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The Role of Salinity in Histopathology Description of Jatim Bulan Tilapia Juvenile (*Oreochromis niloticus*) Exposed by Lead (PB)

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ABSTRACT

The decrease in the number of lands for aquaculture will cause the freshwater fish aquaculture, especially tilapia is reared. As one of the efforts to survive, the breeders use the coastal area to anticipate, so the freshwater fish can adapt to the sea waters. Heavy metal pollution near the coasts (or in the coastal waters) has great potential impacts on the environment. The present study aimed to find out the effect of Lead (Pb, heavy-metal) exposure on the Jatimbulan Juvenile tilapia with the different salinity towards histopathology description of the gill, intestine, and the skin tissues. The method used was an experimental method with a completely randomized design using six treatments and three times repetition. The observed parameters included the changes in histopathology description of gill, intestine, and skin organs of Jatimbulan juvenile tilapia. Kruskal-Wallis scoring method was used for data analysis and was continued by Mann-Whitney. The result of the current study showed the effect of salinity towards histopathology description of gill, intestine, and skin of Jatimbulan juvenile tilapia. The effect of changes was proven with the histopathology description in the form of the damage of edema, hyperplasia, and necrosis on the gill tissue; the damage of edema, atrophy, and necrosis on the gill tissue as well as the damage of edema, atrophy, hemorrhagic and necrosis on the gill tissue. From the result of the current study which has been conducted, it can be concluded that the heavy-metal exposure by lead was 0.03 ppm on the salinity of 10 ppt and 20 ppt. given the significant effect on the histopathology description of gill, intestine, and skin of Jatimbulan juvenile tilapia.

Keywords: Histopathology, Lead, Metal, Oreochromis niloticus, Salinity

INTRODUCTION

One of the superior commodities in fisheries aquaculture activities was tilapia aquaculture (*Oreochromis niloticus*). Tilapia has some superiority over other fish for some features; for example, it has rapid growth, is easy to breed, and is efficient for additional feeding, thus it can be a favorite commodity in an aquaculture activity. Along with the increase in the number of tilapia breeders, the need for lands as the aquaculture area highly increases. Based on the data, the potential pond area in East Java in 2014 was decreased by 64% from the previous year to 129518 hectares (FAO, 2005). The decrease in the number of lands for aquaculture threatens the freshwater fish aquaculture business, especially tilapia. As an effort to survive, the breeders utilize the coastal areas to anticipate whether freshwater fish can be adapted to sea waters (Tuiyo, 2016).

Shrimp and milkfish ponds can be used for tilapia aquaculture activities because it has a euryhaline characteristic, thus tilapia can be used as a substitution in the shrimp or milkfish pond that is less productive (Hosseini Aghuzbeni et al., 2017). Nevertheless, coastal waters have a high potential for environmental impacts. The environmental impact meant is heavy metal pollution due to human activities. Heavy metal pollution in coastal areas has a high potential for aquatic toxicity due to industrial waste discarded into the river. One of the heavy metals usually found is Lead (Pb). Water sources, the most vulnerable to the Lead threats, are the rivers which are usually close to the residential areas and the agriculture, and residue of industrial waste that is not favorable and sufficient (Ritonga and Yunasfi, 2014).

Lead (Pb) is a dangerous heavy metal because it is indestructible (non-degradable) for living organisms, and it can accumulate into the environment. Lead settles to the bottom of waters to form complex compounds together with organic and inorganic materials. The Lead continues to enter the tissues of living organs through the respiratory tract, digestion, and skin. Lead dissolved in fat will penetrate the cell membrane, thus the Lead ions will pile up in the cells and organs (Jaishankar et al., 2014; Okereafor et al., 2020).

The presence of salinity in waters has also an impact on the level of Lead toxicity. Salinity is the total volume of K +, Na +, Mg2 +, NO3-, Ca2 +, SO_4 2-, Cl-, and HCO3- in the water. If there is a decrease in salinity due to the desalination process, it will cause an increase in the toxic power of heavy metals, and will cause a greater level of bioaccumulation of heavy metals (Okereafor et al., 2020). Therefore, it is required to conduct a study to determine the

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effect of Lead as a heavy-metal exposure on Jatimbulan juvenile tilapia with different salinity for organ damage, especially in the gill, intestine, and skin.

MATERIALS AND METHODS

The present study was conducted at the Faculty of Fisheries and Marine, Universitas Airlangga (Surabaya, Indonesia) according to the ethical rules of Universitas Airlangga for animal studies. The materials used in this study consisted of Jatimbulan Juvenile tilapia obtained from the Technical Implementation Unit for Freshwater Aquaculture Development, Umbulan, Pasuruan, Indonesia. The selected Jatimbulan Juvenile tilapia was a juvenile which had a body length of 3-7 cm and weighs ± 13 grams as many as 200 fishes. The Lead used was the Lead (II) Nitrate, and the salinity of the water was 0 ppt, 10 ppt, and 20 ppt, distilled water, and nitric acid.

The current study was experimental using a complete randomized design method. Three treatments and six times repetition were used in this study, thus there were 18 test units. Data collection technique was carried out by direct observation, namely by observing directly the behavior of tilapia juvenile after being exposed to Lead (heavy-metal), and histological observation was conducted to determine the description of gill, intestine, and skin tissue due to the effect of salinity on heavy metal exposure. In this study, there were three treatments with six times repetition, namely A (Salinity 0 ppt and using 0.03 mg/l of Pb), B (Salinity 10 ppt and using 0.03 mg/l of Pb), and C (Salinity 20 ppt and using 0.03 mg/l of Pb).

The dose of lead used in the present study was 0.03 mg/l by as suggested by Tarigan and Rozak (2003). The Lead nitrate was weighed, then mixed using distilled water and 60% nitric acid (HNO_3), and after that stored in a bottle; thus the Lead dissolved easily in the water. The water was mixed with the Lead, then aerated, and waited for 2 hours to be mixed properly because the Lead could cause poisoning effects on the fish after the fish has been exposed to the Lead for two hours (Musthapia and Sunarno, 2006). Furthermore, water salinity was made using seawater which was diluted with fresh water from *Perusahaan Daerah Air Minum* (PDAM, Regional Water Company) to obtain the required salinity concentration. The experiment fish that would be used in this study was previously acclimatized so that the fish would not experience stress with the new environment (Rosdianasari and Perbedaan, 2015).

The next stages carried out in this study were measuring the water quality, calculating the survival rates, also making and observing histopathology preparations. The main observed parameter was the histopathology description of the gill, intestine, and the skin of the Jatimbulan tilapia which was exposed to the Lead (heavy-metal) at a different salinity. Supporting the observed parameter was water quality and survival rate. The water quality for observed parameters included pH, temperature, dissolved oxygen, and salinity. The present study used salinity as the independent variable, dose of Lead as a control variable, and the histopathology description of the gill, intestine, and the skin as a dependent variable.

The result in the form of scoring data from the histopathology was then analyzed using analysis of Kruskal-Wallis one-way ranking variant to determine the differences between samples (Dalgaard, 2008), marking real population differences or the differences (p value less than 0.05) due to accidental variation between random samples from the same population. Furthermore, the Mann-Whitney test was carried out to examine whether two independent groups have been drawn from the same population.

RESULTS

The result of the survival rate of Jatimbulan juvenile tilapia *(Oreochromis niloticus)* after exposure to the Lead heavy metal showed that there was no significant difference in each treatment (Table 1). The lowest survival rate was found in treatment B (10 ppt + 0.03 mg/l Pb), while the highest survival rate was found in the control treatment (0 ppt + 0 mg/l Pb). The observation result of gill tissue damage on the Jatimbulan Juvenile tilapia exposed to the Lead at different salinity for 30 days can be seen in Table 2.

Based on the data above, the most severe value of edema was found in treatment A (0 ppt + 0.03 mg/l Pb) with the high level of damage which was 2.6, while the small value of damage of edema was found in the control with the low level of damage (that was 1.4). Considering hyperplasia, the highest damage value was found in treatment A (0 ppt + 0.03 mg/l Pb) with the medium level of damage which was 1.5, while the smallest average of hyperplasia was found in the control treatment with the normal level of damage which was 0.5. While the highest damage value of necrosis was found in treatment A (0 ppt + 0.03 mg/l Pb) with the medium level of damage which was 1.7, the smallest damage value of necrosis was found in the treatment C (20 ppt + 0.03 mg/l Pb) with the normal level of damage which was 0.1.

Histopathological description of the tilapia's gill organ exposed to the Lead (heavy-metal) showed the change in gill tissue structure in Figure 1. In the gill of the tilapia fish, there was a report of edema, hyperplasia, and necrosis. Edema in histopathology was characterized by the rounded shape, and there was liquid in the circle. Hyperplasia was characterized by the finding of thickening or enlargement in an organ. In the gill, it could be recognized by the

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enlargement of the secondary lamella. Meanwhile, the damage of necrosis occurred due to excessive hyperplasia, thus the gill tissue cells were no longer intact. The observation results of the intestinal tissue damage on the Jatimbulan Juvenile tilapia exposed to the Lead at different salinity for 30 days can be seen in Table 3.

Table 1. Survival rate of Jatimbulan Juvenile tilapia exposed to the lead at different salinity

Treatments	Repetition					means (%) ± SD
	1	2	3	4	5	
Control (0 ppt + 0 mg/1 Pb)	90	100	90	100	100	96 ± 4.89
A (10 ppt + 0.03 mg/1 Pb)	100	100	80	80	70	86 ± 12
B (20 ppt + 0.03 mg/1 Pb)	30	100	100	100	90	84 ± 27.27
C (30 ppt + 0.03 mg/1 Pb)	90	100	70	100	100	92 ± 11.66

*SD: Standard error of the means

Table 2. The histopathology damage of gill in each treatment

Treatment	Edema	*Hyperplasia*	Necrosis
Control (0 ppt + 0 mg/1 Pb)	1.4 ± 0.73	0.5 ± 0.70	0.4 ± 0.51
A (10 ppt + 0.03 mg/1 Pb)	2.6 ± 0.51	1.5 ± 0.70	1.7 ± 0.67
B (20 ppt + 0.03 mg/1 Pb)	2.1 ± 0.87	1.3 ± 0.48	0.6 ± 0.69
C (30 ppt + 0.03 mg/1 Pb)	1.6 ± 0.96	1.4 ± 0.84	0.1 ± 0.31

*p < 0.05, Normal: 0-0.75, Low: 0.75-1.5, Medium: 1.5-2.25, High: 2.25-3

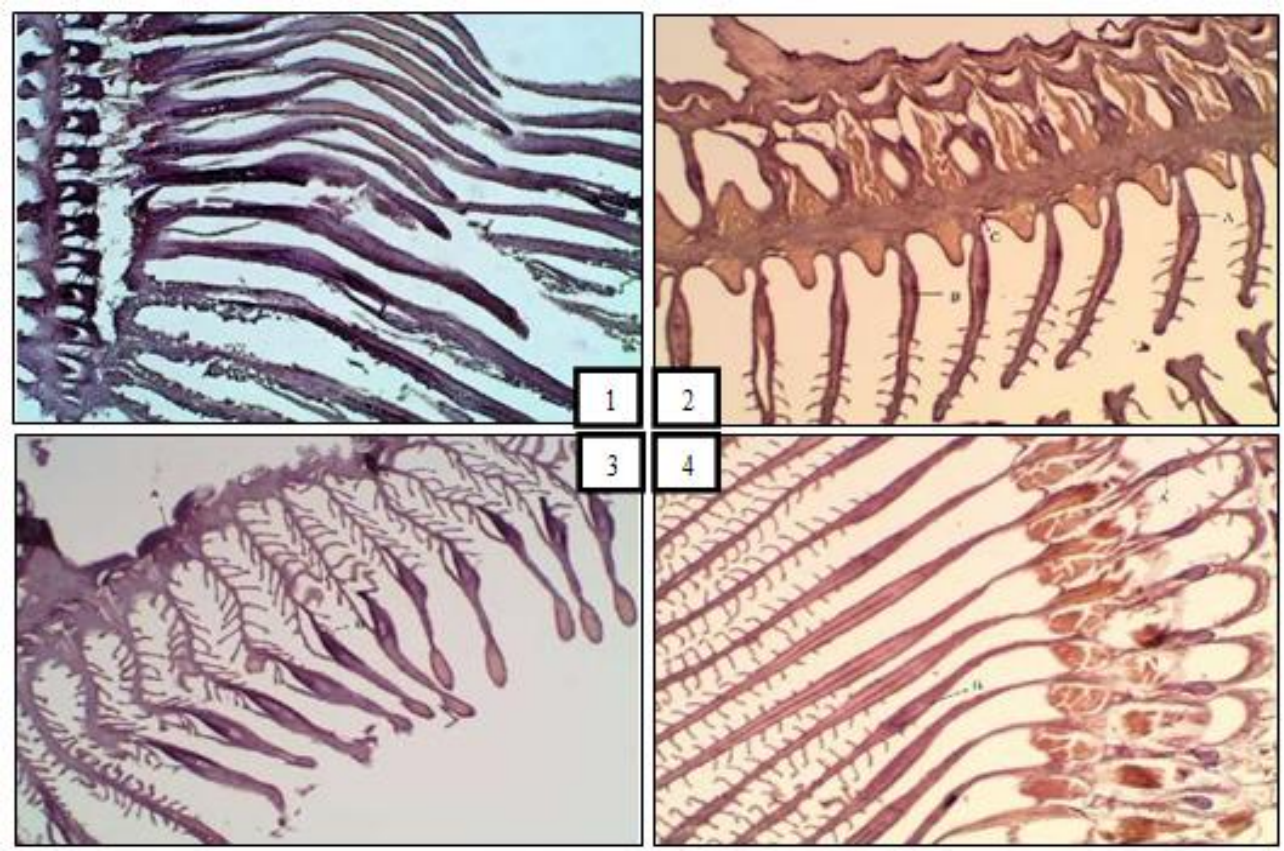

Figure 1. The Histopathologic Description of the gill of Jatimbulan Juvenile Tilapia in the magnification of 400×. **1:** Normal gill, **2:** Treatment A (0 ppt + 0.03 mg/l Pb), **3:** Treatment B (10 ppt + 0.03 mg/l Pb), **4:** Treatment C (20 ppt + 0.03 mg/l Pb); A: Edema, B: Hyperplasia, C: Necrosis, Pb: lead

Table 3. The histopathological damage of the intestine in each treatment

Treatment	Edema	Atrophy	Necrosis
Control (0 ppt + 0 mg/1 Pb)	1.1 ± 0.73	0.4 ± 0.51	1 ± 0.81
A (10 ppt + 0.03 mg/1 Pb)	2.1 ± 0.99	0.7 ± 0.67	0.9 ± 0.99
B (20 ppt + 0.03 mg/1 Pb)	1.6 ± 0.96	0.4 ± 0.51	1.3 ± 0.94
C (30 ppt + 0.03 mg/1 Pb)	1.5 ± 0.70	0.4 ± 0.69	0.9 ± 0.99

p < 0.05, Normal: 0-0.75, Low: 0.75-1.5, Medium: 1.5-2.25, High: 2.25-3

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Based on the data above, the most damage value of edema was found in treatment A (0 ppt + 0.03 mg/l Pb) with the medium level of damage which was 2.1, while the smallest damage value of edema was found in the control treatment with the low level of damage which was 1.1. The most damage value of atrophy was found in treatment A (0 ppt + 0.03 mg/l Pb) with the low damage rate of 0.7, while the average atrophy damage in the control treatment B (10 ppt + 0.03 mg/l Pb) and C (20 ppt + 0.03 mg/l Pb) had the same value of 0.4, and fallen into a normal category. Furthermore, the most damage value of necrosis was found in the treatment B (10 ppt + 0.03 mg/l Pb) with the low level of damage which was 1.3, while the smallest damage value of necrosis was found in treatment A (0 ppt + 0.03 mg/l Pb) with the low level of damage which was 0.9.

The histopathologic description of the intestinal organs of tilapia exposed to the Lead (heavy-metal) revealed the presence of edema, atrophy, and necrosis (Figure 2). Edema was characterized by its rounded shape in an organ due to the liquid entering the cell tissue. Atrophy was characterized by shrinking cells. Meanwhile, the necrotic damage could be found with the characteristic of cells which was blurred or lost because of the inability of these cells to absorb the color when histology staining was done.

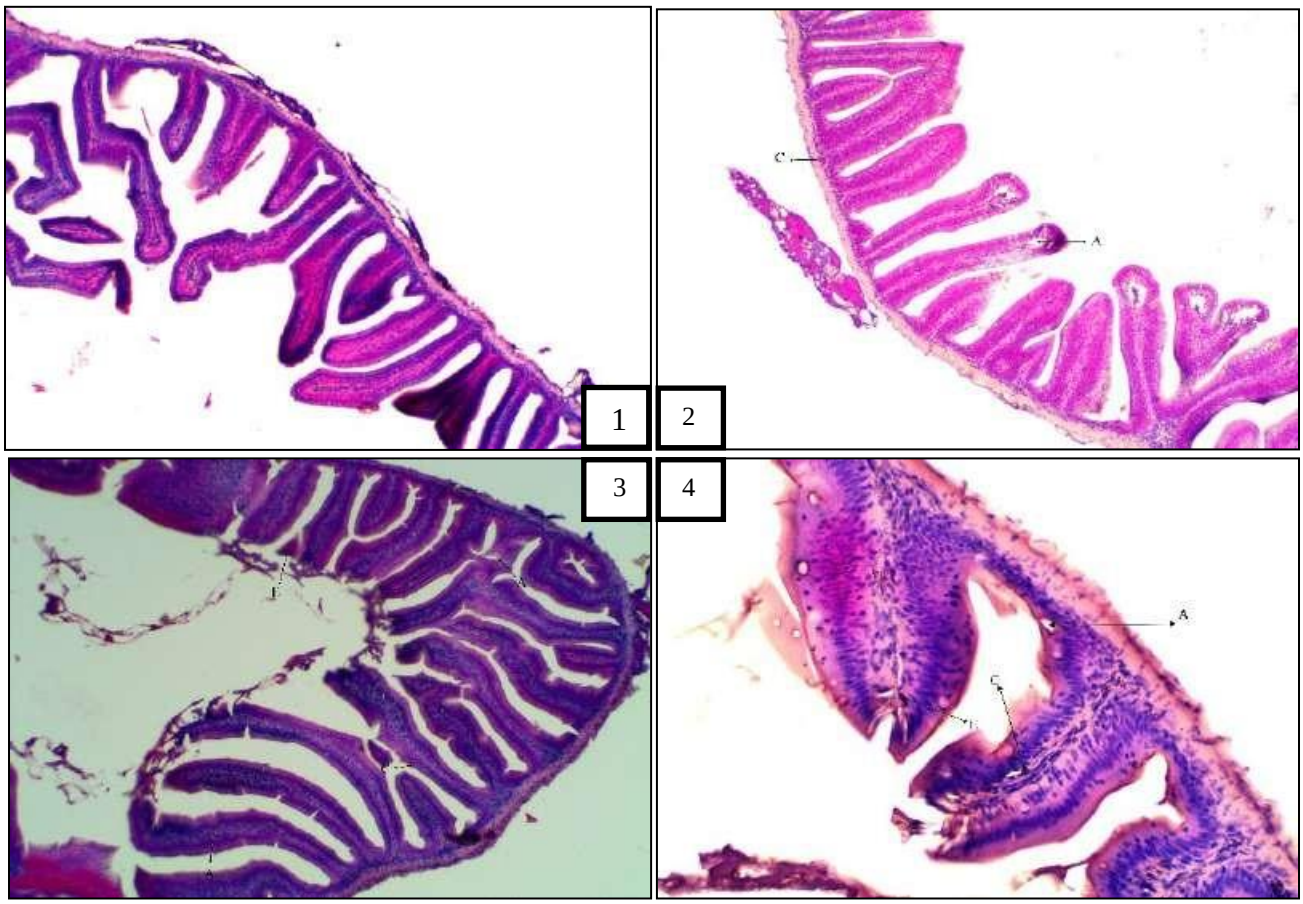

Figure 2. The Histopathologic Description of the intestinal Organs of Jatim Bulan Juvenile Tilapia in the magnification of 100×. **1:** Normal Intestine, **2:** Treatment A (0 ppt + 0.03 mg/l Pb), **3:** Treatment B (10 ppt + 0.03 mg/l Pb), **4:** Treatment C (20 ppt + 0.03 mg/l Pb). A: Edema, B: Hyperplasia, C: Necrosis, D: Hemorrhage, E: Atrophy, Pb: lead

The result of observation of the skin tissue damage on the Jatimbulan Juvenile tilapia exposed to the Lead at different salinity for 30 days can be seen in Table 4 below.

Based on the data above, the highest damage value of edema was found in treatment A (0 ppt + 0.03 mg/l Pb) with the low level of 1.4, while the smallest edema damage was found in the treatment B (10 ppt + 0.03 mg/l Pb) with the normal level of damage which was 0.2. The most hemorrhagic and atrophic damage values were found in the control treatment with the normal level of damage which was 0.6. The most damage value of necrosis was found in treatment A (20 ppt + 0.03 mg/l Pb) with the medium damage level of 1.5, while the smallest damage value of necrosis was found in treatment C (20 ppt + 0.03 mg/l Pb) with the low level of damage which was 0.9.

Histopathologic description of the tilapia's skin organ exposed to the heavy-metal Lead found the presence of edema, atrophy, hemorrhage, and necrosis (Figure 3). Edema was characterized by swelling of cells or excessive accumulation of fluid in the skin tissue. Atrophic damage was characterized by the reduced size of the skin tissue cells. Hemorrhagic damage was characterized by the release of cells from the blood vessels in the skin tissue. Meanwhile, the damage of necrosis was found by the death of skin tissue cells because of the inability to absorb the color when the histology staining was being done.

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Table 4. The histopathological damage of the skin in each treatment

Treatment	Edema	Atrophy	Hemorrhage	Necrosis
Control (0 ppt + 0 mg/1 Pb)	0.9 ± 0,87	0.6 ± 0.82	0.6 ± 0.69	1.1 ± 0.73
A (10 ppt + 0.03 mg/1 Pb)	1.4 ± 0,69	0.5 ± 0.91	0.5 ± 0.70	1.5 ± 0.52
B (20 ppt + 0.03 mg/1 Pb)	0.2 ± 0,94	0.4 ± 0.69	0.4 ± 0.51	1.3 ± 0.82
C (30 ppt + 0.03 mg/1 Pb)	1.1 ± 0.99	0.4 ± 0.51	0.4 ± 0.51	0.9 ± 0.96

$p < 0.05$, Normal: 0-0.75, Low: 0.75-1.5, Medium: 1.5-2.25, High: 2.25-3

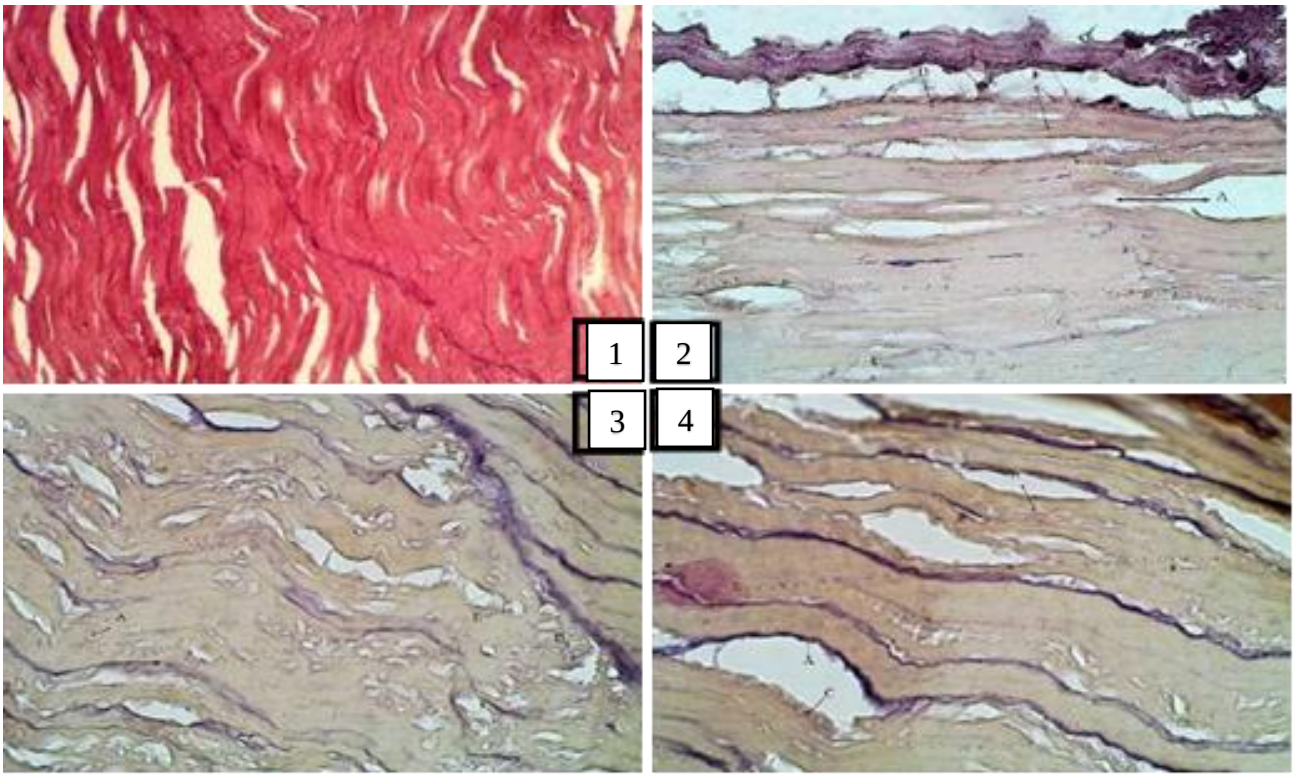

Figure 3. The Histopathologic Description of the skin organ of Jatim Bulan Juvenile Tilapia in the magnification of 400×. **1:** Normal Skin, **2:** Treatment A (0 ppt + 0.03 mg/l Pb), **3:** Treatment B (10 ppt + 0.03 mg/l Pb), **4:** Treatment C (20 ppt + 0.03 mg/l Pb), A: Edema, B: Hyperplasia, C: Necrosis, D: Hemorrhage, E: Atrophy, Pb: lead

The water quality observed in the study included temperature (^{o}C), pH, ammonia (mg/l), and salinity (ppt). The result of the observation of water quality parameters can be seen in Table 5. Based on the data above, it could be seen that the temperature in each treatment had the same range of values among treatments which ranged from 27.5-33℃. In the observation of pH during the maintenance, it was known that the pH among treatments was not significant. In the control treatment and treatment A (0 ppt + 0.03 mg/l Pb), the obtained pH value was the same ranging from 7.7 to 9.1 in the treatment B (10 ppt + 0.03 mg/l Pb), and the lower limit value of the pH was slightly higher than the control treatment and the treatment A (0 ppt + 0.03 mg/l Pb), however the highest value of pH in the treatment B (10 ppt + 0.03 mg/l Pb) was the same as the control treatment (0 ppt) and the treatment A (0 ppt + 0.03 mg/l Pb) which was 7.8-9.1. In the treatment C (20 ppt + 0.03 mg/l Pb), the pH value was higher than the control treatment (0 ppt), A (0 ppt + 0.03 mg/l Pb) and B (10 ppt + 0.03 mg/l Pb), however the pH value from the treatment C (20 ppt + 0.03 mg / l Pb) was not much different from other treatments which was 7.9-9.3. Considering the result of observation of salinity during the maintenance, it was known that the salinity value has increased. It was due to the evaporation during the study. The increase occurred in the treatment B (10 ppt + 0.03 mg/l Pb) and C (20 ppt + 0.03 mg / l Pb). The increase in salinity in both treatments; B (10 ppt + 0.03 mg/l Pb) was 10-12 ppt, treatment C (20 ppt + 0.03 mg / l Pb) was 20-22. From the result of observation of ammonia during the maintenance, it was known that the ammonia value in each treatment was the same as 0-0.5 mg/l, there was no difference at all amongst the treatments.

Table 5. The observation result of the water quality

Treatment / Water Quality Parameter	Control	A	B	C
Temperature (°C)	27.5-33	27.5-33	27.5-33	27.5-33
pH	7.7-9.1	7.7-9.1	7.8-9.1	7.9-9.3
Salinity (ppt)	0	0	10-12	20-22
Ammonia (mg/l)	0-0.5	0-0.05	0-0.05	0-0.05

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DISCUSSION

The results of histopathological examination of gills, intestines, and skin organs in the present study showed the damage caused by exposure to heavy-metal lead with different salinity. The damage in the gill organ included edema, hyperplasia, and necrosis. The initial damage that occurred in the gill was found in the presence of edema, then developed into hyperplasia and necrosis. This could be seen from the histopathologic changes in Jatimbulan Juvenile tilapia during the exposure to the heavy-metal lead at a different salinity. In the intestinal tissue, the changes were found in histopathology in the form of edema and atrophy which then were developed into necrosis. Meanwhile, in the skin tissue, the presence of edema, atrophy, hemorrhage, and necrosis was also found. These conditions indicated that absorption and bioaccumulation of the heavy metal could be stored well in the tissues of skin, gill, stomach, muscles, intestine, liver, brain, kidney, and reproductive organs (Chen and Chen, 2001; Bawuro et al., 2018).

Exposure to the heavy metal lead in treatment A (0 ppt + 0.03 mg/l Pb) had the highest damage effect on the gill organs when being compared with the skin and intestine, especially for edema and necrosis damage. This was because the reaction of the Lead in low salinity resulted in the lead toxicity level became higher (Sullivan, 1977). Besides, the gill was also the first organ to filter water that would enter the body of the fish. Gills were also the organs which were very sensitive to the effect of metal toxicity which would disrupt the normal function of metalloenzyme and metabolism of cells (Darmono , 2006). Therefore, if there was heavy metal in the water sources, the gill would react to the heavy metal.

Edema damage was also found in the intestinal tissue and skin. The highest edema damage to the intestinal tissue and skin occurred when treatment A (0 ppt + 0.03 mg/l Pb) was given. However, from the three tissues, the edema damage was the highest which occurred in the gill with treatment A (0 ppt + 0.03 mg/l Pb) which was 2.6 ± 0.51. Edema was a swelling of cells caused by the entering of the lead into the tissue, thus it resulted in an excessive accumulation of fluid, and was considered as the initial stage of histological damage. The presence of the lead diffused into the gill cells and bounded to the plasma membrane of the lamella epithelial gill cells in synergy, and it caused the lack of Adenosine triphosphate (ATP). The low levels of oxygen in the blood could cause the cells to have insufficient ATP. The low amount of ATP in the cells caused the accumulation of Na + in the cells. This was due to the lack of energy to secrete Na + ions outside the cell. A large amount of Na + could cause osmotic pressure changes, thus water, Ca2 + and Na + could enter and cause swelling or edema (Catron et al., 2015). The high damage value of edema in the gill tissue, intestine, and skin tissue in treatment A (0ppt + 0.03mg/l Pb) with the low salinity value proven that the lower salinity would increase the level of toxicity in the heavy-metal lead toxicity.

The presence of edema in the gill, intestine, and skin was the initial stage of tissue damage and caused other histological damage. As in the gill, hyperplasia and necrosis were found, atrophy and necrosis were found in the intestine, and atrophy, finally hemorrhage, and necrosis were also found in the skin tissue. Excessive edema could cause hyperplasia due to red blood cells coming out of the capillaries, and the cells would be separated from the supporting tissue. Hyperplasia occurred at the lower level of irritation and was usually accompanied by an increase in the number of mucous cells at the base of the lamella, thus resulting in a lamella fusion. The presence of hyperplasia indicated a mechanism of adaptation of gill tissue to protect the tissue from irritants such as heavy metals. The mechanism was as protection and inhibitor of the gill function as a respiratory system because of the process of epithelial cells' cleavage, and excessive chloride cells that disrupted the respiratory system. In this study, the incidence of hyperplasia was found in almost every treatment on the gill tissue. An excessive lead in the gill tissue of Jatimbulan Juvenile tilapia also caused necrosis damage in the gill tissue. The highest necrosis damage was found in treatment A (0 ppt + 0.03 mg/l Pb). This could occur because of the concentration of heavy-metal lead in the water causing continuous absorption into the gill tissue, and causing necrosis (Mulyani et al., 2014).

The lower value of the damage was found in the intestinal and skin tissues. Lead exposure to intestinal tissue caused the damage of edema, atrophy, and necrosis. The intestine has experienced the damage because lead ion was bounded to the food. The results of intestinal histopathology after exposure to the heavy-metal lead did not show a significant difference in each treatment. This occurred because lead exposure entered the intestine through the water and food absorption, where food containing lead was more easily excreted from the body of the fish. Metal absorption through the respiration was usually quite large, while in the digestive tract of fish which most of the metal penetration came from food such as small fishes, aquatic plants, and plankton that have been bound to lead metal ion may not be absorbed by fish and excreted through feces (Darmono , 2006; Kasumyan, 2018).

In the skin tissue which was the outer part of the fish, and at the same time served as a protection against physical, chemical, and biological changes, when it was exposed to the heavy metal lead, it caused damages to edema, atrophy, hemorrhage, and necrosis. The skin experienced damages due to lead exposure that entered through the diffusion process. Histopathological results of the skin observation after the exposure to the heavy-metal lead did not show a significant difference in each treatment. The presence of lead in the skin tissue was able to damage to the necrosis stage or cell death, although Lead was able to cause necrosis, but only with the low value of the damage. This was because the skin had a mechanism for detoxification and excretion so that the toxic effect could still be tolerated (Yulaipi et al.,

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2013). Lead entered the skin organ through the circulatory system, but it took a long time in the distribution process, so only a little Lead and the damage of the skin was found.

The highest mortality rate in Jatimbulan Juvenile tilapia due to exposure to the heavy-metal Lead occurred after getting the treatment B (10 ppt + 0.03 mg/l Pb) with a mortality percentage of 84%, while the highest survival rate occurred after obtaining the control treatment (0 ppt) with a percentage of 96%. This happened because of the efficiency of fish in the utilization of feed, so it did not disrupt the body's metabolic system of fish. The survival rate of fish was also influenced by the condition of water quality which included temperature, pH, salinity, and ammonia. In the result, it could be seen that the parameter of temperature during the study showed an average value of 27.5^{o}C to 33^{o}C. The temperature was in accordance with the condition of the Jatimbulan tilapia fish habitat which was able to grow optimally at the temperature of 14^{o}C to 38^{o}C (FAO, 2018). The result of pH parameter during the study showed an average value ranging from 7.7 to 9.3, which was higher than the optimal PH value which was good for tilapia growth (PH 6 - 8.5; FAO, 2018). Nevertheless, the PH condition did not affect the condition of fish, because Jatimbulan tilapia had a high tolerance to PH. Meanwhile, the results of the ammonia parameter showed the value of 0-0.5, which meant that the waters had a normal ammonia level.

Salinity was also one of the factors highly considered during the study. Salinity is the weight of inorganic halogen salts in gram dissolved in 1kg of water. In this study, the salinity influenced the description of the damage in the gill, intestine, and skin of Jatimbulan Juvenile tilapia. The decrease in salinity caused an increase in the toxicity of heavy metals. The salinity influenced the toxic power of Lead in the body of tilapia which was when the tilapia was placed in the salinity water, then the osmoregulation process of fish tended to maintain the fluid in the body against the changes in salinity. If it was found that Lead has exceeded the limit and could not be tolerated by the body of the fish itself, it would be excreted the xenobiotic substances. The xenobiotic substances in the body of the fish would stimulate the fish to take the physiological resistance to minimize the impact of the poison caused (Yulaipi et al., 2013; Kasumyan, 2018).

CONCLUSION

From the results of the study which has been conducted, it can be concluded that the exposure of heavy-metal Lead was 0.03 ppm at the salinity of 10 ppt and 20 ppt, giving a significant effect on the histopathologic description of the gill, intestine, and the skin of Jatimbulan Juvenile tilapia. The effect of these changes was known with the presence of histopathologic description in the damage of edema, hyperplasia, and necrosis in the gill tissue, the damage of edema, atrophy, and necrosis in the intestinal tissue, and the damage of edema, atrophy, hemorrhage, and necrosis in the skin tissue.

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