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# THE GROWTH OF SANGKURIANG CATFISH (*CLARIAS GARIEPINUS*) WITH PROBIOTICS ADDITION IN CULTURE MEDIA

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KeyWords
*Clarias gariepinus*, Probiotics, Specific Growth Rate, Survival Rate, water quality

## ABSTRACT

The purpose of this research is to determine the optimum dose of probiotic addition that is best used in catfish culture. The research was conducted at the Laboratory of aquaculture, Faculty of Fisheries and Marine Sciences, Universitas Padjadjaran, Jatinangor. The fish used in this research were sangkuriang catfish (*Clarias Gariepinus*). The treatments tested were without the addition of probiotics (control), 10, 15, and 20 ml/L probiotics. Each container was filled with 100 fish densities. The experimental design used was Completely Randomized Design (CRD) with four treatments and three replications. The parameters observed were the fish's specific growth rate, survival rate, and water quality. The results showed that there was no significant difference in specific growth rates. The highest specific growth rate of catfish was obtained in treatment C, which was 1.82%. There is a significant difference in the survival rate of catfish fingerlings between experimental groups. The highest survival rate was obtained in treatment C, which was 91%. In conclusion, the optimum dose of probiotics addition for sangkuriang catfish culture was 15 ml/L.



## INTRODUCTION

The dense population and rapid development, especially in urban areas today, have led to high pollution levels in clean water sources. Starting from household activities and large industries such as factories that produce waste, it is also one of the causes of contamination of clean water sources, making it difficult to get good quality water. This will certainly affect production results in the fish farming sector, while currently, the market demand for aquacultured fish is getting higher, especially for catfish.

Catfish (*Clarias* sp.) is a freshwater fish currently widely cultivated; even almost all over Indonesia have produced this type of fish. This is because catfish is a leading commodity and has good market prospects. The advantages of catfish include having a fairly high nutritional content, economic value, fast growth, and easy maintenance (Prayogo et al., 2012). One type of catfish that is widely cultivated today is sangkuriang catfish. Sangkuriang catfish is the result of genetic improvement from African catfish through back-crossing between the second generation female parent (F2) and the sixth generation male parent (F6) African catfish. Sangkuriang catfish seeds have better growth characteristics than African catfish currently circulating in the market (Sunarma 2004).

According to Elumalai et al., (2002), probiotics are living microorganisms in fish farming that can prevent disease, increase production, and reduce economic losses. The application of probiotics in aquaculture systems plays an essential role in determining the success rate of aquaculture. Probiotics, when consumed by fish in adequate amounts, provide health benefits for fish that can reach the digestive tract and stay alive with the aim of improving fish health. Probiotics have antimicrobial effects and in the field of aquaculture aim to maintain microbial balance and control pathogens in the digestive tract. Currently, probiotics with several kinds of trade products for fish rearing are commercially available. The use of probiotics must be in accordance with both concentration and use. Therefore, it is necessary to conduct research on the effectiveness of several commercial probiotics in maintenance media on the survival and growth of catfish fry.

## METHODE

The study was conducted using an experimental method with a completely randomized design (CRD) consisting of four treatments and three replications. The treatment tested was the concentration of EM4 administration in the culture media. The treatment given in the experiment are as follows:
Treatment A: Control (not given probiotics)
Treatment B: Administration of probiotics with a concentration of 10 ml/L
Treatment C: Administration of probiotics with a concentration of 15 ml/L
Treatment D: Administration of probiotics with a concentration of 20 ml/L

*Observation Parameters:*

1. Specific growth rate

The growth of catfish can be seen from the addition of fish weight in each treatment which was weighed during the study. To calculate the daily growth rate of fish used the formula (Effendi 1997) as follows:

$$SGR = \frac{\ln Wt - \ln Wo}{T} x\ 100\%$$

Note:
SGR : Specific growth rate (%)
Wt : Final body weight
Wo : Initial body weight
T : time in days

2. Survival Rate

The survival rate (SR) of catfish was calculated using the Effendie (1997) formula, as follows:

SR=Nt/No X 100 %



Note:
SR : Survival rate (%)
Nt : Fish number day-t (fish)
No : Fish number day-0 (fish)

3. Water quality parameter

The water quality parameters observed in this study include temperature, pH, DO.

## Result and Discussion

### *Specific Growth Rate*

During the study, the weight and length of sangkuriang catfish seeds increased for each treatment. At the beginning of the study, the average weight of each seed in all treatments was 3.56 g/fish; after being reared for 40 days the weight increased to 6.92 g/fish, with a weight gain of 3.36 g/fish. The specific growth rate (SGR) of catfish weight ranges from 1.56 to 1.83%/day. The highest specific weight growth rate of catfish was obtained in treatment C, which was 1.83%, while the lowest growth rate of catfish specific weight was found in treatment A, which was 1.56%. The results of the calculation of the Analysis of Variance (ANOVA) showed that there was no significant difference (p>0.05) between treatments on the growth rate of catfish specific weight. The graph below shows catfish growth.

$$G = \frac{\ln Wt - \ln Wo}{T} x\ 100\%$$

$$G = \frac{\ln Wt - \ln Wo}{T} x\ 100\%$$

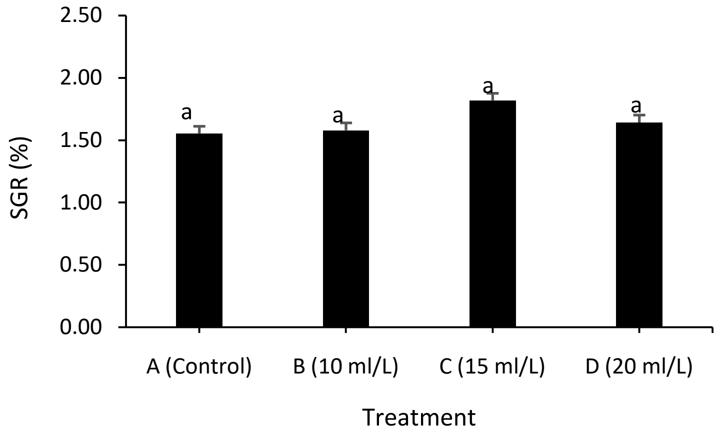


Figure 1. Variation of probiotic dosage on catsifh specific growth rate

The graph above shows that the growth rate of catfish was higher in treatment C with a probiotic dose of 15 ml/L. The high specific growth rate indicates that probiotic bacteria can work optimally both in improving water quality and also in the digestive tract of fish. In the graph above, it can be seen that treatment C with the addition of a probiotic dose of 15 ml/L resulted in the highest specific growth rate in this study compared to other treatments. The growth rate in treatment A had a relatively low growth among other treatments. This is most likely because treatment A lacks bacteria due to the absence of probiotics, which results in no rise in digestive enzymes. The growth of catfish in treatment D was lower than in treatment C. This could be due to the fact that the dose of bacteria was higher than that in treatment C, which was 20 ml/L. According to Aquarista et al., (2012) the content of bacteria that is too much can lead to competition between bacteria in the use of nutrients, so that it inhibits the performance of bacteria. Whereas in treatment B, with the addition of a probiotic dose of 10 ml/L, it was suspected that it was too little to increase the digestibility of catfish digestion. This indicates that the growth of catfish with the addition of probiotics in aquaponic system media has increased but not significantly. Compared to the addition of probiotics to the media, the growth of catfish weight was more significant if probiotics were added to the feed because the content of probiotics directly in the feed could cause high bacterial activity in the digestive tract and the content of probiotic bacteria in the feed could affect the growth rate of fish. Similar findings were reported on the survival and growth rate of Hybrid Tilapia (*Oreochromis* spp.) in biofloc systems using mixed probiotics (Zabidi et al., 2021). Research conducted by (Lili et al., 2018) showed that the addition of probiotics to feed could increase the growth of sangkuriang catfish.

*Survival Rate*

The results showed that the Survival rate of catfish ranged from 67 - 91%. The highest survival rate of catfish was obtained in treatment C of 91%, while the lowest survival of catfish was found in treatment D of 67%. The results of the calculation of the Analysis of Variance (ANOVA) showed that there was a significant difference ($p<0.05$) between treatments on the survival of catfish.

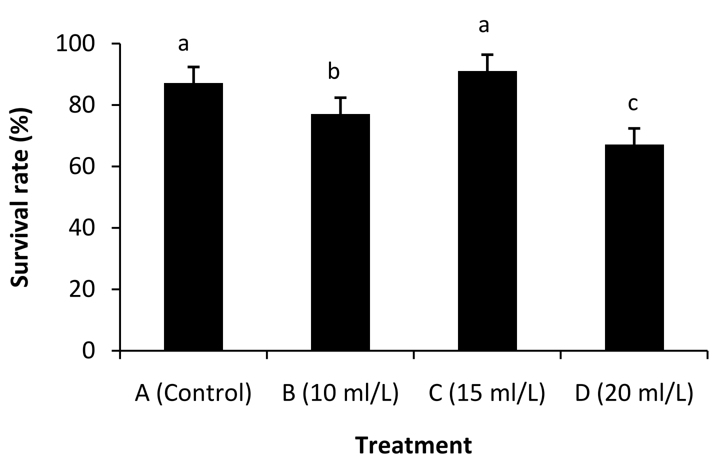

Figure 2. Variation of probiotic dosage on catsifh survival rate

The high survival rate in treatment C showed that the administration of probiotics at a dose of 15 ml/L was optimal in supporting the survival rate of catfish. Treatment D had the lowest survival rate in this study compared to other treatments. The low SR value of catfish in treatment D was due to fish death due to a drastic increase in ammonia levels in the 2nd week. In the 0th week, the ammonia concentration was 0.001 mg/L, but in the 2nd week, the ammonia level increased to 0.112 mg/L. The provision of probiotics with optimal concentrations can increase the survival rate of catfish. The provision of probiotics in treatment C provided the most appropriate media environmental conditions for catfish to produce the highest survival rate of all treatments. One of the reasons for this is the low level of ammonia in the C treatment media. This is also in accordance with the statement of (Setijaningsih and Suryaningrum, (2015), which states that the rearing media supports creating a suitable environment for fish growth, thereby making weight gain and high survival. Based on Primashita et al., (2017) research, optimal probiotic administration can result in high survival in catfish.

## *Water Quality*

Based on the results of water temperature measurements during the study, values ranged from 25, 6℃ - 28.8℃. Changes in temperature during the study can be seen in Figure 3.

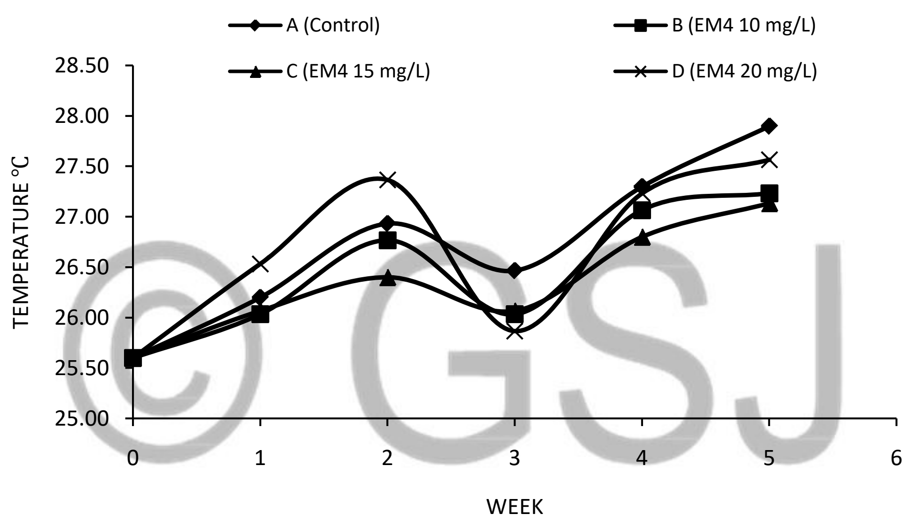


Figure 3. Variation of temperature during study

Referring to SNI, the optimal and good temperature for catfish rearing is in the range of 25 - 30℃. Based on the observations, the water temperature of the catfish rearing media is still in normal condition with a range that can still be tolerated by catfish. Temperature also affects the level of ammonia contained in the water of fish rearing media because if the temperature rises, the consumption of oxygen in the water will increase so that every organism that needs oxygen will also compete for its survival. Lucas (2002) stated that the optimum media temperature affects the performance of digestive enzymes and effective metabolism. High feed consumption accompanied by effective digestion and metabolism processes will produce optimal energy for growth (Zidni et al., 2013). Zahidah et al., (2015) stated that the optimum temperature during the study would affect the activity of bacteria, namely Nitrobacter and Nitrosomonas, so that the role of bacteria in increasing plant productivity will run well.

**Degree of Acidity (pH)**

Measurement of the degree of acidity (pH) during the study showed a range between 6.83 – 7.74. The value of the pH range during the study still met the appropriate range for catfish, which ranged from 6-9 (Khairuman and Amri 2003). A pH concentration above 9.2 or less than 4.8 can result in a decrease in reproductive ability, fish growth, and even death in fish. The pH value of the water will affect the oxidation process of organic matter, phytoremediation processes, and plant growth (Effendi et al., 2015). The optimum pH range of water for the nitrification process is 7-8 because nitrifying bacteria can grow optimally (Zidni et al., 2019). Changes in pH values during the study can be seen in Figure 4.

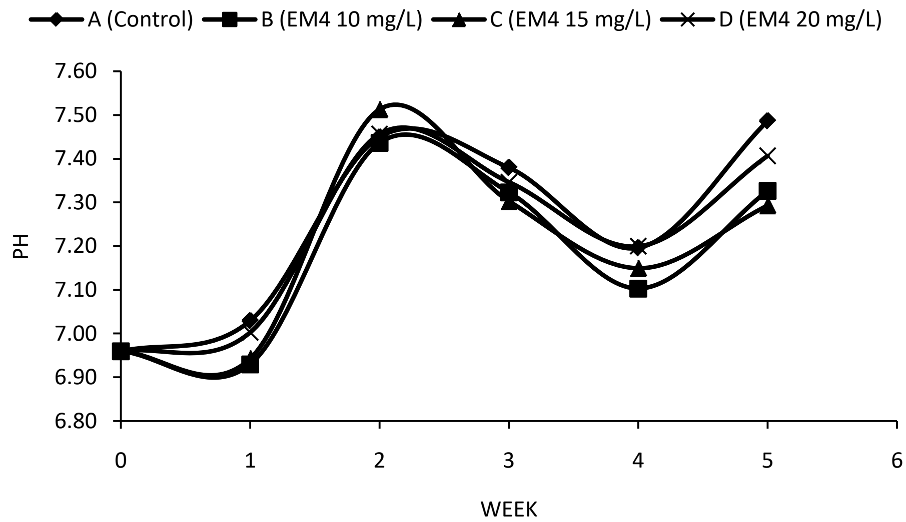


Figure 4. Variation of pH during study

Figure 4 shows a decrease in the pH concentration for each observation. The decline in pH at each observation was thought to be due to the release and uptake of carbon dioxide (CO2) by organisms in the rearing medium. Molleda et al. (2007) stated that the decrease in pH occurred due to water quality degradation caused by leftover feed, feces, algae respiration, and increased CO2 in the water. The decrease in water pH during the study was still within the tolerance limit of catfish, so it did not affect the survival of catfish.

*Dissolved Oxygen*

The dissolved oxygen concentration ranged from 3.5 to 6.8 mg/L in the rearing tank. The optimum quality standard for dissolved oxygen in the water for catfish rearing is > 4 mg/L with a minimum value limit of 3 mg/L. Oxygen concentration < 4 mg/L, catfish can still survive because they have additional breathing apparatus to take oxygen from the air, but their appetite will begin to decrease, which causes fish growth to be slow, while dissolved oxygen < 1 mg/L can be toxic for most fish species (Kordi 2009). Changes in dissolved oxygen concentration during the study can be seen in Figure 5.

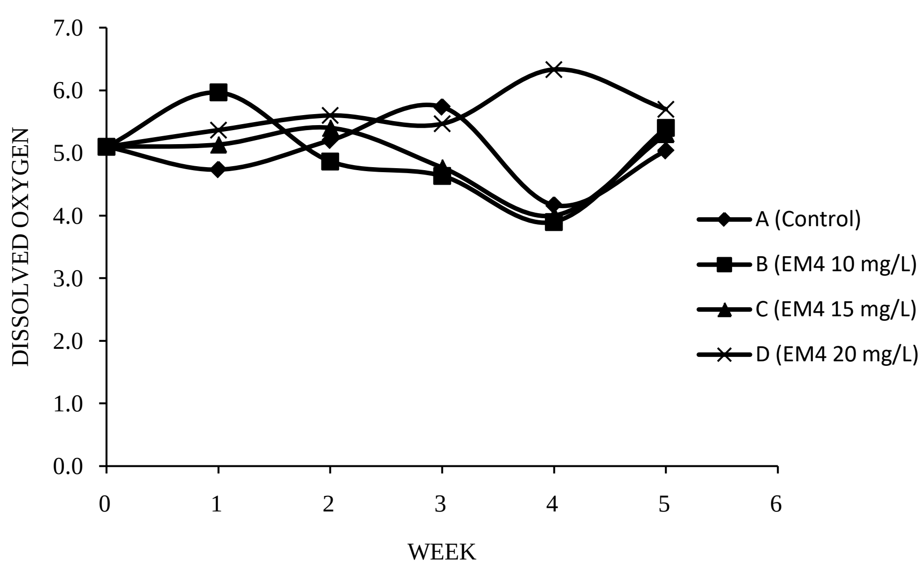


Figure 5. Variation of Dissolved oxygen during study

Observing dissolved oxygen concentration until the end of the observation did not experience a significant change. The addition of fish weight will also increase feed consumption so that feces and metabolic waste produced also increase. The need for oxygen by bacteria also increases in the oxidation process to decompose the waste produced by the catfish, resulting in a decrease in dissolved oxygen concentration at week 5 in the rearing medium. However, the decrease is still in an optimal state. According to Saptarini

(2010) that fish will compete with other fish for respiration; besides that fish will also compete with aerobic bacteria, so that this condition causes the concentration of dissolved oxygen in the pond to decrease drastically. In the aquaponic system, oxygen is also needed in the ammonification process because the ammonification process occurs under aerobic conditions, which requires oxygen in the reshuffle of organic N into total ammonia.

*Ammonia (NH3)*

The average concentration of ammonia in the study ranged from 0.001 mg/L -0.126 mg/L. Ammonia concentration fluctuates and is still within the safe limit for catfish rearing, and this is in accordance with the statement of BBPBAT (2005) that ammonia concentration in catfish rearing should be <0.5 mg/L. And according to Andriani et al., (2018) that the critical limit of fish to dissolved ammonia content is 0.6 mg/l. According to Hussain et al (2014) freshwater fish have a tolerance to ammonia concentrations up to 1.0 mg/L changes in ammonia concentration during the study can be seen in Figure 6.

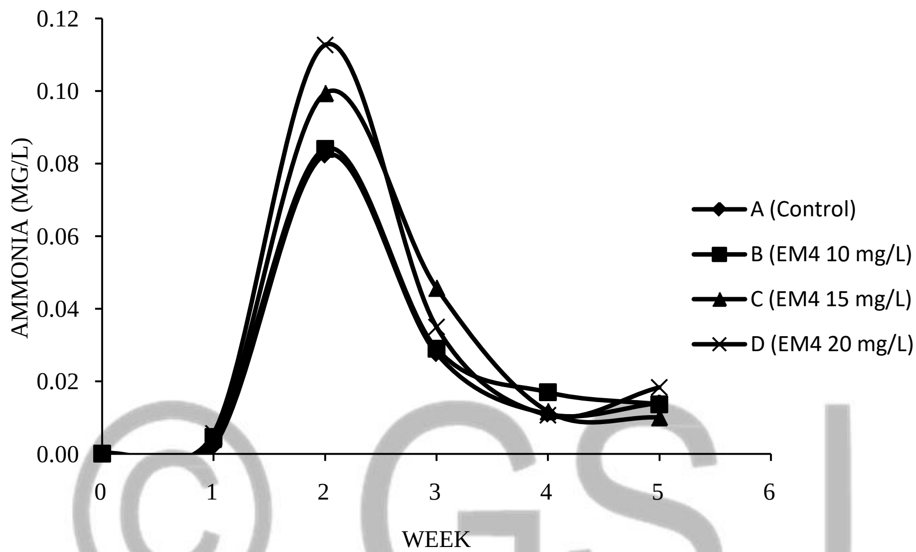


Figure 5. Variation of ammonia during study

Based on Figure 6, the ammonia concentration in the second week increased in all treatments. The increase in ammonia concentration is thought to be due to the increase in dissolved organic matter in the pond which comes from feed residues and fish metabolism products and is not completely oxidized by probiotic bacteria. Some of the feed given to fish is used for growth, but some will be excreted in the form of solid waste and dissolved ammonia ($NH_3$) in the water. The nitrification process by probiotic bacteria in the second week in catfish culture media has not run perfectly, resulting in a fairly high increase in ammonia. Fluctuations in ammonia concentration during the study were still lower than the tolerance limit for catfish. This shows that the addition of probiotics in culture media in an aquaponic system can reduce the concentration of ammonia from fish metabolism residues and also feed residues. Observations at weeks 3-5 ammonia concentrations decreased in all treatments. However, the D treatment had higher ammonia levels than the other treatments. The treatment of D ammonia tends to have higher levels of ammonia, and this is due to the accumulation of ammonia due to feed residues and metabolic wastes that are not completely oxidized by decomposing bacteria. This can be caused by the addition of a dose of probiotics that is too high, causing the decomposer bacteria to experience competition for life because the number of bacteria is too dense, causing the decomposition process of ammonia concentration to be less than optimal.

## Conclusion

The administration of probiotics at a dose of 15 ml/L in a culture media provided suitable environmental conditions for catfish cultivation to produce the highest survival value of 91% and the highest growth rate of 1.83%/day.

## Acknowledgment

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