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THE EFFECT OF DIFFERENCES IN THE LENGTH OF SOAKING TIME FOR THE THYROXIN HORMONE ON THE GROWTH RATE OF FRESH WATER LOBSTER (*Cherax quadricarinatus*)

PENGARUH PERBEDAAN LAMA WAKTU PERENDAMAN HORMON TIROKSIN TERHADAP LAJU PERTUMBUHAN LOBSTER AIR TAWAR *(Cherax quadricarinatus)*

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Muhammad Furqan Ramadhana[a*] , Agus Putra AS[a] , Andika Putriningtias[a]

[a] *Aquaculture Study Program, Faculty of Agriculture, Samudra University, Langsa City, Aceh, Indonesia*

Abstract

Freshwater lobster is one of the lobster commodities that is not widely known by society today. Freshwater lobsters have a high selling value on the market, so information on growth hormones is needed to increase the growth of freshwater lobsters, so that they can meet market demand. Thyroxine hormone is a hormone produced by the thyroid gland which functions to form, store and release substances related to regulating metabolic rate. Therefore, this study aims to see how different soaking times for the thyroxine hormone affect the growth rate of freshwater lobsters and to determine the optimal time for soaking freshwater lobsters using the thyroxine hormone. The research method used in the research was a Completely Randomized Design (CRD) method with 4 treatments and 3 three replications. The treatments carried out were: PHT0 (control), PHT1 (soaking for 12 hours/0.1 mg/L), PHT2 (soaking for 24 hours/0.1 mg/L), PHT3 (soaking for 36 hours/0.1 mg/L). Parameters observed: Absolute Weight Growth, Absolute Length Growth, Daily Growth Rate, Survival Rate (SR), and Water Quality Observations. The results of the research showed that the best soaking time for the thyroxine hormone on the growth of freshwater lobsters (Cherax quadricarinatus) was in PHT2 (24 hours), and the lowest was in PHT0 (control) treatment.

Keywords: *thyroxine hormone, soaking time, freshwater lobster, growth.*

1. Introduction

This freshwater lobster is a solution for farmers who are no longer able to cultivate saltwater lobsters (Panulirus spp.) due to a ban on the capture of saltwater lobster fry, as stipulated in Circular Letter of the Minister of Marine Affairs and Fisheries Number 18/MEN-KP/I/2015 (Kurniawan, 2018). Freshwater lobsters (*Cherax quadricarinatus)* are one type of lobster that is not yet widely known by the general public. Freshwater lobsters can be found living in lakes, swamps, or rivers. Freshwater lobsters have a high market value. The high price of

* *Correspondence: Aquaculture Study Program, Faculty of Agriculture, Samudra University, Langsa City, Aceh, Indonesia*
e-mail: furqanlubis12345@gmail.com

Abstract

This study aims to determine the types of endoparasites, the prevalence and intensity of endoparasites, and the histopathological description of the intestines and stomachs of carp in the Mina Abadi Sejahtera Fish Farmer Group (Pokdakan) in Ngrajek Village, Magelang Regency. A total of 30 fish samples were taken from two ponds. Based on the results of the study, two types of endoparasites were found, namely *Bothriocephalus acheilognathi* and Nematoda worms. *Bothriocephalus acheilognathi* is a cestoda that has a flat and long body shape, is milky white in color, and has a scolex. The nematodes found have a round body shape and a complete digestive system. The prevalence *of Bothriocephalus acheilognathi* was 3.33% (occasional) with an intensity of 4 ind/fish (low). The prevalence of nematodes was 6.67% (occasional) with an intensity of 1 ind/fish (low). All parasites found were located in the intestines of carp, with *Bothriocephalus acheilognathi* being the most dominant parasite. Histopathological test results showed that carp infected with B. *acheilognathi* exhibited damage to the intestinal mucosa in the form of mucosal epithelial erosion, necrosis, and inflammatory cell infiltration in the mucosa, as well as damage to the gastric mucosa in the form of mucosal epithelial erosion and inflammatory cell infiltration in the mucosa. The correlation results between water quality parameters and parasite abundance showed that temperature had the lowest correlation, while ammonia had the strongest correlation. However, the significance value for all pond water quality parameters was >0.05, indicating that there was no significant relationship between the two variables.

Keywords: *thyroxine hormone, immersion duration, freshwater lobster, growth.*

freshwater lobsters ( ) is related to high market demand, both locally and internationally, and the small number of freshwater lobster farmers at present (Saragih, 2020). Intensive farming systems require intensive feeding with artificial feed. However, farming activities are currently faced with the reality of high artificial feed prices. In freshwater lobster farming, feed is a very important part because it accounts for 60-70% of the total production costs that must be incurred (Rahmi, 2016).

According to Lengka (2013), freshwater lobsters have promising prospects in the fisheries sector. In addition to being easy to cultivate, freshwater lobsters are not susceptible to disease and are omnivorous. From a technical cultivation and market potential perspective, freshwater lobsters are worth developing widely in the community so that they can provide economic benefits while maintaining their sustainability. These lobsters have advantages over sea lobsters, one of which is that they can be cultivated and their cultivation techniques are easier than those for tiger prawns and giant river prawns. One effort to increase growth is by using thyroxine hormones. Therefore, information on growth hormones is needed to increase the growth of freshwater lobsters so that they can meet market demand.

Thyroxine is one of the hormones produced by the thyroid gland. The thyroid gland functions to form, store, and release substances related to the regulation of metabolic rate. Thyroxine can increase the metamorphosis process and stimulate development and growth in fish (Kurniawan, 2014). Research on thyroxine hormone immersion to enhance growth has been conducted by Fathur (2022) on sand lobsters, Muslim (2019) on snakehead fish (Channa striata), *and* Adriawan *et al.* (2020). It is hoped that varying the duration of thyroxine hormone immersion in freshwater lobsters can enhance their growth and survival rates.

2. Materials and Methods

2.1. Time and Place

This study was conducted from March 4 to April 12, 2024, for 40 days at the experimental house of the Faculty of Agriculture, Samudra University, Langsa, and continued at the Laboratory of the Faculty of Agriculture, Samudra University.

2.2. Equipment and Materials

The materials and equipment used were Styrofoam as a maintenance container, aerator, sieve, digital scale, caliper, PVC pipe, water quality measuring instruments, namely thermometer, DO meter, pH meter, and materials, namely freshwater lobster seeds, teroxin growth hormone, and alcohol.

2.3 Research Design

The method used in this study was the experimental method, using a Complete Randomized Design (CRD) with 4 treatments repeated 3 times. The treatments used were as follows:

PHT0: Control
PHT1: Soaking for 12 hours/0.1 mg/L
PHT2: Soaking for 24 hours/0.1 mg/L
PHT3: Soaking for 36 hours/0.1 mg/L

2.4. Research Procedure

a. Preparation of Tools and Materials

The preparation involved sterilizing the equipment and containers by first washing the containers with sunlight until clean. After being washed clean, the containers were dried for 24 hours. Next, the containers were filled with 10 L of water per container and aerated. The containers used in the study were styrofoam media measuring 30 cm long, 20 cm wide, and 25 cm high, with a total of 12 pieces. The styrofoam was then marked with treatments 1, 2, 3, and 4.

b. Test Animal Preparation

Lobster larvae were obtained from lobster farmers in the Medan area. Lobster larvae used as test animals must have complete body parts, be free of defects, and be active. The number of freshwater lobster larvae used was 60, with 5 larvae per container, measuring 2-3 cm in length.

c. Administration of Thyroxine Hormone Dose

Thyroxine hormone was administered at a dose of 0.1 mg/L. Based on previous research by Andriawan (2020), administering thyroxine hormone at a dose of 0.1 mg/L can increase the growth rate and survival rate of tilapia larvae.

d. Soaking of Test Animals

Before the freshwater lobster larvae were immersed, they were fasted for 1 day. The thyroxine hormone dose was first diluted using a 2.5% NaCl solution. The number of freshwater lobster seeds immersed was 2-3 cm/seed or around 3.5 grams. Each container was filled with 5 lobster seeds and immersed for the duration of the treatment. The soaked freshwater lobster seeds are placed in containers and maintained for 30 days.

e. Freshwater Lobster Maintenance

Freshwater lobster seeds were kept in containers measuring 30x20x25cm with 5 seeds per container. During the rearing period, the lobster seeds were fed commercial feed twice a day, at 08.00 WIB and 18.00 WIB. Feeding was carried out using the satiation method, which is a feeding technique in accordance with consumption capacity or needs.

F Data Collection

Data collection was conducted to measure the growth in length and body weight of freshwater lobster larvae. The length of freshwater lobsters was measured using a ruler, while body weight was measured using digital scales. Five samples were taken every 10 days for each treatment repetition.

2.5 Research Parameters

a. Absolute Weight Growth

Absolute weight growth was measured using digital scales. Absolute growth was calculated using Effendie's (2002) formula as follows

$$W = Wt - Wo$$

Explanation:
W = Absolute weight gain (g)
Wt = Final average weight (g)
Wo = Average initial weight (g)

b. Absolute length growth

Absolute length growth can be calculated using the Effendie 2002 formula as follows:

$$P = Pt - Po$$

Explanation:
P = Absolute length growth (cm)
Pt = Seed length at the end of cultivation (cm)
Po = Seed length at the start of cultivation (cm)

c. Daily Growth Rate (*Specific Growth Rate*)

The daily weight growth rate is calculated using the formula according to Effendie (2002), namely:

$$LPH = \frac{Ln\ Wt - Ln\ Wo}{t} \times 100$$

Explanation:
LPH = Daily growth rate (%)
Wo = Average weight of fish at the start of the study (g/fish)
Wt = Average weight of fish at the end of the study (g/fish)
T = Duration of maintenance (days)

d. Survival Rate (SR)

The survival rate of the fry is calculated using Effendie's formula (2002) as follows

$$SR = \frac{Nt}{No} x100$$

Explanation:
SR = Survival Rate (%)
Nt = Number of seeds alive at the end of the experiment (tails)
No = Number of seeds alive at the start of the experiment (tails)

e. Water Quality Observation

Water quality monitoring includes temperature, dissolved oxygen (DO), and acidity level (pH). Water quality monitoring is conducted in the afternoon. Water quality monitoring is conducted once every 10 days during maintenance.

f. Data Analysis

The statistical test used in this study was ANOVA, which was used to determine the effect of treatment at a 95% confidence interval. If there was a significant difference ($P<0.05$), it was further tested using Duncan's test to find differences between treatments. The analysis was performed using SPSS (version 16.0).

3. Results and Discussion

3.1 Absolute Weight Growth

Based on the results of the study conducted on the duration of thyroxine hormone immersion on absolute weight growth in freshwater lobsters (*Cherax quadricarinatus*), the average weight growth can be seen in Table 1 as follows.

Table 1.
Average absolute weight growth of freshwater lobsters

Treatment	Initial Weight (g)	Final Weight (g)	Absolute Weight (g)
PHT0	0.40 ± 0.01	3.18 ± 0.02	2.78 ± 0.01[a]
PHT1	0.40 ± 0.01	3.24 ± 0.01	2.83 ± 0.00[b]
PHT2	0.41 ± 0.01	3.43 ± 0.02	3.01 ± 0.02[d]
PHT3	0.41 ± 0.00	3.33 ± 0.02	2.92 ± 0.02[c]

Note: Figures followed by the same letter are not significantly different at α = 0.05. The values shown are the mean and standard error.

Based on Table 1, the results of the analysis of variance (ANOVA) of the absolute weight of freshwater lobsters (*Cherax quadricarinatus*) show that the administration of thyroxine hormone with different immersion times has a significant effect (Fhit>Ftable). In the Duncan test, the absolute weight growth values in the treatment show significant differences between each treatment. In the highest thyroxine hormone immersion treatment, namely PHT2 (immersion time of 24 hours) with a value of 3.01 grams, PHT3 (immersion time of 36 hours) with a value of 2.92 grams, PHT1 (12 hours) with a value of 2.83, and the lowest treatment was PHT0 (control) with a value of 2.78 grams. To determine the average weight gain per 10 days based on the duration of thyroxine hormone immersion in freshwater lobsters, refer to Figure 1.

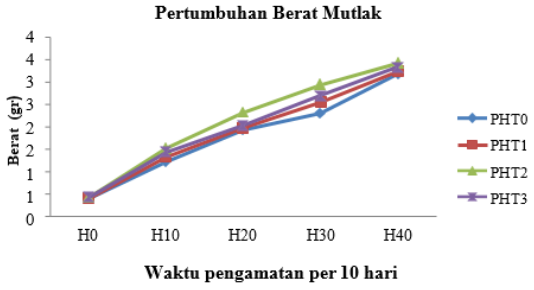

Figure 1. Average weight growth

Figure 1 shows that the average weight gain of freshwater lobsters during thyroxine hormone immersion produced the best treatment, namely PHT2 (24 hours), at 3.01 grams. This is due to an increase in the number of cells that affect the weight of lobsters. The proper use of thyroxine hormones will increase cell growth, which also affects the weight of the lobsters themselves. The duration of thyroxine hormone immersion in freshwater lobsters shows a different increase compared to those without treatment. This is because the thyroxine hormone given to freshwater lobsters works according to its function, which is to accelerate the metamorphosis process and increase cell growth by increasing protein retention or utilization in the body (Febriyanti *et al.*, 2015).

3.2 Absolute Length Growth

Based on the results of the study on freshwater lobsters (*Cherax quadricarinatus*) over 40 days of maintenance, the average results of absolute length growth observations are presented in Table 2 as follows.

Table 2.
Average absolute length growth of freshwater lobsters.

Treatment	Initial Length (cm)	Final Length (cm)	Absolute Length (cm)
PHT0	3.02 ± 0.02	5.09 ± 0.05	2.07 ± 0.06[a]
PHT1	3.05 ± 0.01	5.17 ± 0.04	2.11 ± 0.04[a]
PHT2	3.07 ± 0.02	5.38 ± 0.06	2.31 ± 0.07[b]
PHT3	3.07 ± 0.01	5.27 ± 0.06	2.23 ± 0.06[ab]

Note: Numbers followed by the same letter are not significantly different at α = 0.05. The values shown are the mean and standard error.

Based on Table 2, the results of the analysis of variance (ANOVA) of the absolute length of freshwater lobsters (*Cherax quadricarinatus*) show that the administration of thyroxine hormone with different immersion times had no significant effect (Fhit<Ftable). Duncan's test shows that PHT0 is not significantly different from PHT1 and PHT3, but is significantly different from PHT2. Meanwhile, PHT2 is not significantly different from PHT3 but is significantly different from PHT1 and PHT2. The highest absolute length growth was found in PHT2 (24 hours) with a value of 2.31 cm, followed by PHT3 (36 hours) with a value of 2.23 cm, followed by PHT1 (12 hours) with a value of 2.11 cm, and the lowest was in PHT0 (control) with a value of 2.07 cm. To determine the average weight growth per 10 days based on the duration of thyroxine hormone immersion in freshwater lobsters, see Figure 2.

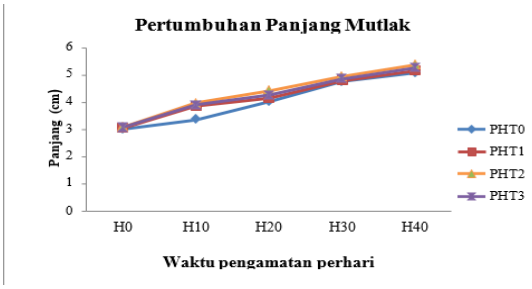

Figure 2. Average length growth

Figure 2 shows that the average growth in length of freshwater lobsters during thyroxine hormone immersion produced the best treatment, namely PHT2 (24 hours), at 2.31 cm. According to (Tinendung et al., 2022), thyroxine hormone functions to increase protein retention in the body. Thyroxine hormone can also cause more protein to be absorbed into the body than is excreted. This is supported by Hareadi *et al.* (2018), who found that thyroxine hormone can increase the metabolic rate. With an increase in the metabolic rate in the body, appetite will increase. The PHT0 treatment (control) had the lowest growth performance value, as there was no hormone immersion, thus no stimulation of growth performance. The 36-hour immersion in PHT3 showed a lower value than PHT2 because the amount of hormone absorbed into the body exceeded the limit, causing slow growth in fish. According to Hereadi *et al.* (2018), prolonged immersion in thyroxine hormone solution can cause the amount of hormone absorbed by the body to exceed normal physiological needs and reach a thyrotoxic state.

3.3 Daily Growth Rate (Specific Growth Rate)

Based on the results of the analysis of variance (ANOVA) study, the duration of thyroxine hormone immersion showed a significant effect on the daily growth rate (P<0.05), as shown in Appendix 3. The average results of the daily growth rate observations are presented in Table 3 as follows.

Table 3.
Average Daily Growth Rate of Freshwater Lobsters

Treatment	LPH (%)
PHT0	5.20 ± 0.04[a]
PHT1	5.21 ± 0.02[a]
PHT2	5.29 ± 0.04[b]
PHT3	5.24 ± 0.01[ab]

Note: Numbers followed by the same letter are not significantly different at α = 0.05. The values shown are the mean values and standard errors.

Based on Table 3, Duncan's test shows that PHT0 is not significantly different from PHT1 and PHT3, but is significantly different from PHT2. Meanwhile, PHT2 is not significantly different from PHT3 but is significantly different from PHT1 and PHT2. The highest average daily growth rate was found in PHT2 (24 hours) at 5.29%/day, and the lowest was in PHT0 (control) at 5.20%/day. The daily growth rate in this study had a significant effect because there were differences in the average growth rates between treatments. This was due to the addition of thyroxine at different doses, which increased the growth rate of freshwater lobster seeds.

In the PHT3 treatment, the immersion was carried out for 36 hours but showed a lower value than PHT2 with a 24-hour immersion because the prolonged use of thyroxine at too high a dose can damage cells in the body, resulting in death during maintenance and abnormalities in the lobster's body. Oktaviani *et al.*, (2017), stated that high thyroxine levels can cause cell formation and destruction rates to be almost equal, resulting in relatively low quantitative cell addition for growth. According to Setiadi *et al.* (2016), prolonged exposure to thyroxine hormones causes the amount of thyroxine absorbed by the body to exceed normal physiological needs (hyperthyroidism). In hyperthyroidism, the body's metabolism increases significantly (hypermetabolic), so it tends to remain thin, as if the body is metabolizing its own cells.

3.4 Survival Rate (SR)

Based on the research findings, the duration of thyroxine hormone immersion did not have a significant effect (P > 0.05) on the survival rate of freshwater lobsters (*Cherax quadricarinatus*). The survival rate can be seen in Table 4.

Table 4.
Average survival rate of freshwater lobsters during the study

Treatment	SR (%)
PHT0	80.0 ± 11.5[a]
PHT1	73.3 ± 11.5[a]
PHT2	80.0 ± 0.00[a]
PHT3	86.67± 11.5[a]

Based on the results of observations of the survival rate of freshwater lobsters (*Cherax quadricarinatus*), the best treatment was PHT3 (soaking for 36 hours) and the lowest was PHT1 (soaking for 12 hours) at 73.3%. The survival rate results during maintenance obtained from the Duncan test showed no significant difference between all treatments. The duration of thyroxine hormone immersion can affect the survival rate of freshwater lobster seeds. It is suspected that differences in the dosage given to lobster seeds may cause negative effects and abnormalities in the lobster's body, which can lead to death. Purwati, *et al.*, (2004) stated that too high a dosage causes the metabolic rate in the body to run too fast, resulting in mortality in the organism. Survival rates are influenced by biotic and abiotic factors (Effendi, 2003). Biotic factors that affect the survival rate of freshwater lobsters include parasites and diseases, while abiotic factors include water, temperature, oxygen, and pH.

3.5 Water Quality

Water quality is a key factor that must be considered. To maintain water quality, siphoning and water changes of 10–15% of the tank volume are performed. The results of water quality parameter observations in a long-term study on the effects of thyroxine immersion on the growth rate of freshwater lobsters (*Cherax quadricarinatus*) over 40 days of cultivation are shown in Table 6 below.

Table 6.
Range of water quality in the rearing medium

Parameter	Water Quality				
	PHT0	PHT1	PHT2	PHT3	Quality Standard
Temperature ℃	24.2–25	24.2–25.1	24.1–25	24.2–25	24–30℃(Setiawan, 2006)
DO (mg/l)	4.5–4.6	4.7–4.8	4.6–4.7	4.8–4.9	2–4 mg/l (Bachtiar, 2012)
pH	7.15–7.17	7.17–7.18	7.18–7.21	7.19–7.21	6–8 (Salamin, 2005)

Based on Table 6, the water quality results show that the temperature ranges from 24.2– The water quality obtained during the study is still within the optimum range for freshwater lobster farming (Iskandar, 2019). Furthermore, Setiawan (2006) states that the ideal temperature for freshwater lobster cultivation is 24-31oC. Temperatures below or above this range are very dangerous for freshwater lobsters.Furthermore, the water quality value for oxygen use is 4.5-4.9 mg/l. The dissolved oxygen content during this study was sufficient for the growth of Cherax, ranging from 2-4 mg/l (Bachtiar, 2012). In general, the results of the study show that the oxygen concentration in the cultivation medium is still adequate and can support the life of lobsters. Additionally, an increase in lobster numbers accompanied by higher density did not affect oxygen consumption levels. During the study, water pH during maintenance ranged from 7.17 to 7.21, which is still suitable for lobster maintenance. For freshwater lobster maintenance, the ideal pH is 6-8 (Salamin, 2005).

4. Conclusion

Based on the research conducted, it can be concluded that different lengths of thyroxine hormone immersion in freshwater lobsters (*Cherax quadricarinatus*) have a significant effect on absolute weight gain (AWG) and daily growth rate (DGR). However, it does not have a significant effect on absolute length growth (ALG), survival rate, and growth of freshwater lobsters (*Cherax quadricarinatus)*. The optimal thyroxine hormone immersion time for the growth of freshwater lobsters (*Cherax quadricarinatus)* is 24 hours (PHT2), while the lowest effect is observed in the PHT0 treatment (control).

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