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# The effect of dissolved glucose on survival rate and performance of swimming crab larvae *Portunus pelagicus* from zoea stadia to megalopa

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**Abstract**
The main problem faced by swimming crab hatchery today is the low survival rate of larval stages, especially zoea to megalopa. This research aims to examine the effect of dissolved glucose administration on survival and performance of swimming crab larvae of *Portunus pelagicus* in the zoea stadia to megalopa. This research was conducted at the Brackish Water Aquaculture Fisheries Center of Takalar, Takalar Regency, Province of South Sulawesi. Swimming crab larvae of zoea-1 are maintained in a black plastic basin with a volume of 40 L totaling 24 pieces equipped with aeration equipment and filled with water by salinity 32 ppt as much as 30 L. Feed given is rotifers and *Artemia salina* with the addition of dissolved glucose. The research was designed using a Completely Randomized Design (CRD) with 4 dose treatments of dissolved glucose with 3 replications. The four doses are 0, 50, 100 and 150 ppm. The results of Analysis of Variance (ANOVA) showed that the administration of dissolved glucose had a very significant effect ($p<0.01$) on glycogen content, stress resistance, and swimming crab larvae survival. The glycogen content, stress resistance and survival rate were produced at a dose of 100 ppm, respectively 4.31%, 91 and 39.22%, while the lowest at a dose of 0 ppm respectively 3.14%, 119 and 9.15%.

**Keywords:** Swimming crab, glucose, survival rate, performance

## 1. Introduction
The swimming crab is a fishery commodity that has good prospects to be developed. The swimming crab hatchery has actually been successful in several hatcheries. However, there are still some obstacles, which are limited availability of seeds, so they have not been able to supply the needs of seeds for crab production activities.

The main problem faced in the swimming crab hatchery activities and until now is the low survival rate of larvae in the critical phase, namely in the zoea to megalopa phases. Elferizal *et al.* (2019) [7] the highest mortality rate in the swimming crab is in the zoea stage to megalopa. Some research results related to swimming crab larvae survival from zoea stadia to megalopa include Bakkara *et al.*, only getting 15% (2015) [5]; 3.17% (Azis *et al.*, 2016) [4]; 12.89% (Prastyanti *et al.*, 2017) [17] and 5.91% (Abriyadi *et al.*, 2017) [1].

The low survival rate of swimming crab larvae in the zoea stage to megalopa is caused by the low quality of the feed provided so that nutritional needs are not fulfilled, and the maintenance environment is not appropriate and the presence of cannibalism (Zaidin *et al.*, 2013) [23]. According to Budi *et al.* (2016) [6] the cause of low survival rate of swimming crab larvae is internal factors such as organ and nerve development, energy and external factors such as environmental stressors, nutrition and pathogens.

One of the supports of success in the activity of swimming crab seed production is the availability of adequate nutrition. According to Ikhwanuddin *et al.* (2016) [11] nutritional deficiencies can cause nutritional stress and can reduce or slow down the development of larvae because energy needs are not fulfilled. Nutritional improvement and availability is one of the effort that can be done to increase survival and improve swimming crab larvae performance. Larva performance is a display/form, how well the performance of larvae to survive and grow in an environment. According to Budi *et al.* (2016) [6], the availability of sufficient energy, the organisms are needed to achieve high survival rate and growth. One of the sources of energy for larvae is glucose.

Glucose is a monosaccharide compound from carbohydrates that is needed by every organism and is one of the nutrients that is easily revamped into energy when needed. The body needs glucose especially to produce energy. The benefits of glucose are as a ready source of energy and as a source of energy reserves or glycogen (Fujaya, 2015) [5, 10]. According to Rantetondok & Karim (2010) [18] the digestive system in the larvae has not been fully formed so that the utilization of feed is still low and causes energy needs are not fulfilled. Therefore it is necessary to provide nutrients such as glucose which can be directly used as a source of energy without going through the digestive process. Glucose can be absorbed directly through the skin or gills by diffusion. Glucose is absorbed and enters the blood and will be distributed throughout the body, especially to the brain, liver, muscles, kidneys, fat tissue and other tissues (Firani, 2017) [9]. Research on the use of glucose in several larvae has been carried out by Jamal (1995) [15] 82.22% of marble sleeper; Rantetondok & Karim, (2010) [18] 31% mud crab *S. serrata*; (Sulfiadi, 2015) [20] 48.33% of climbing perch and Imran *et al.*, (2018) [13] 94.44% of saline tilapia. The results of the research stated that administration of dissolved glucose can increase the survival rate of several types of larvae.

From the above problems in order to produce high survival rate and good performance of swimming crab larvae (*P. Pelagicus*) it is necessary to study related to the provision of glucose in the maintenance of swimming crab larvae.

## 2. Materials and Methods

This research was conducted at the Brackish Water Aquaculture Fisheries Center or BPBAP, Mappakalompo Village, District of Galesong, Takalar Regency, as a larval rearing site. Analysis of larval glycogen content was carried out at the Food Chemistry Laboratory, Faculty of Animal Husbandry, Hasanuddin University, Makassar.

Test animals used were swimming crab larvae of zoea-1 obtained from spawning and hatching of parent swimming crab mains at the Brackish Water Aquaculture Fisheries Center or BPBAP, South Sulawesi, with a parent weight of 158 g/individual. The larvae are stocked with a density of 50 individuals/L and are kept until they enter the Megalopa stage. Maintenance containers are 24 black plastic basins with volume of 40 L filled with 30 L of media water with salinity 32 ppt, including 12 containers used for glycogen content analysis and 12 other containers used for observation of stress resistance and survival rate of swimming crab larvae.

Natural feed used such as rotifer and nauplius *artemia* is given 2 times a day at 07.00 am and 05.00 pm. Rotifer began to be administered on the zoea-1 stage to the beginning of the zoea-4 stage with a density of 50 individuals/ml and naupli *artemia* was given to the zoea-4 stage to the megalopa stage with a density of 1-3 individuals/ml. Giving glucose is given before the larvae are spread and given once a day in the morning according to the treatment doses. Before it is given to maintenance media, glucose is weighed according to the treatment dose using a digital scale, then glucose is dissolved into 1 L of water and then spread evenly to the maintenance media.

## 3. Observed Parameters

The observed parameters were glycogen content, stress resistance and survival rate of swimming crab larvae. The glycogen content was measured at the beginning and end of the research using the method of Wedemeyer & Yasutake (1977) [22]. Stress resistance of swimming crab larvae is tested by osmotic shock, that is, swimming crab larvae are put into water with salinity 0 ppt. Cumulative Stress Index (CSI) is calculated using the formula of Ress *et al.* (1994) [19].

Stress resistance is calculated using the following formula:

CSI = D5 + D10 + D15 + … + D60
CSI = Cumulative stress index
D = Numbers of swimming crab larvae that are stressed at a certain minute
Survival rate is calculated using the formula as follows:

$$S = \frac{N_t}{N_0} x\ 100$$

S = Survival rate of tested larvae (%)
$N_0$ = Numbers of larvae that lived at the beginning of the experiment
$N_t$ = Numbers of larvae that lived at the end of the experiment
Data obtained in the form of glycogen content, stress resistance and survival rate are analyzed using Analysis of Variance (ANOVA). The physical-chemical parameters of water were analyzed descriptively based on the viability of life of swimming crab larvae (*P. pelagicus*).

## 4. Results

**Table 1:** Average of Glycogen Content of the swimming crab larvae of *Portunus pelagicus*

| Dose (ppm) Dissolved Glucose | Glycogen Content |
|---|---|
| 0 (control) | 3,14 ± 0,48$^b$ |
| 50 | 3,61 ± 0,48$^b$ |
| 100 | 4,31 ± 0,44$^a$ |
| 150 | 3,75 ± 0,12$^b$ |

Description: Different letters show significant differences between treatments at level of 5% ($p$<0.05)

The results of the Analysis of Variance showed that administration of dissolved glucose significantly affected glycogen content of swimming crab larvae ($p$<0.01). The highest glycogen content is produced at a dose of 100 ppm with a value of 4.31, followed by a dose of 150 ppm (3.75), 50 ppm (3.61) and the lowest at 0 ppm (control) with a value of 3.14.

**Table 2:** Average of Cumulative Stress Index (CSI) of the swimming crab larvae of *Portunus pelagicus*

| Dose (ppm)Dissolved Glucose | CSI (*Cumulative Stress Index*) |
|---|---|
| 0 (control) | 119,00 ± 1,00$^a$ |
| 50 | 108,66 ± 2,08$^b$ |
| 100 | 91,00 ± 2,00$^c$ |
| 150 | 106,00 ± 2,64$^b$ |

Description: Different letters show significant differences between treatments at level of 5% ($p$<0.05)

The results of analysis of variance (ANOVA) showed that the administration of dissolved glucose had a very significant effect ($p$<0.01) on the stress resistance of small crab larvae. High stress resistance results in a low CSI (Cumulative Stress Index). The highest CSI (Cumulative Stress Index) is produced at 0 ppm (control) with a value of 119, followed by

doses of 50 ppm (108), 150 ppm (106) and the lowest is produced at a dose of 100 ppm with a value of 91

**Table 3:** Average of Survival Rate of the swimming crab larvae of *Portunus pelagicus*

| Dose (ppm) Dissolved Glucose | Survival Rate |
|---|---|
| 0 (control) | $9.15 \pm 0,17^{d}$ |
| 50 | $15,84 \pm 0,90^{c}$ |
| 100 | $39,22 \pm 0,49^{a}$ |
| 150 | $31,09 \pm 0,52^{b}$ |

Description: Different letters show significant differences between treatments at level of 5% ($p<0.05$)

The results of analysis of variance (ANOVA) showed that the administration of dissolved glucose had a very significant effect ($p<0.01$) in survival of crab larvae. The highest survival rate is at a dose of 100 ppm with a value of 39.22%, followed by a dose of 150 ppm (31%), a dose of 50 ppm (15%) and the lowest is at 0 ppm control with a value of 9%.

## 5. Water quality during the course of the maintenance period

Water physics chemistry parameters in this study are still in optimal condition. Temperatures range from 27 - 32$^0$C, salinity ranges from 33 - 38 ppt, the degree of acidity of the water (pH) ranges from 7 - 8.1, DO ranges from 5.30 - 7.58 ppm and Ammonia ranges from 0.048 - 0.083.

## 6. Discussion

Based on the Table 1 it can be seen that the highest glycogen content of swimming crab larvae are produced at a dose of 100 ppm and the lowest is at control of 0 ppm. The highest glycogen content is produced at a dose of 100 ppm with a value of 4.31%. The high content of glycogen in the larvae is suspected that glucose from the media absorbed by the larvae is not all used directly as energy but is stored in the form of glycogen in the body through the process of*glycogenesis*. Glycogen acts as a source of energy reserves. According to Fujaya (2015) [5, 10] glucose that is not utilized will be stored in the form of glycogen through the process of glycogenesis, namely the formation of glycogen from glucose. Glycogen is glucose stored in the liver and in the muscles that will flow in the blood as energy providers (Andany *et al.*, 2016; Szablewski, 2017) [2, 21]. The low glycogen content is produced at 0 ppm with a value of 3.14%. This is due to the fact that glucose in the body is utilized directly without the process of glycogenolysis, which is the formation of glycogen (food reserves), so that the glycogen content of larvae becomes low. According to Fujaya (2015) [5, 10] the process of glycogenolysis is the breakdown or utilization of glycogen into glucose to fulfill energy needs.

Based on the Table 2 it can be seen that the highest stress resistance of swimming crab larvae are produced at a dose of 100 ppm and the lowest is at control of 0 ppm. The lowest level of stress resistance with CSI is produced at a dose of 100 ppm with a value of 91. The high level of stress resistance in the larvae is caused by food reserves or glycogen which can be used as an energy source in maintaining the condition of the body to keep hemostasis. According to Arifin (2014) [3] states that to cope with stress conditions requires the ability of animals to provide sufficient energy in the tissue to deal with the allostatic burden that can be obtained from glucose and protein. The lowest CSI is produced at control of 0 ppm with a value of 119. This is due to the lack of nutritional intake so that energy needs are not fulfilled to maintain the condition of the body in the new environment. Environmental conditions affect conditions in the body so that it affects the use of energy. Arifin (2014) [3] states that under stress conditions will occur a metabolic energy reallocation. The energy initially used for growth and reproduction will change to be used to improve homeostasis, such as respiration, movement, hydromineral regulation, and tissue repair. The new environment or an environment that is not suitable to cause increased energy use thus affecting the endurance of the larvae. CSI value of swimming crab larvae obtained in this research is lower than the results of the research of Jamal *et al.* (2019) [14], which is 112% with enrichment of natural feed using Beta Carotene.

Based on the Table 3 it can be seen that the highest survival rate of swimming crab larvae are produced at a dose of 100 ppm and the lowest is at control of 0 ppm. The highest survival rate of swimming crab larvae was produced at a dose of 100 ppm with a value of 39.22%. The high survival rate of swimming crab larvae is suspected to have additional feed in glucose derived media which is used as an energy source without going through the digestive process so that the larvae still exist to maintain survival. According to Fujaya (2015) [5, 10] glucose is required by larvae as an energy source that is ready to use or ready to be used without the digestion process, so that energy needs are fulfilled. Glucose is a source of energy for the body and when energy is required, glucose is rapidly metabolized to produce adenosine triphosphate (ATP), a high-energy product (Szablewski, 2017; Fadaka *et al.*, 2017) [21]. The low survival rate was generated at control of 0 ppm with a value of 9.15%. This is due to the absence of additional food intake or glucose supplementation from the media as an energy source available to the larvae in maintaining survival rate. Lack of energy sources will trigger the high nature of larval cannibalism so that the survival rate of larvae is low. According to Szablewski (2017) [21] glucose is the main source of energy production. The survival rate value of swimming crab larvae obtained in this research was higher compared to the results of other studies that were still below 30% (Bakkara *et al.*, 2015; Azis *et al.*, 2016; Prastyanti *et al.*, 2017; and Abriyadi *et al.*, 2017) [5, 4, 17, 1].

Water quality in this research is still in optimal condition. The temperature in this research ranges from 27-32°C. The temperature range values in this research are still in optimal conditions. Temperature greatly affects crab activity, appetite, growth and survival. According to Ikhwanuddin *et al.* (2016) [11] the optimal temperature for rearing larvae is 25 - 34 $^0$C. Salinity in this research ranged from 33-38 ppt. Salinity range values in this research are still in optimal condition. The degree of acidity (pH) in this research ranges from 7-8.1. The pH range value in this research is still in optimal condition. According to Abriyadi *et al.* (2017) [1] the value of the salinity range for crab larvae is 23-40 ppt. Low and high salinity can cause crab larvae to become stressed and even die. DO in this research ranged from 5.30-7.58 ppm. DO range values in this research are still in optimal condition. According to Zaidin *et al.* (2013) [23] the DO range for viability of swimming crab larvae is in the range of > 4 ppm. The low dissolved oxygen content can cause the organism's appetite to decrease so that it affects the physiological processes in terms of survival, respiration, circulation, metabolism, moulting and crustacean growth (Karim 2013) [16]. Ammonia levels in this research ranged from 0.048 to 0.083 ppm. Ammonia range values in this research are still in

optimal condition. According to Zaidin *et al.* (2013) [23] the range of ammonia for survival of swimming crab larvae is in the range <0.1 ppm. High ammonia concentration will cause loss of balance and even death will occur (Ikhwanuddin *et al.*, 2016) [11].

## 7. Conclusion

7.1 Provision of dissolved glucose in the media of rearing swimming crab larvae results in better survival rate and performance of swimming crab larvae from zoea stadia to megalopa becomes better.

7.2 The best dose of 100 ppm of dissolved glucose which produces glycogen content is 4.31%, stress resistance is 96.00% and survival rate is 39.22%.

## 8. References


1. Abriyadi H, Nikhlani A, Sukarti K. Provision of Phytoecdisteroid Hormone (Vitomolt) in Natural Feed on the Survival Rate of the Swimming Crab Larvae (*Portunus pelagicus*) in the Stadia of Zoea to Megalopa. Journal of Aquaculture Technology and Science. J. Aquawarman. 2017; 3(2):1-8.
2. Andany. MM, MG Lucan, CD Garcia, CF Fernandez and EA Rodriguez. Glycogen Metabolism in Humans. Elsevier Journal. 2016; 5:85-100.
3. Arifin MY. Physiological Response of Mantis Shrimp Seed (*Harpiosquilla raphidea*) of Dry Post-Transportation System, Valley, and Wet Systems. Postgraduate Thesis, Bogor Agricultural University, Bogor, 2014.
4. Azis Y Fujaya, MY Karim. The Effects of Various Light Intensity on Feed Predation Rate and Survival Rate of the Swimming Crab Larvae (*Portunus pelagicus*) of Zoea Stadia. Journal of Science & Technology. 2016; 16(1):62-69.
5. Bakkara OR, Aslamyah S, Fujaya Y. Development Response of Swimming Crab Larvae *Portunus pelagicus* on the Prediction of Natural Feed Turning to Predigest Artificial Feed. J Science and Technology. 2015; 15(1):74-83.
6. Budi S, Karim MY, Trijuno DD, Nessa MN. Effect of Ecdyson Hormone on Mortality and Moult Death Syndrome of Larvae Mud Crab *Scylla olivacea*. International Journal of Chem Tech Research. 2016; 10(6):158-164.
7. Elferizal E, Zakaria IJ, Rusnam Suryati, Yolanda N. Studies on Biological Tests of Formulated Diets Supplementation of Vitamin E for the Broodstock of Femaleles Blue Swimming Crab, *Portunus pelagicus*. F1000Research Journal. 2019; 7:1780.
8. Fadaka A, Ajiboye B, Ojo O, Adewale O, Olayide I, Emuowhochere R. Biology of Glucose Metabolization In Cancer Cells. Journal of Oncological Sciences. 2017; 3:45-51.
9. Firani NK. Carbohydrate Metabolism. Biochemical and Pathological Review. Publisher of Ub Press. Malang, 2017.
10. Fujaya Y. Fish Physiology and Its Application in Fisheries. Publisher of Al-Zikra References, Yogyakarta, 2015.
11. Ikhwanuddin M, Hayimad T, Ghazali A, Halim SSA, Abdullah SA. Resistance Test at Early Larval Stage of Blue Swimming Crab, *Portunus pelagicus*. Songklanakarin J. Sci. Technol, 2016, 38(1).
12. Ikwanuddin MMN, Azra, Noorulhudha NF. Embryonic Development and Hatching Rate of Blue Swimming Crab, *Portunus pelagicus* (Linnaeus, 1758) Under Different Water Salinities. Turkish Journal of Fisheries and Aquatic Sciences. 2016; 16:669-677.
13. Imran MA, Maharani Y, Marding H, Dahliah A, Karim MY. Use of Dissolved Glucose on Cultured Media on the Survival Rate, Growth Rate, and Stress Resistance of Saline Tilapia Larvae (*Oreochromis Niloticus*). Journal of Fisheries and Marine Science. 2018; 1(2):1.
14. Jamal K, Zainuddin, MY Karim. The Effect of Natural Feeding Enrichment Using Beta Carotene on Stress Resistance and Survival Rate of Blue Swimming Crab (*Portunus pelagicus*) Larvae. International Journal of Scientific and Research Publications. 2019; 9:789-790.
15. Jamal M. The Effect of Provision of Dissolved Organic Materials (Glucose) on Aquaculture Media on the Survival Rate and Growth of Marble Sleeper Larvae (*Oxyeleotris marmorata*). Thesis. Bogor Agricultural University, Postgraduate Program, Bogor. (Not published), 1995.
16. Karim MY. Mangrove Crab (*Scylla* Spp.) (Biotechnology, in Cultivation and Seeding). Yarsif Watampone (Member Ikapi). Jakarta, 2013.
17. Prastyanti KA, Yustiati A, Sunarto, Andriani Y. Survival and Growth of Swimming Crab Larvae (*Portunus pelagicus*) through Giving Nauplius Artemia Enriched with Fish Oil and Corn Oil. IJAS, 2017, 7(3).
18. Rantetondok A, Karim MY. Increasing Immunity of Mud Crab Larvae (*Scyllca Serrata*) through Prevention of Parasitic Attacks by Giving Glucose to Cultured Media. Indonesian Aquaculture Journal. 2010; 11(1):49-60.
19. Ress JF, Cure K, Piyatiratitivorakul S, Sorgelos P, Menasveta P. Highly Unsaturated Fatty Acid Requirements of *Penaeus monodon* Postlarvae: An Experimental Approach Based on Artemia Enrichment. Journals. Aquaculture. 1994; 122:193-207.
20. Sulfiadi. Study of Glucose Administration in Maintenance Media for the Survival of the Climbing Perch Larvae (*Anabas tesdineus* Bloch). Journal of Fisheries Sciences, 2015, 20(2).
21. Szablewski L. Glucose Homeostasis. Journal of Intechopen, 2017, 7-8.
22. Wedemeyer GA, Yasutake WT. Clinical Methods for the Assessment of the Effects of Environmental Stress on Fish Health. Tech. Pap. US Fish. Wildl. Serv. Washington DC, 1997, 89.
23. Zaidin MZ, Effendy IJ, Sabilu K. Survival Rate of Swimming Crab Larvae (*Portunus pelagicus*) Megalopa Stadia Through the Combination of Natural Feed Artemia Salina and *Brachionus Plicatilis*. Mina Journal of Indonesian Sea. 2013; 1(1):112-121.