

CORTISOL ANALYSIS OF *Pterygoplichthys pardalis* FROM CILIWUNG RIVER

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Abstract

The existence of *Pterygoplichthys pardalis* as one Loricariidae species were introduced to Indonesia and dominated the Ciliwung River. The high contaminant in Ciliwung River can lead to high stress levels so that fish experienced a decline due to the death or failure to reproduce. But not entirely external stressors affect the existence *Pterygoplichthys pardalis*. *P. pardalis* stress levels need to be determined to identify the adaptive mechanism in a polluted environment through the concentration of the hormone cortisol. This study was conducted to identify the level of stress *P. pardalis* based on the concentration of the hormone cortisol. The method used a sample of fish raised in a tank and fish from the river. Fish plasma will be analyzed using the ELISA method to measure the cortisol. The higher concentration of cortisol showed more stress in Ciliwung fish. Based on the statistical result, the significance value between two groups was 0.012 ($\text{sig} < 0.05$). This assumed difference in cortisol level between fish from a tank and river. The results show that *P. pardalis* collected from the river have higher concentrations of cortisol than from a tank. The cortisol level was 113.06 ng / ml.

Keywords: *Pterygoplichthys pardalis*, stress, cortisol

1. INTRODUCTION

Pterygoplichthys pardalis species of the family Loricariidae originating from Central and South America (Armbruster, 2004). *P. pardalis* introduced to Indonesia and has a wide distribution area, one of the areas is Ciliwung River (Wowor 2010). Ciliwung river has been used as a source of drinking, irrigation, bathing and washing, and waste disposal. With the increase in people activity along the River and the liquid waste discharged can cause increased amounts of heavy metals in the Ciliwung River. High amounts of heavy metals and are not able to be detoxified will accumulate in various organs of the species living in the river, causing disorders and diseases of the immune system, respiratory, excretory, coordination of the central nervous system, reproduction and growth. Based on previous research, know that the highest heavy metal content in *P. pardalis* organs is Pb, Hg and Cd (Aksari, Perwitasari, & Butet, 2015).

The environment is polluted with waste or heavy metals, can affect the health condition of the fish. The health condition of a disturbed or contaminated environmental conditions can affect the stress level of fish. The stress level of fish is a manifestation of the functional response to external stressors. The response of fish to high levels of stress can be a death, immunodeficiency, decreased reproduction and survival. But it is not entirely applicable to *P. pardalis*. *P. pardalis* has the ability to withstand the polluted environment indicated by the ability of this species to reproduce and dominate other species in the Ciliwung river (Hadiaty, 2011). In addition, information on the levels of stress *P. pardalis* the origin of the Ciliwung River also was not identified. Analysis of the stress response can be applied to the conservation and management of wildlife. Hormone levels and growth rates can be useful in determining the response. Types of hormones that can be analyzed to see the stress level can be fish using hormone Glucocorticoid (GC) or also known as cortisol.

Stress analysis *P. pardalis* using hormone cortisol needs to be done in order to know the level of stress and the fish of adaptive mechanisms on the current condition of the Ciliwung River. The analysis aims to identify the hormone cortisol and can determine the level of stress *P. pardalis* Ciliwung river origin.

2. RESEARCH METHODS

2.1. Time and Place of Research

The research was conducted for 6 months, starting from October 2019 to March 2020. Analysis of samples was conducted in the Laboratory of Chemistry University of Al Azhar Indonesia and Integreted Research Laboratory Of Syiah Kuala University in Banda Aceh Darussalam.

2.2. Equipment and Materials Research

The tools used are 1 ml syringe, TDS meter, pH meter, thermometer, ELISA analyze. While the materials used are EDTA, microtube, microtip, masks, gloves, and 16 tail brooms fish samples were divided into 2 groups: the origin of the Ciliwung River fish samples and a control sample group maintained tank.

2.3. Fish Sampling

P. pardalis from Ciliwung River origin was taken by throwing nets with the help of local fishermen. Control fish is a fish raised in maintained tank with water that is not polluted conditions.

2.4. Separation of Blood Plasma

Blood sample taken by using 1 ml syringe. Blood samples were separated using centrifuges the blood plasma. Then the measurement of cortisol levels is done by sending the blood plasma sample to Integreted Research Laboratory Of Syiah Kuala University in Banda Aceh Darussalam.

3. RESULT AND DISCUSSION

3.1. Result

In testing the concentration of the hormone cortisol through blood plasma samples *Pterygoplichthys pardalis* obtained the following results:

Table 1. Cortisol Concentrations for two group

Group	cortisol		
	Mean (ng / ml)	SD	Sig. (2-tailed)
Fish from tank	23.6	6.7	
Fish from river	51.4	26.5	.012

3.2. Discussion

Glucocorticoid hormones or cortisol is a steroid hormone that is synthesized and released by the adrenal glands in response to physiological cues and stress. The release of glucocorticoid hormones begins when the pressure on the individual and cause stress that would stimulate the paraventricular nucleus (PVN) in the hypothalamus to release krikotropin releasing hormone (CRH) and arginine vasopressin (AVP). These hormones work on the anterior pituitary and activate cells to secrete adrenocorticotropim kortikotrof (ACTH), then ACTH stimulates the adrenal cortex to the synthesis and release of glucocorticoids (Ramamoorthy & Cidlowski, 2016)

Cortisol is a hormone which until recently was used as an indicator of stress in living organisms. Based on the results of statistical calculations were performed obtained results (Table 1) showed the value of significance (2-tailed) between the concentrations of the hormone cortisol fish pond maintained and fish Ciliwung River was 0.012 (sig. <0.05), so it can be concluded that there are significant differences between the concentrations hormone cortisol maintain pond fish and fish Ciliwung River. The highest concentration of the hormone

cortisol in fish from the Ciliwung River showed concentrations of 113,06 ng / ml indicates *P. pardalis* origin from Ciliwung River in a state of stress. According (Supriyono, 2011) the concentration of the hormone cortisol showed that the higher concentration of cortisol hormones, the higher the level of stress on the fish.

The high concentration of the hormone cortisol in one of the individuals the Ciliwung River fish origin than any other fish in the group, can be caused by other fish has declined and returned to the normal condition. The decline in hormone concentrations of fish may happen for several reasons as already experiencing adaptation and no longer feel the stress that the concentration of cortisol begins to decline. Another thing can cause by β -endorphine secretion in response to stress (Supriyono et al, 2011).

When under stress, can decrease immunity reaction by fish. It can be caused due to glucocorticoid hormones or cortisol can inhibit the formation of interleukin-1 and 2 so that the T lymphocyte cells die and can not stimulate the B lymphocytes to produce (Berne & Levy, 1988). These conditions will allow fish infected with parasites, bacteria, fungi and viruses (Varsamos, 2006). Besides as an indicator of response to stress, cortisol also plays a role in life because it can affect the metabolism bases, defense mechanisms and blood pressure (Syawal, 2011)

Based on temperature data obtained, is known to maintained tank water temperature is 28 °C and the water temperature when the Ciliwung River fish samples obtained was 25 °C. According to research (Syawal, 2011) note that both the optimum temperature is 32 °C to fish because it shows the lowest level of stress. It can be caused due to the temperature of 25-27 °C parasite can develop well, and potentially infected fish parasites (Lom & Dykova, 1992). This condition maybe can become another factor of stressor. However, there are other things besides temperature that can cause fish experience stress mainly due to polluted environments such as those in the Ciliwung River.

4. CONCLUSIONS, SUGGESTIONS, AND RECOMMENDATIONS

It can be concluded that based on statistic calculation result showed there are significant differences between concentrations of hormone cortisol of fish from maintained tank and fish from Ciliwung river. *P. pardalis* from Ciliwung river have higher stress levels than fish from maintained tank by the concentration of the hormone cortisol. The highest stress levels in fish origin Ciliwung River is 113.06 ng / ml. This concentration shows that the higher concentration of the hormone, the higher the stress on the fish.

Advice can be given that the addition of the parameters that play a direct role in the level of stress hormone glucocorticoid namely fish besides blood glucose levels. Moreover, it can be supported by the data of hematology and more water data.

5. ACKNOWLEDGMENTS

Funding for this project was provided in part by Kemenristekdikti University Collaboration Research scheme and Al-Azhar Indonesia University Grant. The conference was fully supported by Research and Community Service Institution.

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