Different Levels Of Addition Of Salinity To Survival, Growth And Conversion-Efficiency Feed's Tilapia (*Oreochromis* sp.)

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Abstract

Tilapia is one of the consumption fish commodities that was very popular with the public. The development of tilapia aquaculture was growing rapidly, especially saline tilapia. The high potential of saline tilapia development causes the demand for fingerlings to increase. This research aimed to determine the best dose of salinity increase in the effort to adapt freshwater tilapia to saline tilapia. In addition, it also observed survival, growth and feed efficiency. The method used was experimental method with completely randomized design and data were analyzed using SPSS16 and Tukey's test. The research treatments included the levels of addition of salinity by 1 ‰/day, 2 ‰/day, 3/day and 4 ‰/day. The difference in salinity had a significant effect on Survival Rate (SR), Growth Rate (GR), Specific Growth Rate (SGR), Feed Conversion Ratio (FCR) and Feed Utilization Efficiency (FUE). The best treatment in this research was the addition of salinity of 1 ‰/day with SR of 96%, GR of 35.1 g / t, SGR 1.22% w / day, FCR of 1.04 and FUE of 96%.

Keywords: Tilapia (*Oreochromis* sp.), SR, GR, SGR, FCR

Introduction

Tilapia is a very popular fish in the world, more than 100 countries have been able to cultivate and produce it en masse (Aliah, 2017). In Indonesia, tilapia production continues to increase and was targeted to be 15,000,000 tonnes by 2030. The existence of a clear market means that tilapia can be found in various types and cultivation techniques (Amidra et al., 2017). One of the cultivation techniques of tilapia that was currently developing was saline tilapia, which is to maintain tilapia at high salinity, reaching 20-30 ppt by utilizing the ability of tilapia which was euryhalin fish (Angriani et al., 2020). The high potential of saline tilapia development causes the demand for fingerlings to increase. The success in maintaining saline tilapia fingerlings was determined by the adaptability of the fish to increased salinity (Simorangkir et al., 2020).

Salinity is one of the environmental parameters that affect the biological processes of an organism and will directly affect the life of the organism, including affecting growth rate, the amount of food consumed (food conversion) and survival. Salinity as one of the water quality parameters that affects the osmotic pressure of tilapia body fluids, then the osmotic pressure of the media will become a burden for tilapia so that relatively large energy was needed to maintain its osmotic body through the osmoregulation process so that it remains in an ideal state (Aliyas et al., 2016). Changes in salinity treatment of saline tilapia fingerlings can be done slowly to avoid death (Perwito et al., 2015). Therefore, this research aims to determine the best dose of increase in salinity in an effort to adapt freshwater tilapia to saline tilapia and observed growth and survival rates in this salinity level.

Materials and Methods

Tilapia were obtained from Politeknik Kelautan dan Perikanan Sorong of freshwater cultivation installation. The fingerlings have an average weight of 2.3 g, the number of fish used was 360 fish. Tilapia were kept in a controlled environment and fed in the form of pellets. The stocking density of fish in an aquarium volume size was 15 L as much as 30 fish. The amount of feed given was 5% of the fish biomass. The test fish were reared for 30 days without sampling each week. The research used experimental methods by a completely randomized design, then the data were analyzed by SPSS16. The treatments that were tested were as followed:

Treatment A: Addition of salinity by 1 ‰/day
Treatment B: Addition of salinity by 2 ‰/day
Treatment C: Addition of salinity by 3 ‰/day
Treatment D: Addition of salinity by 4 ‰/day
The research stage was carried out by weighing the fish and inserting the fish into their respective aquariums. The main parameters in this research were SR, GR, SGR, FCR and FUE, while the supporting parameters measured were temperature and salinity.

Results and Discussions

Based on the results of the observations at the end of the research that has been carried out for 30 days, it showed the effect of each treatment with different salinity. The results of the treatment of different salinity additions to tilapia of SR, GR, SGR, FCR and FUE were analyzed by Tukey's SPSS 16.0 as in Table 1.

Table 1. The average value of the treatment during the research

Treatment	SR (%)	GR (g/t)	SGR (%wb/hari)	FCR	FUE (%)
A : 1 ‰/day	96%^{a}	35.1a	1.22a	1.04a	96%a
B : 2 ‰/ day	89%^{a}	27.6b	1.14b	1.21a	83%b
C : 3 ‰/ day	80%^{b}	21.8c	1.08c	1.43b	70%b
D : 4 ‰/ day	60%^{c}	10.4d	0.95d	2.19c	46%c

Note: Different notations indicate the results of the test are significantly different at the 0.05 level

Survival Rate (SR)

The viability of tilapia fingerlings in each treatment was the average percentage of the number of live fish and the number of fish stocked during maintenance. For more details, the average survival rate of tilapia can be seen in Figure 1.

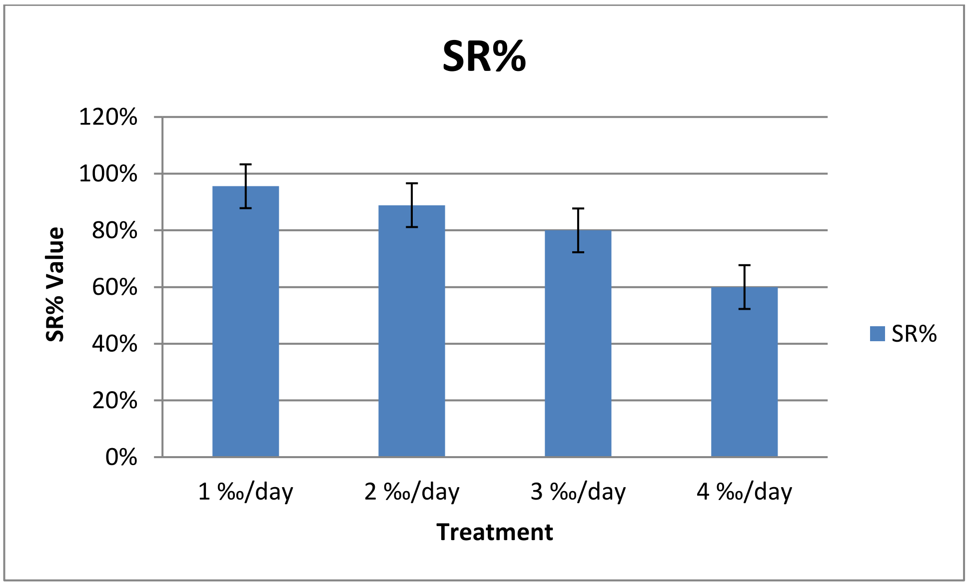

Figure 1. Survival Rate

Based on Figure 1 regarding the survival rate of tilapia, the highest SR value was 96% in the treatment of adding salinity of 1 ‰/day and the lowest SR value of 60% in the treatment of adding salinity of 4 ‰/day. Changed in salinity levels affect the osmotic pressure of the fish's body fluids, so that the fish make adjustments or adjust their internal osmotic work so that the physiological processes in their bodies can work normally again. If the salinity was higher, the fish continue to strive so that the homeostatic conditions in their body can be reached up to their tolerance limits. Osmotic work requires higher energy as well. Even though it was significantly different, its life span was still high. After crossing the tolerance limited, the fish experienced death. Given that not all fish have died, it can be ascertained that the tolerance for fish populations in containers was different. That was presumably due to differences in body conditions before inclusion in the media, including parasite intensity, stress levels and others. For fresh water, the organs involved in osmoregulation include the gills, intestines and kidneys (Fitria, 2012).

Table 2. Results of SPSS 16.0 Survival Rate of Tilapia

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Survival Rate	Between Groups	2163.000	3	721.000	25.006	.000
	Within Groups	230.667	8	28.833		
	Total	2393.667	11			

The test results on SPSS 16.0 on the survival of tilapia in Table 2, showed $p < 0.05$, which means that salinity had an effect (very significantly different) on the survival of tilapia. That was because the addition of 1 to 4 ‰/day for 30 days can disturb the physiology of tilapia, so that when the salinity was too high, the tilapia was unable to maintain the stability of its osmoregulation, causing death. This was in line with the statement from Dahril et al. (2017) that maintenance media with high enough salinity levels are not effective in increasing seed survival.

Growth Rate (GR)

Each species had an optimum salinity range, beyond this range fish must expend more energy on osmoregulation than other processes. One of the adjustments of fish to their environment was to regulate the balance of water and salt in their body tissues. Some aquatic vertebrates contain salt with a different concentration than the environmental medium. Fish must regulated their osmotic pressure to maintain the balance of body fluids at all times. Likewise in this research, the first week the fish were still in the adaptation stage. For more details, the increase in the average weight growth of tilapia can be seen in Figure 2.

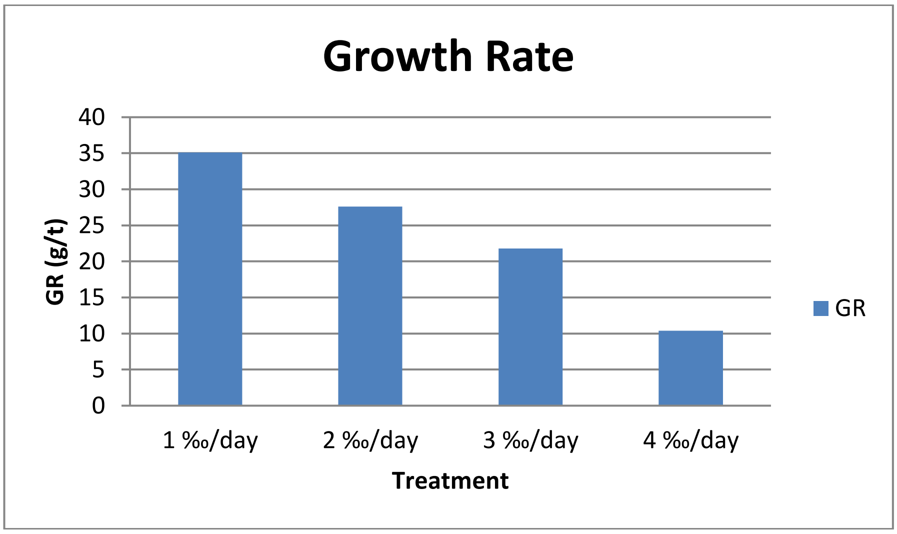

Figure 2. Growth Rate

Based on Figure 2, it can be seen that the highest GR value was obtained in treatment A (addition of salinity of 1‰/day), namely the average GR value of 35.1 g/t, then followed by treatment B (addition of salinity of 2‰/day) of 27.6 g/t, treatment C (addition of salinity of 3‰/day) was 21.8 g/t and the lowest GR value was obtained in treatment D (addition of salinity of 4‰/day) which was 10.4 g/t. Anova test results showed $p < 0.05$, meaning that salinity affected the growth rate of tilapia. In the addition of 1 ‰/day salinity treatment, the energy was absorbed and maximally used for growth. This means that the highest absolute weight growth rate limitation was the addition of 1‰/day salinity for 30 days of treatment, because if the salinity value was too high it would affected the metabolism of tilapia. In line with Prayudi (2016) statement that the weight growth of tilapia was not directly or inversely proportional to the salinity value, with the higher salinity value it was not certain that the weight growth of tilapia has increased, as well as the lower salinity, the weight growth of tilapia was not certain. increased. It was because tilapia try to be in an isotonic condition, which was a condition where the concentration of body fluids was the same as the concentration of its living medium. It was in accordance with the opinion of Fitria (2012), each organism has different abilities to deal with osmoregulation problems in response to external osmotic changes.

Specific Growth Rate (SGR)

The specific growth rate was the percentage increase in tilapia weight per day. The weight of the test fish will increase during maintenance activities. The results of the Anova test for specific growth rates can be seen in Figure 3.

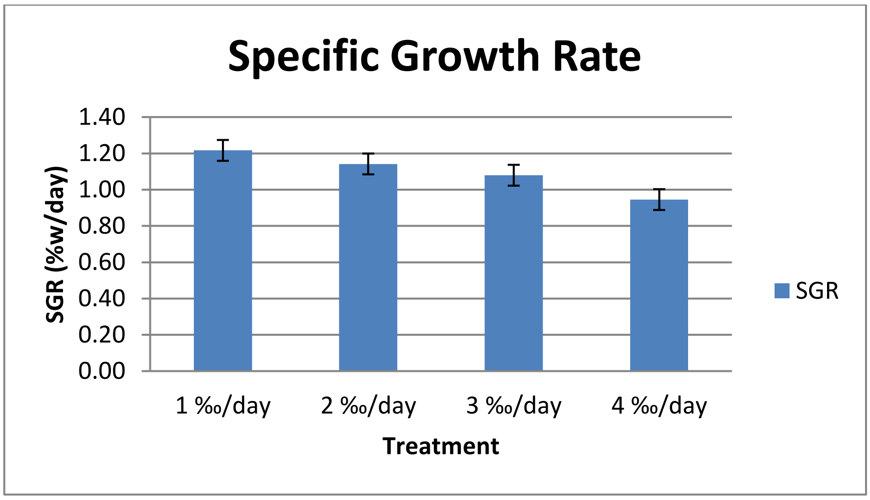

Figure 3. Specific Growth Rate

Based on Figure 3 above, it can be seen that the highest SGR value was obtained in treatment A (addition of salinity of 1‰/day), namely the average SGR value of 1.22%w/day, followed by treatment B (addition of salinity of 2‰/day) of 1.14%w/day, treatment C (addition of salinity of 3‰/day) of 1.08%w/day and the lowest SGR value obtained in treatment D (addition of salinity of 4‰/day) was 0.95%w/day. Anova test results showed $p < 0.05$ means that salinity affects the SGR value of tilapia. This showed that the daily growth rate of red tilapia showed a significant difference between treatments. It was due to the addition of salinity treatment, age of the fish and feed given, as stated by Amri and Khairuman (2008) that the growth rate of cultivated tilapia depends on the physical and chemical influences of the waters and their interactions. According to Fitria (2012), too high salinity can affect growth between treatments due to the effect of salinity which affects metabolism of changes in function in gill epithelial chlorid cells and Na^+ K^+-ATPase activity. This effect absorbs energy that should be used for growth and was used as an energy source for changes in metabolic processes, causing fish to be suboptimal. The growth rate was also influenced by food and maintenance media factors.

Feed Conversion Ratio (FCR)

The feed conversion ratio was the ability of fish to convert feed into meat. The feed conversion value showed that which food was more efficient can be utilized by fish (Simanjuntak, 2018). The results of this research, data obtained from the conversion of tilapia fingerlings feed in each treatment had increased in the range of 1.04 - 2.19, for more details it can be seen in Figure 4.

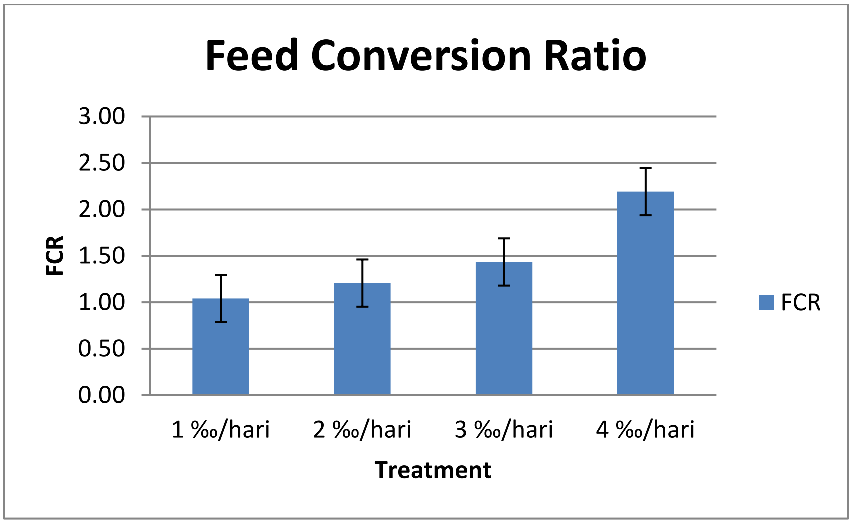

Figure 4. Feed Conversion Ratio

Based on Figure 4 above, it can be seen that the highest FCR value was obtained in treatment A (addition of salinity of 1‰/day), namely the average FCR value of 1.04, then followed by treatment B (addition of salinity of 2‰/day) of 1.21, treatment C (addition of salinity of 3‰/day) of 1.43 and the lowest FCR value obtained in treatment D (addition of salinity of 4‰/day) was 2.19. Anova test results showed $p < 0.05$, meaning that salinity affects the FCR value of tilapia. Mudjiman (2001) stated that the value of the feed conversion ratio was closely related to the quality of the feed, the lower the value the better the quality of feed and the more efficient the fish were in utilizing the feed they eat for growth. So that, the body weight of the fish can increase because the feed can be digested optimally.

Feed Utilization Efficiency (FUE)

Feed efficiency was the ratio value between weight gain and feed consumed which was expressed in percent (%) (Mudjiman, 2004). The results of this research, the data obtained from the conversion of tilapia seed feed in each treatment decreased by a range of 46-96%, for more clearly the efficiency of tilapia feed can be seen in Figure 5.

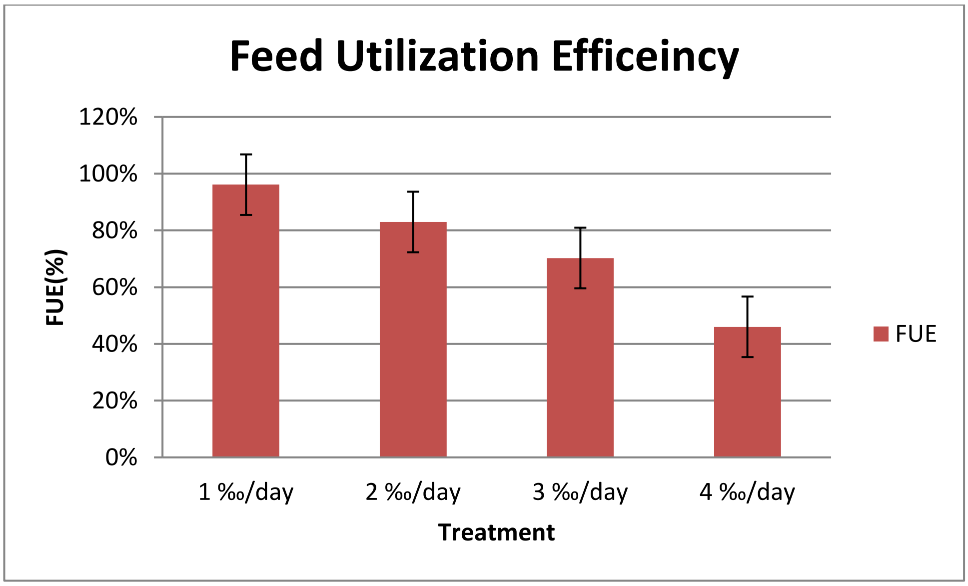

Figure 5. Feed Utilization Efficiency

Based on Figure 5 above, it can be seen that the highest EP value was obtained in treatment A (addition of salinity of 1‰/day), namely the average EP value of 96%, then followed by treatment B (addition of salinity of 2‰/day) of 83% , treatment C (addition of salinity of 3‰/day) was 70% and the lowest FUE value was obtained in treatment D (addition of salinity of 4‰/day) which was 46w/day. Anova test results showed p <0.05, meaning that salinity affects the efficiency of tilapia feed. This showed that differences in salinity can affect feed efficiency and was very useful for comparing feed values that support fish weight gain. Feed efficiency can be influenced by several factors including feed, the amount of feed given, fish species, fish size and water quality. According to Kordi (2011), the higher the value of feed efficiency, the more efficient fish used the feed.

Water Quality

Water as a living medium for fish must have properties that were suitable for fish life, because the quality of water can have an influence on the growth of creatures that live in the water. Water quality was a limited factor for the types of biota cultivated in a waters (Kordi and Tancung, 2007). The temperature value obtained in this research reached an average of 29-30°C, while the salinity at the end of the research was 30‰. Based on the results of water quality observations, it was found that the temperature at the time of the research was relatively normal, this was in accordance with the statement of Amri and Khairuman (2008) that the optimal temperature for tilapia fingerling was between 25-30°C. Tilapia seed growth would usually be disrupted if the habitat temperature was lower than 14°C or at a high temperature of 38°C. Tilapia fingerlings was collaps at 6°C or 42°C.

Conclusions

The conclusion was that the difference in salinity has a significant effect on Survival Rate (SR), absolute Growth Rate (GR), Specific Growth Rate (SGR), Feed Conversion Ratio (FCR) and Feed Utilization Efficiency (FUE). The best treatment in this research was the addition of salinity of 1‰/day with SR of 96%, GR of 35.1 g/t, SGR 1.22% w/day, FCR of 1.04 and FUE of 96%.

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