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PHYSIOLOGICAL RESPONSE AND SURVIVAL RATE OF RED TILAPIA (*OREOCHROMIS* SP.) AT DIFFERENT LEVELS OF SALINITY

Irfan Zidni[1], Walim Lili[1], Ayi Yustiati[1], Iskandar[1], Yuli Andriani[1], Achmad Rizal[1], and Ibnu Bangkit[1]
[1]*Lecturer at Faculty of Fisheries and Marine Science, University of Padjadjaran*
Fish Farming Laboratory Ciparanje, Study Program of Fisheries, Faculty of Fisheries and Marine Science, University of Padjadjaran
Bandung-Sumedang km 21 West Java 45363, Indonesia

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Nile tilapia seeds, osmoregulation, survival rate , physiological response,

ABSTRACT

This study aims to determine the effect of different salinity levels on the physiology response of Red tilapia (Oreochoromis sp.) determined from survival rate, overculum motion, motion activity, and mucus production. The test animals used in this study were Red tilapia seeds with weights ranging from 1-3 grams acclimatized for 5 days in aquarium media measuring 60x40x40 cm. The method used in this study was Experimental with Completely Randomized Design consisting of 10 salinity treatments (0, 2, 4, 6, 8,10, 12, 14, 16, 18) with 3 replications. Observation of operculum motion is done by observing open operculum cap / minute, identification of motion activity seen from fish movement and fish shock power. While the observation of mucus production is done by looking at the mucus derived from the fish body. The results showed that the average of Red tilapia fish operculum motion ranged between 102,43-138,33 / minute, the activity of Red tilapia seed motif was active and producing enough mucus. The survival of Red tilapia seeds at 0-16 ppt salinity ranges between 97 -100%, and decreased at 18 ppt salinity of 93.67%. Based on the results of statistical analysis shows that there is a significant difference in each treatment of the survival of Red tilapia seeds.

INTRODUCTION

Red tilapia is one of freshwater fish that has high economic value and favored by many people. Because of its popularity it makes red tilapia fish has a promising business prospects. This fish is known as Taiwan red or hybrid indigo between Oreochromis hornorum with Oreochromis mossambicus which is named red tilapia Florida (Mansyur & Mangampa, 2011).

When viewed from the level of productivity red tilapia fish has a high potential to be developed and cultivated in various lands such as in the ground pool, therapeutic pond, floating net cage (KJA), in rice fields with minapadi system, as well as in brackish water ponds. This is because red tilapia fish has the ability to adapt to various aquatic environments, especially salinity.

Salinity is one of the environmental parameters that can affect the physiological response of an organism such as can affect the survival, growth rate, the amount of feed consumption, and the process of osmoregulation of tilapia (Aliyas, Ndobe, & Ya'la, 2016). Osmoregulation is the process of regulating fluid concentration and balancing the influx and discharge of body fluids by living cells or organisms. The process of osmoregulation is necessary because of the difference in body fluid concentration with the surrounding environment (Fitria, 2012).

Salinity can affect the osmotic pressure of the red tilapia fish fluid, so the osmotic pressure of the media will be a burden for the tilapia to maintain its osmotic body through the osmoregulation process in order to stay in the ideal state, therefore a relatively large energy is required in maintaining the condition.

The purpose of this study was to determine the effect of different salinity levels on the physiological response and the survival of red tilapia fish. In addition, this research is expected to be the basic information for further research on the application of red ila cultivation on brackish water ponds.

Research Methods

Time and Place of Study

The research was conducted in November-December 2017 at the Fish Physiology Laboratory and Ciparanje Fish Farming, Faculty of Fisheries and Marine Sciences, Padjadjaran University.

Tools and Materials

The tool used in this research is the aquarium size 60x40x40 cm as a place of fish maintenance, petridish where the measuring salt, hand counter to calculate the open fishkit cover, aerator installation for oxygen supply, scales to measure fish weight and salt weight, DO meter to measure oxygen content in water, pH meter to measure pH content in water, thermometer to measure temperature, and refractometer to measure salinity in each treatment. The materials used are red tilapia seeds with 1-3 grams weight, salt krosok to determine the salinity in each treatment, feed the type of Hi Pro Vite as the red tilapia fish seed.

Research Procedure

The preparation phase of the research includes preparation of fish breeding container in the form of aquarium composed of 54 pieces with each measuring 60x60x40 cm. Determination of salinity obtained by diluting the salt krosok with fresh water until the water conditions obtained with the desired salinity and water media in aeration. The salinity measurement is using refractometer. This stage aims to test fish can adapt to the new environment and not too stressful. Research phase includes feeding, life cycle calculation, and observation of fish physiology response, fish test maintenance and water quality observation.

Methods

This research was conducted by using the experimental method of Completely Randomized Design (RAL) design consisting of 10 treatments with 3 replications. The treatment is the difference of salinity value 0, 2, 4, 6, 8,10, 12, 14, 16, and 18.

Parameter of Research

The study parameters included survival Rate measurement, measurement of fish physiology response including calculation of operculum motion, motion activity observation, and fish mucus production. In addition, water quality observed included DO, temperature, pH, ammonia, and salinity.

Data Analysis

Data on the effect of the treatment on survival and open-cap opercine response of Red tilapia seed fish can be determined by analyzing diversity with F-test with 95% confidence level, if there is difference between treatments done by Duncan multiple-range test with 95% confidence level. The fish's fisetic response parameters were analyzed descriptively.

Results And Discussion

Survival Rate of Tilapia Seeds

Based on the observations at the end of the study, the average survival rate of red tilapia seeds is maintained on media with different salinity. Based on statistical analysis indicated that the treatment of difference of salinity value gives a significant different effect to the indigo of seed survival of red tilapia fish.

Table 1. Average Survival (%) Red Tilapia Fish Seeds During The Study

Treatment	Survival Rate (%)
A (0 ppt)	100 ± 0,00[a]
B (2 ppt)	100 ± 0,00[a]
C (4 ppt)	98,67 ± 0,33[a]
D (6 ppt)	97,67 ± 0,00[a]
E (8 ppt)	98,00 ± 0,33[a]
F (10 ppt)	97,00 ± 0,00[a]
G (12 ppt)	96,67 ± 0,33[a]
H (14 ppt)	97,00±0,00[a]
I (16 ppt)	97,33± 0,33[a]
J (18 ppt)	93,67±0,66[b]

Description: The average value followed by the same letter are not significantly different based on Multiple Comparison test at α level of 5%.

Based on Table 1 and Graph 1, the highest survival rate was found in the salinity treatment 0-16 ppt, which ranged between 96.67-100%, while the survival rate of the lowest Red tilapia seed was found in treatment I with the 18 ppt maintenance media of 93.67% . The average graph of survival rate value of red tilapia seeds during the study is shown in Figure 1.

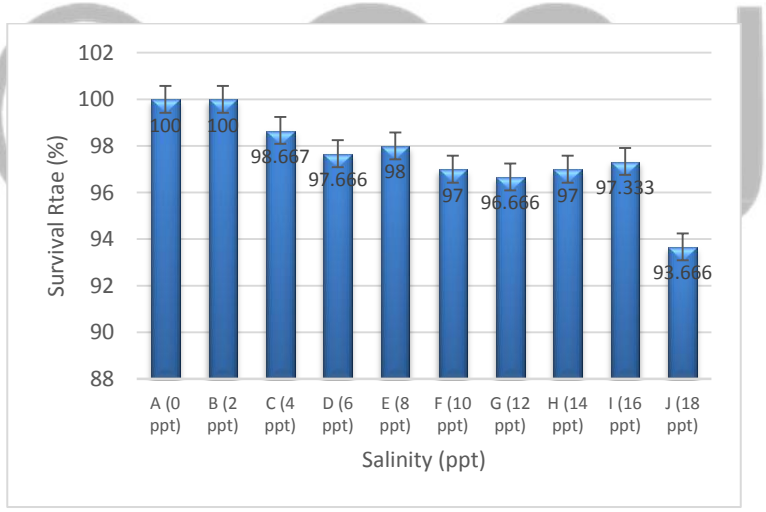

Figure 1. Average Survival of Red Tilapia Seeds During Research

Based on the results of the study seen that the increase in salinity on maintenance media can affect the survival of Red tilapia seeds. Overall survival value of Red tilapia seeds in various salinity during the study is high, this is because tilapia is included in the category of fish euryhaline. Tilapia maintained on the 0-16 ppt medium of suspension is thought to be good in utilizing the energy in the feed because the osmotic pressure condition in the maintenance medium approaches the osmotic pressure of the tilapia seed (isoosmotic). According to (Hepher & Pruginin, 1981) tilapia has a good ability in regulating osmoregulation system in high-balance media.

According to (Holliday, 1969) the ability of fish to survive on the medium of correlation is related to the level of fish's ability to regulate fluid balance in the body. Bigger fish are able to regulate body fluids better than small fish because it deals with the perfection of organs to adapt to the environment bersititas.

At 18 ppt salinity there is a difference in fish behavior when the water salinity changes. As the salinity gets higher, the fish more often remove the dirt so the water becomes quickly turbid. This causes the low survival rate of tilapia seeds in treatment J (salinity 18 ppt). Due to osmoregulation system is not balanced then it can affect the low response of fish to feed so much feed accumulate in the bottom of the container maintenance. In addition, the osmoregulation system has an impact on the disruption of the fish's metabolism system, resulting in increased feces and ammonia disposal (Lee, Kaneko, & Aida, 2005).

Physiological Symptoms

Operculum Motion

Based on the results of the research, it can be seen that the difference of the salinity level influences the average movement of tilapia in opening and closing the operculum. The lowest average was found in treatment A with salinity of 0 ppt, whereas the highest open and close movement of operculum was found in treatment J with 18 ppt salinity. Here is the average indigo of open lid operculum of tilapia seeds during the study (Table 2).

Table 2. Average movement of Red tilapia fish operculum on various salinity

Treatment	Average movement operculum
A (0 ppt)	102,43±4,43^{a}
B (2 ppt)	104,33±7,47^{ab}
C (4 ppt)	108,33±9,51^{ab}
D (6 ppt)	111,67±8,45^{ab}
E (8 ppt)	120,20±5,28^{abc}
F (10 ppt)	122,33±8,26^{abc}
G (12 ppt)	124,00±4,75 ^{bcd}
H (14 ppt)	127,00±6,85^{bcd}
I (16 ppt)	127,67±4,10^{cd}
J (18 ppt)	138,33±3,79^{d}

Description: The average value followed by the same letter are not significantly different based on Multiple Comparison test at α level of 5%.

In the treatment with salinity of 18 ppt it is assumed that the osmose value of the tilapia seeds is much different from the environmental pressure, causing the more metabolism energy needed to perform osmoregulation as an adaptation effort. This is marked by the speed of movement of the capture cap of the tilapia seed fish operculum during the study which aims to balance the intake of ions in the fish body. Osmoregulation in freshwater fish involves removing ions from the environment to limit ion loss. Water will enter the fish body because of hypertonic condition, so many fish to express water and hold the ion (Genz, Taylor, & Grosell, 2008).

According to (Barton, 2002), fish physiology responses to environmental stresses such as differences in the value of sanity in maintenance media include changes in the metabolic system and respiratory system in fish associated with the speed of overculum cover book movement in fish.

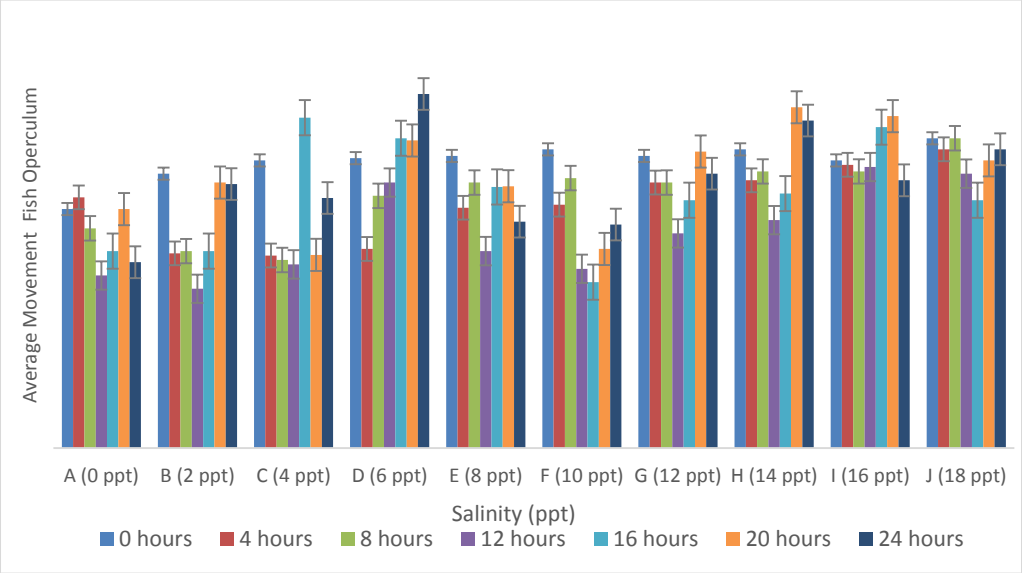

Figure 2. Average Movement Fish Operculum

Based on the above graph shows that there is a change in fish behavior at the beginning of salinity change is the level of open cap of Red tilapia seed fish operculum at the beginning of observation and more fish position on the surface. However, after a while the fish tends to be based aquarium and still often open his mouth.

The high level of open lid of tilapia seed fish operculum shows the indigo seeds to oxygen as energy to perform high metabolic activity. This occurs when the salinity value changes in each treatment, the greater the salinity value of the fishcopper feeding rate increases. Changes in fish behavior on media with different salinity due to adjustment related to osmoregulation process adjustment in fish body (Susilo, Meilina, & Simanjuntak, 2012).

Changes in salinity levels during the study affect the osmotic pressure of the fish's body fluids, so the fish adjust their internal osmotic work settings so that the physiological processes in their bodies can work normally again. If the salinity is higher, the fish try to keep the condition of homeostation in the body is reached, to the limit of tolerance it has. The osmotic work requires higher energy by oxygen uptake in the waters.

During the study, the use of aeration at the time of observation is needed to supply the oxygen content at high salinity, due to the high salinity of low oxygen content. Fast mouth opening and fast gill movements in treatments using salinity 18 ppt were performed by fish for the purpose of obtaining oxygen. At high salinity, the fish in its adaptation will lose water through the diffusion out of the body.

Clinical Symptoms

Observation of red tilapia seeds (Orechromis sp.) is done 10 times in 4 hours, once every 8 hours, 12 hours once every 24 hours. Aspects observed are the activity of fish motion in water and the number of mucus contained in the body of tilapia seeds.

Based on the results of research indicate that high value of media salinity can mempengaruihi activity of movement and content of mucus on tilapia seed. At the beginning of observations ranging from 0-10 hours seen that the movement of active fish is characterized by active fish operculum movement and low mucus content in the fish body. After observation for 12 hours visible movement of tilapia fish is still active and the content of mucus in the body began to fish a lot. In the next observation the movement of fish is more active, the movement of operkum that continues to increase, and the content of mucus in fish body more and more.

The more openings of fish operculum, the more mucus secreted. The faster the motion of the operculum indicates that the fish has a high metabolic rate. High metabolism requires a lot of energy and to get the energy obtained by pumping oxygen, then open the cap of the operculum faster. Salinity can affect the metabolism in which the fish live in fresh water and transferred into the waters of the

salinity, it causes the normal fish should first adjust the body with new environmental conditions and release the body's response by removing mucus.

The content of salt content in a medium is closely related to the osmoregulation system (mechanism) of freshwater organisms. According to (Haryadi, 2003) aquatic organisms have different osmotic pressures with their environment. Therefore, fish should prevent excess water or water shortage so that physiological processes in the body take place normally. If the regulation of osmotic pressure on each fish is not good then the negative impact is the fish will experience stress, characterized by the emergence of mucus in the body of tilapia fish.

Water Quality

The water quality parameters observed during the study were dissolved oxygen, pH, temperature, and ammonia content. DO (Dissolved Oxygen) is a dissolved oxygen content in water, dissolved oxygen content (DO) during research in the media ranges from 4.3 to 6.7 mg / L is still within a reasonable range for tilapia life, because in the research media applied aeration system that aims for the occurrence of oxygen diffusion process in the waters. According to (Akbar, Adriani, & Aisiah, 2011) the DO content of 4-7 mg/L is ideal for growing and developing tilapia seeds. The temperature of maintenance media during the study ranged from 26.4-27.6oC. According to (Amri & Khairuman, 2003), states that the appropriate temperature for tilapia seeds ranges from 14 - 35 oC so that the temperature during the study is still feasible for the life of tilapia. The pH value is very important in the cultivation of tilapia, because the pH of water is a limiting factor in the life of fish and other microorganisms, the pH value during the study ranged from 6.7 to 7.7. The pH of water is good for fish life is neutral to slightly alkaline 7-8 (Amri & Khairuman, 2003). This is in accordance with water pH conditions during the study. (Abbas, 2002) suggests that the ammonia content contained in water should be no more than 1 ppm, if the ammonia level is more than 0.5 ppt, then in the short term the fish will be stressed, the pain and the growth decrease. From the results of the study showed that ammonia levels obtained ranged from 0.0026-0.0062 mg/L, then still categorized feasible for the cultivation.

Conclusion

Based on the result of research indicate that difference of salinity level give real effect to survival and open cap value of red tilapia fish seed operculum. The survival of red tilapia seeds at 0-16 ppt salinity ranges between 97 -100%, and decreased at 18 ppt salinity of 93.67%. The higher the salinity, the more mucus secreted and the physiological symptoms such as fish operculum opening faster and the movement was passive cederung.

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