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Growth Response and Post Larva Performance of Tiger Shrimp to the Use of Artemia Instars

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A B S T R A C T

Nutritional needs in hatcheries are very important to support the growth and health of larvae. This study aims to determine the growth response and performance of tiger shrimp post larvae given artemia instars that have a yolk sacand artemia that do not have a yolk sac. The test animals used were stadia Pl-1 of tiger shrimp post larvae, rearing containers of fiber tanks, volume of 1,000 liters, 12 units, stocking density of 30 individuals/liter. Using a completely randomized design with 3 treatments and 4 replications, namely (A) the use of instar artemia which still hada yolk sac, (B) artemia which did not have a yolk sac and (C) 50% of treatment A and 50% of treatment B respectively. The results of this study were weight growth in treatment A 0.00258 g and treatment B 0.00232 g and treatment C 0.002280. The relative growth rate in treatment A was 45.4%, B 40.0% and C 39.2%. Survival rates ranged from 67.4%-62.2% and there was no significant difference. Morphological score values ranged from 91.8-89.0. Vitality performance of post larvae through immersion test in 200 ppm formalin for 30 minutes which treatment A 78.67%, B 73.33% and C 75.33% while through freshwater immersion test for 15 minutes that treatment A 23%, B 13.33% and C 20.0%. In conclusion, the relative growth rate of post larvae of tiger shrimp given artemia which has a yolk sac(A) is better (13.5%) than artemia which does not have a yolk sac(B) or from a combination of both (C) which is 16.0%. The survival rate of treatment A was better (7.6%) than treatment B and (3.7%) of treatment C. Morphological performance was not significantly different between treatments A, B and C. Vitality performance with the formalin test was relatively similar and not significantly different, but through freshwater immersion treatment A was much better (120%) and significantly different than treatment B, and better (47.7%) than treatment C.

Introduction

One of the reasons for the decline in shrimp production is post larvae quality, this condition is partly due to insufficient supply of natural feed, both in terms of quantity and quality (Gustrifandi, 2011). The same opinion was conveyed by (Yustianti *et al.*, 2013), the biggest component that determines success in cultivation is the feed factor itself. According to (Chanratchakool *et al.*, 2005), growth, larval survival depend on the quality and quantity of food. Quality shrimp feed contains protein, fat, carbohydrates, as well as vitamins and minerals. Feed with a high nutritional content will increase the resistance of the shrimp so that survival rates and high harvest productivity are also obtained (Puput *et al.*, 2014).

Adequate feeding and in accordance with nutritional needs is needed to support the growth of post larvae shrimp. Nutrients are used by shrimp as a source of energy for growth (Nuhman, 2009). The use of feed determines the production quality of tiger shrimp larvae such as the use of natural feed types *Chaetoceros* sp, *Skeletonema sp*. *Branchionus* sp. Instar I *Artemia* sp. has an influence on the development and survival rate of tiger shrimp larvae. *Artemia* sp. is one of the good natural food used for shrimp larvae (Hasyim, 2002.). *Artemia* sp. has a high nutritional content that is needed by shrimp such as protein as much as 52.7%, carbohydrates 15.4%, fat 4.8%, water 10.3%, ash 11.2%, EPA 0, 27% -0.39% (Suprayudi, 2002). The protein content of nauplius *Artemia*spthat is 42% (Yuniarso, 2006). The nutrients that function as a source of energy in the body are carbohydrates, fats and proteins. Protein together with minerals and water forms cells in the body while the balance of acid-base regulation, osmotic pressure, fluids in the body of fish metabolism occurs because of the cooperation between proteins, minerals and vitamins (Fujaya, 2004).

Based on their eating habits, shrimp larvae in mysis and post larval stages prefer live food such as zooplankton, namely nauplius *Artemia* sp. because apart from the high nutrient content, *Artemia* sp. easily digested by shrimp larvae (Gustrifandi, 2011). *Artemia sp*. is a natural feed that is widely used in shrimp seed hatcheries because *Artemia* sp. contain lots of nutrients, especially protein and amino acids (Mintarso, 2007). Feeding regimes applied to tiger shrimp (*Penaeus monodon)* larvae hatcheries in Indonesia generally use *Skeletonema* sp., *Artemia* sp. feed and artificial feed. *Skeletonema* sp. given at naupli-5 or naupli-6 (N-5 or N-6) to mysis-3 (M-3) stages, and *Artemia* sp. given to M-3 to the postlarvae (PL) stage, while artificial feed was given from the start of rearing, namely from the zoea stage to the postlarvae stage. Provision of quality feed in sufficient quantities will reduce the percentage of dead larvae. Feeding regimes of tiger prawn larvae were given *Artemia* sp. at Mysis 3 to PL-12 stages (Nofiyanti *et al.*, 2014).

Cysts *of Artemia* sp. will hatch within 24 - 36 hours, *Artemia* sp. The newly hatched ones are called nauplii. During its growth, nauplii undergoes 15 shape changes, each change is a level called an instar (Pitoyo, 2004). The first larval phase (Instar I) measures 400-500 microns and is brown-orange in color indicating that in this phase the nauplii still use the *yolk sac* as a food reserve. As the age of *Artemia* sp. *Yolk sac* will run out and the size will also get bigger. About 24 hours after hatching, first instar nauplius will change to second instar (Mudjiman, 1989). Nauplii *Artemia* sp. already need nutrition from the outside because their digestive system is already working properly.

Composisition nutrition between Nauplius Artemia sp and adult artemia is very different (Toi *et al.*, 2013). Instar I of *Artemia* sp has proteolic enzymes which really help the digestive process so that it is easier for the larvae to digest feed because it has a thin exoskeleton layer (Ghufran, 2006). Apart from having high protein, *Artemia* sp also contains carotenoids. The carotenoid content *of Artemia* sp which was not enriched was 1.535 ppm while that which was enriched with 10 ppm β-Carotene for 8 hours had a carotenoid content of 8.812 ppm (Ernawati *et al.*, 2020).

Carotenoids in *the yolk sac* are transferred gradually into the embryo until it grows. Subsequent developments, the amount of carotenoid content decreases gradually until *the yolk sac* runs out (Kitahara, 1983). Carotenoids in fish have a physiological function as an antioxidative which provides protection against damage caused by free radicals and enhances immunity against pathogens through increased production of antibodies or the development of immune cells (Peters Anne, 2007). Carotenoids also play a role in respiration when organisms lack oxygen and as provitamin A which functions in vision and growth (De la Fuente *et al.*, 2006).

So it is suspected that the use of *Artemia* sp which still has egg yolk has a better nutritional content for tiger prawn post larvae and has an influence on the development and growth and quality of tiger prawn post larvae. For this reason, this study will examine the growth response and quality of post larvae of tiger prawns fed *Artemia* sp. which still have *a yolk sac* and *Artemia* sp. which do not have *a yolk sac* and a combination of both.

Materials and Methods

Culture and observation and analysis of artemia content

The research activity began with evaluating the nutritional content of artemia that still had *a yolk sac* and those that did not have *a yolk sac* and the time it took from the start of the culture to hatching and how long after hatching the *yolk sac* was used up. The *Artemia* hatching tanks used are fiber tubs with a conical shape of 250 L in volume. Each tub is equipped with aeration to supply oxygen and as a stirring process so that the artemia cysts are evenly distributed in the water. Before being cultured, artemia cysts were decapsulated according to standard instructions for the artemia decapsulation method. To find out if artemia has hatched, a random sample was taken. Sampling was 1 ml and taken 3 times. Counting the number of artemia cysts that hatch using a hand counter and morphological observations with a microscope. Hatching time was determined from the time it was cultured until it hatched. Observation of the first instar phase or until *the yolk sac* is used up is done periodically every hour.

Analysis of nutritional content was taken in two phases, namely the first phase of artemia which still has *a yolk sac* (instar I phase) and the phase after *the yolk sac* is used up. Each artemia sample was dried and its proximate analysis (protein, fat, carbohydrates) and analysis of carotenoid content were carried out. Artemia hatching was obtained from the hatching effectiveness value of artemia cysts. Calculation of the number and age of first instar nauplius artemia that had hatched at the start of cyst hatching during the incubation period of 12, 14, 16, 18, 20 and 24 hours.

The hatching time obtained is used as a reference to set the culture time for artemia cysts which will be used in testing post larvae. About 24 hours after hatching, first instar nauplius will change to second instar (Mudjiman, 1989). The number of samples *of Artemia* sp. For proximate analysis, each sample of *Artemia* sp *is taken* as much as 900 g of gross weightwhich has *a yolk sac* and which does not have *a yolk sac.*

The research used post larvae of tiger prawns stage PL1. Tiger prawn larvae were obtained from the production of the Maros BRPBAP3 hatchery located at IPUW Barru. Feeding other than artemia uses artificial feed, namely commercial feed types of frippak and lanzy. The research vessel used was a round fiber tub with a diameter of 110 cm and a height of 120 cm with a capacity of 1,000 liters of water, consisting of 12 pieces. There are 6 pieces of *Artemia sp m1,000-liter* hatching tubs in the shape of a cone with a volume of 250 liters. The aeration installation is used to supply oxygen to the larval rearing tanks and hatching tanks *of Artemia* sp. The seawater used has a salinity of around 30-33 ppt, has been treated using 90% TCCA chlorine at a dose of 12.5 ppm and has been neutralized using 6 ppm of sodium thiosulfate.

The use of equipment for measuring weight and observing the development of post larvae as well as observing morphology used an Olympus BX-40 microscope equipped with a camera, monitor and measuring application system with an accuracy of 1 µm. The tool for sampling weight growth uses an electric scale with an accuracy level of 0.00 g.

Water quality measurements for the parameters of temperature, salinity, pH and dissolved oxygen will be used by the JALA-Baruno DO meter which has four measurement parameters.

Experimental design

The experimental design used was a completely randomized design (CRD). This research will use 3 treatments and each treatment will be repeated 4 times. The treatment to be used is as follows:

The use of artificial feed and *Artemia* sp. which have *a yolk sac*

The use of artificial feed and *Artemia* sp. Which do not have *a yolk sac*

The use of artificial feed and a combination of 50% *Artemia* sp. which have *a yolk sac* and 50% *Artemia* sp. which do not have *a yolk sac*

Parameters observed were relative growth rate, post-larval survival rate of tiger prawns, and diversity through morphology tests and resistance through vitality tests (Haryanti *et al.*, 2005).

Relative growth rate (RGR)

The relative growth ratecan be calculated using the following formula (Takeuchi *et al.*, 1983):

$$RGR = \frac{W_t - W_0}{W_0 \times t} \times 100\%$$

Where:

RGR = Relative Growth Rate (%)

W_t = Average weight of fish at the end of the study (g)

W_0 = Average weight of fish at the beginning of the study (g)

t = Maintenance time (days)

Survival Rate

The survival rate isthe value in percent of the number of shrimp that can survive until the harvest, which can be calculated using the following formula (Budiardi, 2008):

$$SR = \frac{N_t}{N_0} \times 100\%$$

Where:

SR = Survival (%)

N_t = Number of fish at the end of the study (individu)

N_0 = Number of fish at the begining of the study (individu)

Observation of morphology and vitality test

Observation of morphology and vitality test of tiger shrimp post larvaecarried out at PL-12, observation method and vitality testproposes to the scoring method developed by (Haryanti *et al.*, 2005). Morphological tests were carried out to see the expression of various levels of health and quality of post larvae shrimp. Vitality test was carried out to assess the level of vitality and resistance of post larvae shrimp. Observation of morphology using a microscope, while the morphological parameters observed were; *Antenulla, Hepatopancreas, Intestines, Midgut, Uropoda, Tail muscel, Chromatophora,* attachment of the parasites and *stress*. The observation method is by looking at each morphology whether the condition is normal or not.

The morphology of normal conditions will be given a positive mark, and abnormal conditions will be given a negative sign and then scored according to their respective weights. The number of samples observed for morphology was 10 for each replicates. The weight of each morphological parameter is presented in Table 1.

Vitality test was carried out physically and chemically. Physically it was carried out by testing fresh water media for 15 minutes, the number of post larvae tested was 30 individuals for each replication.

Then observed and calculated how many expressions are normal and stressed or dead. Chemical vitality test by immersionformalin 200 ppm for 30 minutes, then observed and calculated the expression of post larvae shrimp that were still normal, stressed or dead. The number of samples tested was 30 individuals for each replication.

Preparation of rearing tanks and preparation of test animals

The preparation of the tubs used for rearing post larvae and artemia hatching tubs begins with cleaning with a detergent and chlorine concentration of 100 ppm and rinsing using fresh water and then drying for 2 days. The tub is filled with seawater of 33 ppt salinity which has been sterilized using 12.5 ppm 90% TCCA chlorine and neutralized using 6 ppm sodium thio sulfate, then the water is filtered using a filter membrane equipped with ultraviolet. Each tub is equipped with 1 point of aeration to supply oxygen needs.

Before the test animals were stocked, a sample of the test animals was first carried out to determine the stocking density of the ponds and at the same time measure the length and initial weight. Length measurement using a microscope. The shrimp weight sampling will be used with an electric scale. The results of the sampling data will be used as the initial data. The number of samples measured to determine the average size of the length is 10 individu of post larvae and a weight of 300 individu of post larvae which are considered to represent the test animals to be used.

Spreading post larvae and feeding

Spreading of the test animals into rearing tanks containing 1,000 liters of water, with a stocking density of 30 individuals per liter or 30,000 individuals per tank so that the total number of test animals used was 360,000. Prior to stocking, acclimatization to temperature and salinity is carried out first so that the post larvae do not stress

Feeding in maintenance used two types of feed, namely artificial feed and natural feed. The dose of artificial feeding given is 1 mg/liter for PL-1 to PL-3 stages, 1.5 mg/liter for PL-4 to PL-6 stages and 2 mg/liter for PL-7 to PL-12 stages. The frequency of artificial feeding will be carried out 5 times per day, namely at 05:00, 08:00, 11:00, 16:00 and 21:00.

Natural food for *Artemia* sp is given 1 time per day, namely in the morning at 09:00. The dose of *Artemia* sp given to PL-1 to PL-3 stages was given 15 individuals/post larvae, PL-4 to PL-6 stages were given 20 individuals/post larvae, PL-7 to PL-9 stages were given 25 individuals/post larvae and at PL-10 to PL-12 stages, 30 individuals/post larvae were given. The post larval stage was fed *Artemia* sp around 15-30 individuals/head of post larvae shrimp up to PL-12 (Djunaidah, 1988).

Sampling growth and observation of post larval development

Weight growth sampling was carried out at PL-1, PL-6 and P-12 stages. The number of samples was 100individu/times with carried out three times or 300 for each treatment. The post larvae samples taken were samples from other replicates that were treated in the same way in each treatment, so as not to reduce the population size of each replicate. The sampling method for observing the development of post larvae was using an Olympus BX-40 microscope equipped with a camera and monitor as

well as measuring applications with a scale of 1 µm. While the sampling method for weight growth is using an electric scale with an accuracy of 0.00 g.

The post-larval sample was first filtered using a post-larval filter, and then the post-larvae was stored on filter paper with the aim that the water in the sample could be absorbed by the filter paper and then weighed.

Calculation of the passing rate of life

The calculation of the survival rate of tiger prawn post larvae was carried out at the end of the study, when the post larvae reached PL-12 stage. The way to calculate the number of post larvae in the rearing tank is by harvesting the post larvae as a whole, starting with removing the water in the rearing tank and then placing the PL-12 in a basin with a volume of 40 liters until the water in the rearing tank runs out. Post larvae were counted manually using plastic cups.

Water quality measurement

As supporting data, water quality measurements will be carried out consisting of parameters of dissolved oxygen (DO), temperature, salinity, pH, nitrite, nitrate, ammonia and total organic matter. Measurements of DO, temperature, salinity and pH parameters were carried out twice a day, namely at 06:00-07:00 and 16:00-17:00.

While the parameters of nitrate, nitrite, ammonia and total organic matter were carried out at the beginning (day 1), mid (day 6) and end of maintenance at PL-12 stage (day 12).

Data Analysis

Data on relative growth rate (RGR), survival (SR), scoring of morphological observations and vitality tests were analyzed using a test of variance to determine the effect of the treatments being tested. Further tests were carried out using the BNJ test if there were differences in treatments.

Results and Discussion

Culture and observation and analysis of artemia content

The results of measuring the water quality parameters in the hatchery tank are to see fluctuations in several parameters including salinity, temperature, pH and DO. The hatchery used 3 fiber tubs with a capacity of 200 liters of water. Observations were made for 24 hours with measurement intervals every 4 hours. The data on the results of water quality measurements for artemia hatcheries are presented in Figure 1.

Based on the results dats, it shows that the salinity data for the artemia hatcheries is in the range of 31.0 ppt to 31.8 ppt. This figure does not show high fluctuations and is still in the optimal range for artemia hatching. Artemia will hatch in the salinity range of 5-70 ppt. the temperature parameter fluctuated in the range of 28.0-33.6 ^{o} C (Sorgeloos, 1980). The lowest temperature value occurred at 08:00 and the highest at 16:00. The temperature parameter value is still in the optimum temperature range for *Artemia* sp. The pH and dissolved oxygen parameters did not show high fluctuations where the range of pH parameter values was lowest at 20:00, namely 7.2 and highest at 08:00, namely 8.22. While the dissolved oxygen content with the lowest range value at 20:00 was 5.02 ppm and the highest at 08:00 was 6.1 ppm.

Observation of artemia during culture to determine the time needed to hatch as well as measurement of the length and observation of *the yolk sac of Artemia* sp. carried out every 4 hours, from the time of hatching until the age of 28 hours as shown in Figure 2.

The results of measurements and observations of the development of the artemia *yolk sac* showed that the newly hatched ones were marked when releasing the shell measuring 336.0 µm in length with a dense yolk sac condition. Observations at the age of the next 4 hours had a length of 420.8 µm with the

condition ofthe yolk sacbeing still quite dense. Observations up to 24 hours of age increased in length and the condition of the yolk sac began to thin. After 28 hours, the yolk sac content is very thin and has started to run out. About 24 hours after hatching, first instar nauplius will change to second instar (Mudjiman, 1989). Analysis of proximate samples of *Artemia* sp which had a yolk sacand those without *a* yolk sacwas carried out in the Maros BRPBAP3 laboratory and analysis of carotenoid content was carried out in the PT. Saraswanti Indo Genetech Bogor. The data from the proximate analysis is in Table.2 and the data from the carotenoid analysis is in Table.3

The results of proximate analysis of *Artemia* sp. which have a yolk sac, especially fat content and content, are much higher compared to *Artemia* sp. which do not have a yolk sac. This shows that the content of the yolk sacgreatly determines the size of the protein content and fat content.

The results of the analysis of carotenoid content showed that the artemia that had a yolk sac was higher than the artemia that did not have a yolk sac. One source of fairly high carotenoid content comes from the yolk sac. The content of carotenoids is needed in shrimp feed, one of the goals is to increase immunity. Carotenoids are primarily needed to increase pigmentation and survival of fish or shrimp (Zainuri *et al.,* 2003; Kusumaningrum *et al.,* 2004; Zainuri *et al.,* 2008a; Zainuri *et al.,* 2008b; Zainuri *et al.,* 2008c).

Postlarval growth

Growth of tiger prawns post larva from early rearing (PL-1), mid rearing (PL-6) and end of rearing (PL-12) are presented in Figure 3.

The highest average weight growth was obtained in treatment A using *Artemia* sp. which had *a yolk sac* of 0.00258 g from an average initial weight of 0.0004 g and the lowest was in treatment C (a combination of 50% treatment A and 50% treatment B) namely 0.00228 g. Treatment B using *Artemia* sp. which did not have *a yolk sac* obtained a growth of 0.00232 g/head, relatively almost the same as treatment C.

This is presumably because the high protein content of the feed is still fulfilled for the growth of post larvae shrimp. Which states that shrimp in the post-postlarva stage need protein in the feed ranging from 30-55% to support growth (Yustianti *et al.,* 2013). Based on the results of the proximate analysis, the protein content of artemia with *a yolk sac* of 45.94% and those without *a yolk sac* of 40.26%.

Relative growth rate

The relative growth rate based on the results of weight measurements until the end of maintenance at PL-12 stage is presented in Figure 4.

The results showed that in treatment A, the highest relative growth rate was 45.4% and the lowest was in treatment C 39.2%, while treatment B was not much different from treatment C, namely 40.0%. These results show the effect of differences in the nutritional quality of the feed given, especially the protein content and fat content between artemia that have a yolk sac and those that do not have a yolk sac. larval growth depends on the quality of the food (Chanratchakool *et al.,* 2005). Based on the results of the proximate analysis, the protein content of artemia with a yolk sacand those without a yolk sac were 45.94% and 40.26%, respectively. Fat content with a much different content respectively 25.15% and 6.44%. Fat is needed for growth, because fat has a high energy source value that can be used for activities such as swimming, foraging, avoiding enemies, growth, and body resistance.

According to Gufran (2006), several nutritional components that are important and must be available in shrimp feed include protein, fat, carbohydrates, vitamins and minerals (Gufran, 2006). Protein an important role for growth (Watanabe, 1988). The more protein that can be retained in the body and the less protein that is catabolized into energy, the greater the growth value (Heptarina *et al.,* 2010).

Survival rate (SR)

The survival rate is a comparative value between the initial number of organisms at the time of stocking which is expressed in percent form where the greater the percentage value indicates the more organisms that live during rearing (Effendi, 2002). Survival data of tiger prawns post larval obtained are presented in Fig. 5

Results showed that the survival rate in treatment A which was given *Artemia* sp. which has the highest yolk sac which is equal to 67.4% then followed by treatment C (a combination of 50% treatment A and 50% treatment B) that is equal to 65.0%. Whereas in treatment B the lowest survival rate was 62.6%. This shows that the administration of *Artemia* sp. which has a yolk sac has an influence on the survival rate of tiger prawn post larvae because besides having a better protein content it also has a fairly high carotenoid content, namely 352.34 mg/kg compared to *Artemia*sp. those who do not have a yolk sac only 221.32 mg/kg. Carotenoids are primarily needed to increase pigmentation and survival of fish or shrimp (Zainuri *et al.,* 2003). Feed with a high nutritional content will increase the resistance of the shrimp so that a high survival rate is obtained (Puput *et al.*, 2014). In addition, the quality of the environment, especially the culture water media, will also affect the survival rate because it will support the metabolic processes of the shrimp being reared. The survival data obtained by all treatments was quite good, this is presumably because the water quality for maintaining several parameters was relatively in the optimum range. Stated that the factors that most influenced the survival rate of postlarvae shrimp were water quality in the rearing medium and feed quality.

Observation of morphology and vitality test

The number of post larval samples used for morphological observations was 10 individuals and for the vitality test as many as 30 individuals for each replication. The scoring data for morphological values can be seen in Table 4. While the vitality test data by immersing in fresh water for 15 minutes and immersing in 200 ppm formalin for 30 minutes in Table 4. The results of morphological observations showed that in treatment A the use of *Artemia* sp. which had the highest yolk sac with a value of 91.3 but relatively not much different from treatment B using *Artemia* sp. who did not have a yolk sacand in treatment C a combination of 50% treatment A and 50% treatment B, namely 89.0 and 91.4 respectively. These results indicate that the morphological quality of post larvae is relatively not significantly different because environmental conditions and water quality parameters are also relatively the same. The results of immersion using fresh water showed the highest stress response in treatment B using *Artemia* sp. which did not have a yolk sac with a value of 86.67% and the lowest was in treatment A using *Artemia* sp. which have a yolk sac with a value of 70.67%. While the combination of 50% treatment A and 50% treatment B gave a stress response of 80.67%. Soaking in 200 ppm formalin for 30 minutes showed the highest total stress response in treatment B, which was 26.67% and the lowest in treatment A, was 21.33%. This is presumably due to the effect of differences in the feed content of *Artemia* sp. consumed by post larvae, especially the carotenoid content. Based on data from laboratory analysis, the carotene content of *Artemia* sp, which has a yolk sac, is higher than *Artemia* sp, which does not have a yolk sac, namely 352.34 mg/kg and 221.32 mg/kg, respectively. *Artemia* sp. has high protein and carotenoid content, the carotenoid content of *Artemia*sp which was not enriched was 1.535 ppm while that which was enriched with 10 ppm β-carotene for 8 hours had a carotenoid content of 8.812 ppm (Ernawati *et al.*, 2020). Carotenoids in fish have a physiological function as an antioxidative which provides protection against damage caused by free radicals and enhances immunity against pathogens through increased production of antibodies or the development of immune cells (Peters Anne, 2007). Carotenoids also play a role in respiration when organisms lack oxygen and as provitamin A which functions in vision and growth (De la Fuente *et al.*, 2006).

Table.1 Weight Assessment of post larval shrimp morphological parameters

S.No	Parameter	Weight (%)
1.	*Antennulla*	5
2.	*Hepatopancreas*	20
3.	*Midgut*	15
4.	*Intestine*	10
5.	*Uropoda*	5
6.	*Tail muscel*	10
7.	*Chromatophore*	5
8.	*Attachment*	15
9.	*Stress*	15
	Amount	100

Table.2 Proximate Analysis of *Artemia* sp. those with a yolk sacand those without a yolk sac

Artemia type	Parameter				
	Ash Content	Water content	Fat level	Protein Content	Coarse Fiber
Artemia* sp. those with *a yolk sac	17,18	11.23	25,15	45.94	4.68
Artemia* sp. who do not have *a yolk sac	39.05	1.63	6,44	40,26	5.70

Table.3 Analysis of the carotenoid content *of Artemia* sp. those with a yolk sacand those without a yolk sac

Artemia type	Parameter	units	Results	Limit of Detection	method
Artemia* sp. those with *a yolk sac	carotene	mg/kg	352,34	-	18-9-16/MU/SMM-SIG (spectrophotometry)
Artemia* sp. who do not have *a yolk sac	carotene	mg/kg	221.32	-	18-9-16/MU/SMM-SIG (spectrophotometry)

Table.4 Morphological values of PL-12 tiger prawn post larvae

Morphological parameters	Treatment		
	A (*Artemia*sp. has *a* yolk sac*)*	B (*Artemia*sp. does not have ayolk sac)	C (Combination of 50% A and 50% B)
Antennulla	4,3	4,5	4,5
Hepatopancreas	19.5	20.0	20.0
Midgut	13.5	11,6	12,8
Intestine	5,3	3,3	4.0
Uropoda	4,8	5.0	5.0
Tail muscel	9,5	10.0	10.0
Chromatophore	5.0	5.0	5.0
Attachment	15.0	15.0	15.0
Stress	15.0	14,6	15.0
Amount	**91.8**	**89.0**	**91.4**

Table.5 Vitality test of tiger shrimp post larvae by immersion in fresh water for 15 minutes and 200 ppm formalin for 30 minutes.

Treatment	Amount (tail)	Fresh water immersion 15 minutes		Soak in 200 ppm formalin for 30 minutes	
		Postlarval response		Postlarval response	
		Normal (%)	Stress (%)	Normal (%)	Stress (%)
A (*Artemia*sp. has a yolk sac)	30	29.33±7.96	70.67±7.96	78.67±3.80	21.33±3.80
B (*Artemia*sp. does not have a yolk sac)	30	13.33±4.08	86.67±4.08	73.33±7.45	26.67±7.45
C (Combination of 50% A and 50% B	30	20.00±7.45	80.00±7.45	75.33±10.17	24.67±10.17

Fig.1 Data of Water quality for artemia hatcheries

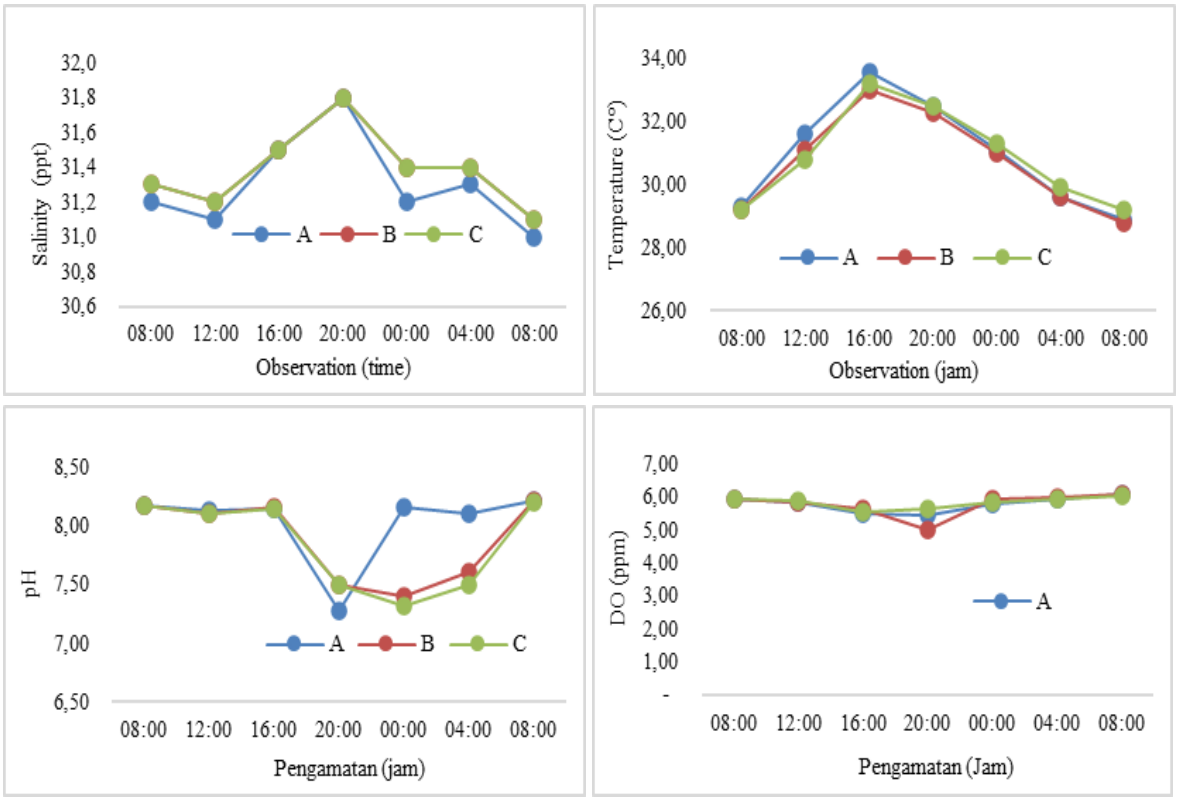


Fig.2 Length and condition of *the Artemia* sp yolk sac from hatching to 28 hours of age.

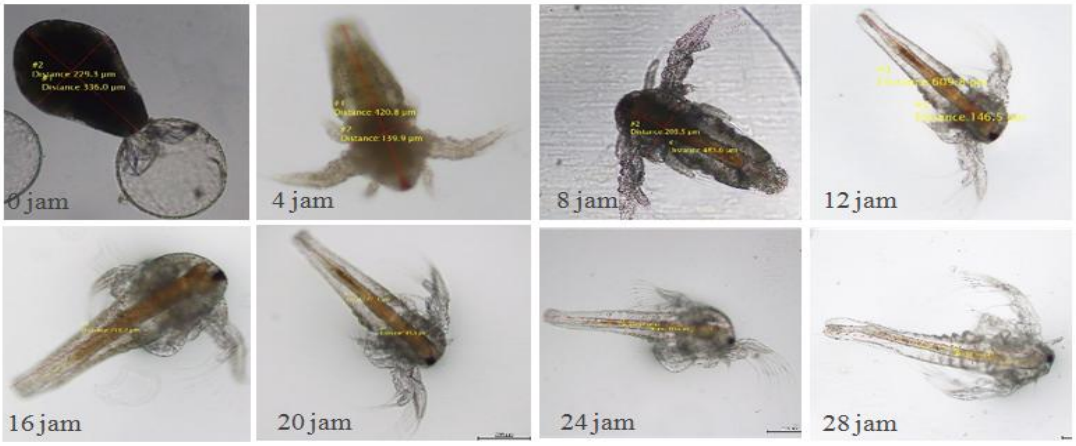


Fig.3 Growth of tiger prawn post larvae PL-1 to PL-12

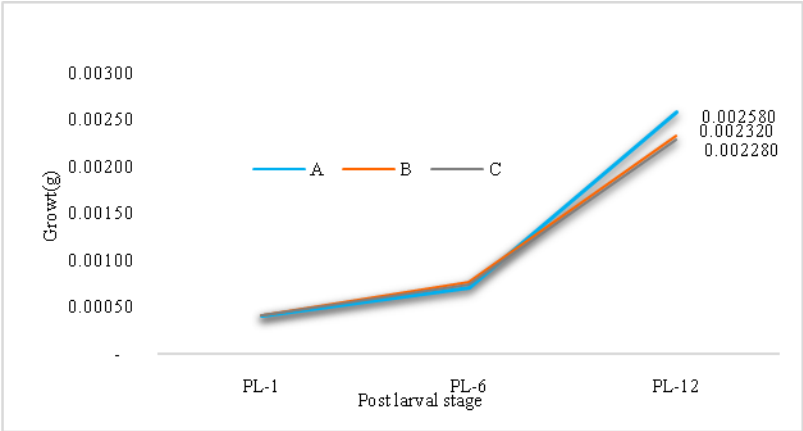


Fig.4 Relative growth rate (weight) of PL-12 tiger prawn post larvae.

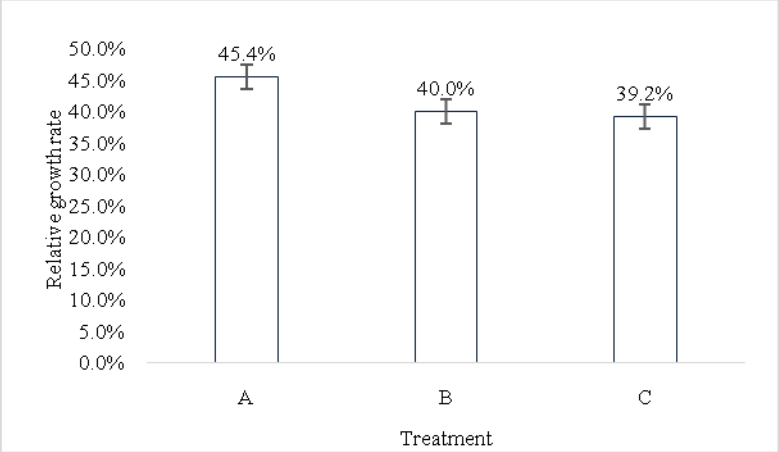


Fig.5 Survival rate of tiger prawn post larvae PL-1 to PL-12.

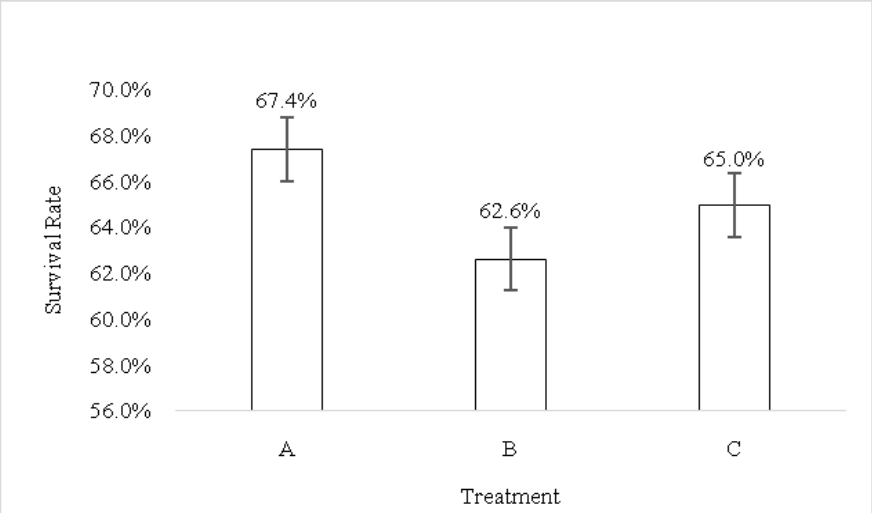


Fig.6 Water quality measurements for temperature, salinity, pH and dissolved oxygen parameters

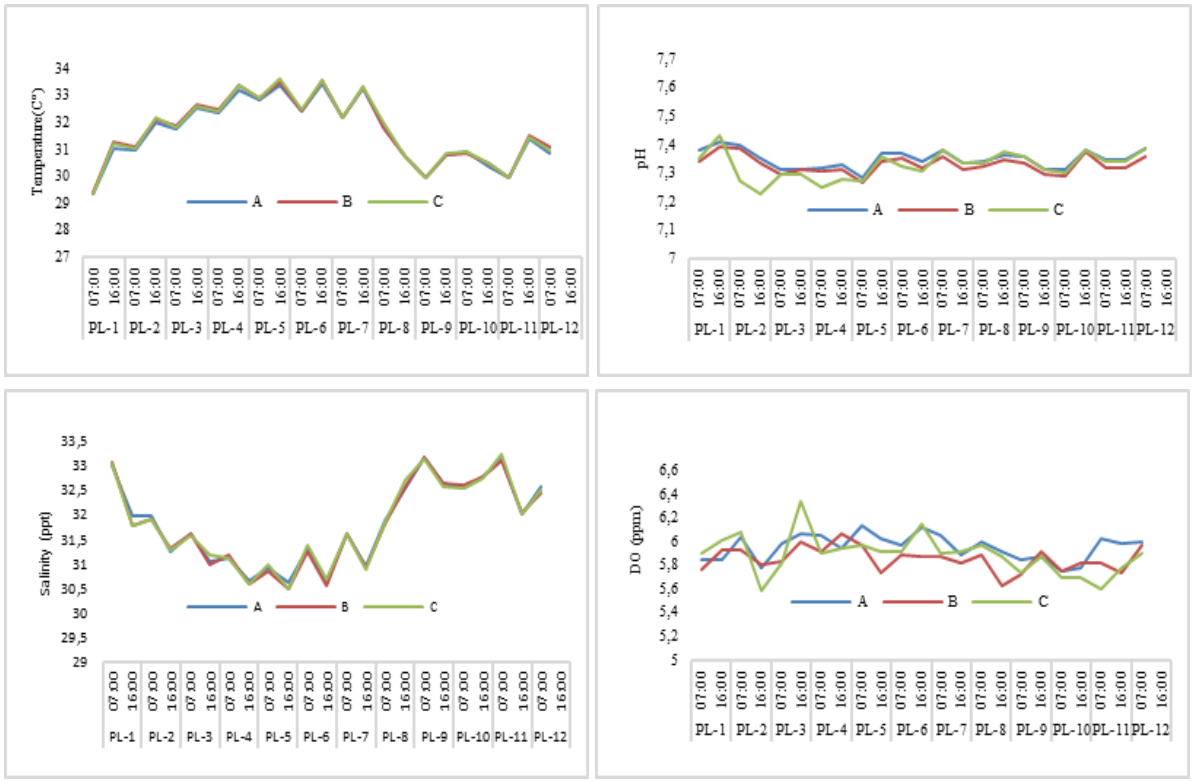
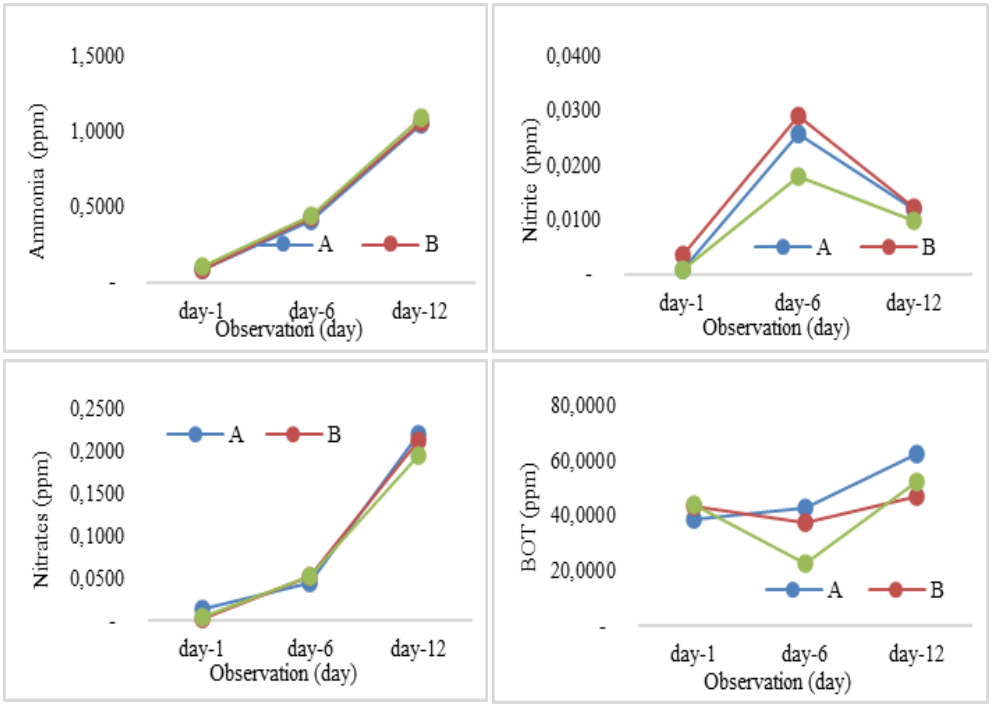


Fig.7 Results of water quality measurements for the parameters ammonia, nitrite, nitrate and BOT



Water quality

The results of water quality measurements for temperature, pH, salinity and dissolved oxygen are presented in Figure 6 and the parameters of ammonia, nitrite, nitrate and dissolved organic matter in Figure 7.

In the research, the water quality is an important supporting data. Good rearing media environmental conditions can support the survival of shrimp and reduce stress conditions that allow death during rearing. Based on data from temperature parameter measurements, all treatments showed a range between 29.1 $^{\circ}$C – 33.8 $^{\circ}$C. Daily fluctuations in the morning and evening were relatively low and the treatments were relatively similar. The salinity parameter was in the range of 30.4 ppt-33.6 ppt, the highest at the start of rearing, namely at PL-1 stage. This condition is very dependent on the salinity level of the available water in the initial reservoir of water filling. The fluctuations in daily salinity changes are caused by water changes that are carried out every two days. The pH parameter shows a range of 6.87-7.44 and daily fluctuations are relatively low. Dissolved oxygen parameters are in the range of 5.15 ppt-6.50. Dissolved oxygen content and daily fluctuations were relatively similar between treatments. Water quality parameters including temperature, salinity, pH and DO are still in the optimum range for rearing tiger prawn larvae.

The growth response of tiger prawn post larvae given artemia which had a yolk sac(treatment A) was better (13.5%) than artemia which did not havea yolk sac(treatment B) or from a combination of both (treatment C) which was 16.0%. The survival rate of treatment A was better (7.6%) than treatment B (7.6%) and (3.7%) of treatment C. The morphological performance was relatively almost the same between treatments A, B and C with their respective scores. respectively 91.8 and 89.0 as well as 91.4. Vitality performance with the formalin test, normal post larvae were almost the same, respectively 78.67%, 73.33% and 75.33%. Vitality performance with freshwater immersion in treatment A was much better (120%) than treatment B and (47%) from treatment C.

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