I E N C E Vol. 11, No. 1, pp. 30-34 May 2019 ISSN: 2087-3948 E-ISSN: 2087-3956 DOI: 10.13057/nusbiosci/ n110106
The nutrient content of Plecostomus (Pterygoplichthys pardalis) flesh from Ciliwung River Jakarta, Indonesia DEWI ELFIDASARI1,♥, AFINA PUTRI SHABIRA1, IRAWAN SUGORO2, LAKSMI NURUL ISMI1,♥♥ 1Program of Biology (Biotechnology), Faculty of Science and Technology, Universitas Al Azhar Indonesia. Jl. Sisingamangaraja, Jakarta 12110, Indonesia. Tel.: +62-21-72792753, Fax.: +62-21-7244767, ♥email: d_elfidasari @uai.ac.id, ♥♥ laksminrlism@gmail.com 2Center of Isotope and Radiation Application (PAIR), National Agency of Nuclear Energy (BATAN). Jl. Lebak Bulus Raya No. 49, Jakarta 12440, Indonesia. Manuscript received: 28 December 2018. Revision accepted: 10 February 2019. 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 ELFIDASARI et al. – The nutrient content of Plecostomus 31 Ciliwung Letjen MT. Haryono Gg. Ciliwung, Cawang, The fish was dissected and its flesh was separated from its East Jakarta (Figure 1). skin using fillet technique. After that, the flesh was The samples collection were conducted from 26th weighed using an analytic scale. Then, the flesh was put August to 22nd September 2017. Plecostomus were caught into crucibles and dried in the 600C microwave for five using nets and put into containers. days. The dried Plecostomus flesh was then weighed using a digital scale and crushed using a blender and put into Materials Ziploc bag. Each bag was labeled according to the size of The instruments employed during the sampling were the fish. containers and nets. The instruments used in the laboratory were knife, scissors, 1 mm precision ruler, blender, ± 100 Analysis of protein content mesh sieve, microwave oven, analytical balance with The protein content of Plecostomus from Ciliwung 0.0001 g precision, Ziploc plastic bag 6x8 cm, desiccator, River was analyzed using Kjeldahl method as follow: 0,5 g spatula, crucible, crucible brace, Kjeldahl flask, burette, of the sample was put into Kjeldahl flask and added with beaker glass, Erlenmeyer, soxhlet, filter papers, and concentrated H_2SO_4 and selenium. After that, it was heated microwave oven. The research materials were 18 until the color turns greenish clear. When the sample cools Plecostomus fish, divided into three groups and three based down, it was homogenized in distilled water, put in a on their body size, namely smaller-sized fish weighed < distillation flask, and distilled using NaOH 15%. The 115 g (18-23 cm), medium-sized fish weighed 140-180 g distillation was put into Erlenmeyer containing HCl and (24-28.5 cm), and large-sized fish weighed > 215-310 g methyl red and titrated with NaOH. The endpoint of (29-33 cm). distillation was shown by the change in color to yellowish. The protein content was calculated using the following Procedures equation: Preparation of Plecostomus samples The research was conducted at the Biology Laboratory %N= x 0.1 x 1.4 and PTBGN Laboratory, National Nuclear Energy Agency. Morphometric measurements of the fish including the total length and weight of Plecostomus were done. The samples Protein content (%) = % N x 4.2 (Conversion factor) that were not yet identified were preserved in the freezer. B A Figure 1. The Map of Samples Collection in Ciliwung River (A) sampling initial point [Rindam Jaya] (B) sampling final point [Kampung Melayu] 32 N U S A N T A R A B I O S C I E N C E 11 (1): 30-34, May 2019 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: Fat content (%) = 100 - (x 100%) 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 1050C 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 6000C temperature for five hours. The furnace was turned off, and waited for its temperature to decrease at < 250C, then the porcelain cup on the furnace was weighed using analytical balance (w2). The ash content was calculated using the following equation: Ash content (%) = × 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: Carbohydrate content (%) = 100% - (protein + fats + ash)% Data analysis Data were analyzed statistically with ANOVA using SPSS 17th 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. ELFIDASARI et al. – The nutrient content of Plecostomus 33 Table 1. The nutrient content of Plecostomus flesh from Ciliwung River Jakarta, Indonesia No. Size Protein (%) Fats (%) Ash (%) Carbohydrate (%) 1 Small 2 Medium 3 Large 50.0517±4.6583a 45.0959± 9.0089a 47.7146±1.9086a 1.1261 ± 0.0363a 1.1165 ± 0.5399a 1.1207 ± 0.6328a 1.1446 ± 1.4684a 0.7971 ± 0.5985a 0.2251 ± 0.3859a 47.3753 ± 4.2347a 52.9905 ± 9.3599a 50.9410 ± 1.4776a 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.

ACKNOWLEDGEMENTS Gratitude is expressed to the Ministry of Research, Technology and Higher Education for the funding of the University Flagship Research (PUPT) year 2017 which has funded the research. Gratitude is upon Mr. Udin who helped the sampling activity and Mr. Dinardi as the laboratory attendant at the Biology Laboratory of National Agency of Nuclear Agency (BATAN) of Nuclear Area in Pasar Juma'at, South Jakarta. REFERENCES Armbruster JW, Page LM. 2006. Redescription of Pterygoplichthys punctatus and description of a new species of Pterygoplichthys (Siluriformes: Loricariidae). J Neotrop Ichthyol 4 (4): 401-409. AOAC. 2005. Official Method of Analysis of The Association of Official Analytical of Chemist. The Association of Official Analytical Chemist, Inc., Arlington, USA. Badal D, Mihir D. 2015. Fat content of an Indian Major Carp, Catla catla, in relation to age and size for optimizing harvesting period. International Journal of Fisheries and Aquatic Studies pp.2(6): 386- 390. Ciptanto S. 2010. Top 10 Ikan Air Tawar. Lily Publisher, Yogyakarta. [Indonesian] Hadiati RK. 2011. Diversitas dan hilangnya jenis-jenis ikan di Sungai Ciliwung dan Sungai Cisadane. Berita Biologi 10 (4): 491-504. [Indonesian] Murray J, Burt JR. 2001. The Composition of Fish. FAO, Rome, Italy, in partnership with the support unit for International Fisheries and Aquatic Research. Pang G, Xie J, Chen Q, Hu Z. 2014. Energy intake, metabolic Loricariidae) in Malaysia Peninsula. Res J Fish Hydrobiol 3 (2): 48- homeostasis, and human health. J Food Sci Hum Well 3: 89-103. 53. Rasmussen RS, Ostenfeld TH. 2000. Effect of growth rate on quality traits Sugianti B, Enjang HH, Nuah J, Yeni A. 2014. Daftar Pisces Yang and feed utilisation of rainbow trout (Oncorhynchus mykiss) and Berpotensi Sebagai Spesies Asing Invasif di Indonesia. Cetakan Ke-2 brook trout (Salvelinus fontinalis). Aquaculture 184: 327-337. (Edisi Revisi). Kementerian Kelautan dan Perikanan, Jakarta. Samat A, Shukor MN, Mazlan AG, Fatimah MY. 2008. Length-weight [Indonesian] relationship and condition factor of Pterygoplichthys pardalis (Pisces: