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INCREASING GROWTH OF TILAPIA FISH (*Oreochromis niloticus*) USING PROBIOTICS FROM LOCAL RAW MATERIALS

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ABSTRACT

Tilapia (*Oreochromis niloticus*) is one of the freshwater fishery products that people are interested in. One of the obstacles faced is the growth of tilapia which is less than optimal so it is necessary to optimize it by giving probiotics to the feed to increase the digestibility and nutritional content of the feed. The purpose of this study was to determine the use of probiotics with local ingredients to increase the growth and survival rate of tilapia (*Oreochromis niloticus*) seeds. The research used a completely randomized design (CRD) method with 3 treatments and one control, each treatment had 3 replications with a tilapia density of 10 fish/10 liters measuring 3-5 cm long. Dosage of probiotic treatment A (2 ml/10gr), B (4 ml/10gr), C (6 ml/10 gr), and Control (0 ml). The results showed that each treatment had a significant difference in growth and survival rates. Treatment C was the best treatment with a growth of 3.62 gr, and a daily growth rate of 0.126 gr. The survival of tilapia seeds in the treatment and control was 100%. The water quality during the study was within a reasonable range for the life of tilapia.

KEYWORDS : Tilapia (*Oreochromis niloticus*), Probiotics, Feed, Banana fronds.

INTRODUCTION

Tilapia (*Oreochromis niloticus*) is one of the freshwater fishery products that people are interested in. The advantages of tilapia are that it has a special taste, dense flesh, is easy to serve, doesn't have a lot of spines, and the cost is relatively cheap. Tilapia meat contains 17.5% protein, 4.7% fat and 74.8% water (Yans, 2005). Tilapia is included in the type of fish that can be used as a business because it has a promising selling value and a large number of enthusiasts, because the cost is relatively affordable and easily available in various regions in Indonesia (Salsabila and Suprapto, 2018).

Tilapia has a great tolerance for its environment, namely the salinity is high enough so that tilapia can be found living and breeding both in fresh water and ponds. Tilapia has several advantages when compared to other fish, namely easy to maintain in various maintenance media, easy reproduction or nurseries, reproduces every month, has high resistance to extreme areas and has high economic and nutritional value (Sutanto, 2011).

Feed is one of the main aspects that affect the development and survival of cultivated fish, for this reason it is necessary to simplify the use of feed in aquaculture to maximize production. The feed given is expected to have a very large influence in producing a larger fish biomass (Akbar et al., 2021). One aspect that affects the continuity of activities and production of fish farming is feed, which is about 70% of production costs used for feed production. Therefore, alternative feeds are needed from local raw materials to save production costs by recycling household waste (Nahak *et al.*, 2020).

Local raw materials can be interpreted as basic materials that can come from various places, which can be used to be processed with certain processes into other forms that are different from their original forms, such as processed banana fronds, yeast, yakult, turmeric, fine bran, and molasses. into fishery products in the form of probiotics that can increase the growth and survival rate of fish (Arsyad *et al.*, 2015).

The use of probiotics is very important in aquaculture activities, but the amount of use of probiotics must also be considered because excessive use of probiotics can increase mortality or death rates in fish (Sumule *et al.*, 2017). The purpose of using probiotics is to improve and maintain the environment, suppress harmful bacteria, produce enzymes that help the digestive system, produce beneficial nutrients and increase the immunity of shrimp or fish (Irianto, 2003).

According to Mulyani *et al.*, (2021), probiotics are additives in feed that have several bacteria (microbes) that are beneficial for the health and growth of fish and can improve the balance of intestinal microflora. Probiotics function to improve digestion, increase appetite in fish and increase immunity from disease, thereby reducing the mortality rate in cultivated fish.

The purpose of using probiotics made from local ingredients is to increase the growth and survival of tilapia (*Oreochromis niloticus*). The application of probiotics made from local ingredients such as banana stems is expected to be a recommendation for tilapia farmers to increase their production at a more affordable cost so that their profits will increase.

MATERIALS AND METHODS

The fish used was tilapia (*Oreochromis niloticus*) with a length of between 3-5 cm which was cultivated for 1 month. The materials used in this study are as follows: Aquarium, ruler, digital scales, aerator, Scoop net, bucket, filter, thermometer, pH meter, stationery, camera, sprayer while the materials used include: tilapia fish seeds, banana fronds , yakult, yeast, water, molasses/molasses, turmeric, and rice bran.

The method used was a completely randomized design (CRD) with 3 treatments and one control, each treatment had 3 replications, each consisting of 10 tilapia.
A : Addition of local raw material probiotics at a dose of 2 mL/10 gr
B : Add local probiotics at a dose of 4 mL/10 gr
C : Add local probiotics at a dose of 6 mL/10 gr
K : Fish feed without the addition of probiotics

Giving probiotics is carried out using the probiotic combination method into fish feed by spraying it on fish feed that has been mashed according to the mouth openings of the fish being kept. The feed used is 5% of the weight of the fish biomass that is kept (Arsyad *et al.*, 2015).

DATA COLLECTION

Identification and isolation of probiotics in banana fronds was carried out using a series of tests for total bacteria, lactic acid bacteria, and Lactobacillus sp tests, while bacterial isolation used the pouring method (Pour Plate), Spread Plate technique (scattering cup) and media dilution technique (Kartika *et al.* , 2015).

DATA ANALYSIS

Data analysis was performed by measuring absolute weight growth, absolute length growth, specific daily growth rate, fish survival rate, feed conversion ratio and feed efficiency.

Absolute Weight Growth

Fish weight growth is calculated using the formula Effendi (2002) as follows:

$W = W_t - W_o$

Information :
W = Absolute growth (gr)
W_t = Body weight of the tested fish at the end of the study (gr)
W_o = Body weight of the test fish at the beginning of the study (gr)

Absolute Length Growth

Absolute length growth is calculated by the formula (Zonneveld *et al.*, 1991):

$L = L_{T-Lo}$

Information:
P = Length gain (cm)
L_T = Length of test individual at the end of maintenance (cm)
L_o = Length of test individual at start of maintenance (cm)

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***Specific Growth Rate*SGR)**

Specific growth rate(SGR) is calculated by the formula (Zonneveld *et al.,* 1991):

$$SGR = \frac{\text{In Wt} - \text{In Wo}}{T} \text{x100\%}$$

Information :
SGR = Specific daily growth rate (%)
Wt = average weight of fish at the end of rearing (g/head)
Wo = average weight of fish at the start of rearing (g/head)
T = Maintenance time (days)

***Feed Conversion Ratio* (FCR)**

Feed conversion is calculated using the Djajasawaka formula (1985), namely:

$$FCR = \frac{F}{(Wt + D) - Wow}$$

Information :
FCR = Feed Conversion Ratio
Wo = Weight of test fish at the beginning of the study (gr)
Wt = Weight of test fish at the end of the study (gr)
D = Number of dead fish (gr)
F = Amount of Pakam consumed (gr)

Feed Efficiency

Feed efficiency is calculated using the formula according to NRC (1997), namely:

$$EP = \frac{(Wt + D) - Wo}{F} \text{ x 100 \%}$$

Information :
EP = Feed efficiency (gr)
Wt = Fish weight at the end of the study (gr)
D = Number of dead fish (gr)
Wow = Weight initial fish research (gr)
F = Amount total feed consumed (gr)

***Survival Rate*(SR)**

(Muchlisin *et al.*, 2016) states that survival rates can be calculated using the formula:

$$SR = \frac{Nt}{No} \text{x100\%}$$

Information :
SR = Survival rate / survival (%)
NT = Seeds at the end of the study (tail)
NO = Seeds at the start of the study (tail)

Water quality

Water quality parameters observed once a week included dissolved oxygen, BOD, NH3, NO3, and DO. Meanwhile, observations of temperature and pH were carried out every day and the observation time was at 08.00 and 16.00 WIB.

RESULTS AND DISCUSSION

Absolute Individual Weight Growth (gram

The application of probiotics with different doses through feed gave different results between treatment A (2 ml/10 g) with an average of 1.71 g, followed by treatment B (4 ml/10 g) with an average of 3.02 g, treatment C (6 ml/10 gr) with an average of 3.62 gr and Control (0 ml) with an average of 0.61 gr as presented in Figure 1 as follows:

Figure 1. Absolute Individual Weight Growth of Tilapia (*Oreochromis niloticus*)

Based on Figure 1 above, it shows that in treatment C with a dose of 6 ml/10 g showed the highest absolute growth, this was due to the high level of feed digestibility due to the activity of the probiotic bacteria Lactobacillus sp which contains protease enzymes which can simplify complex proteins into complex proteins. simpler so that it is easily absorbed by the intestines of tilapia (Arsyad *et al.*, 2015). Bacteria *Lactobacillus sp*. also produces lactic acid from sugar and other carbohydrates produced by photosynthetic bacteria and yeast (Fadhilah, et.al., 2012). Atlas and Richard (1993) explained that high bacterial density causes competition in taking high substrates or nutrients so that bacterial activity becomes inhibited.

Based on the results of The Normality test using The Shapiro-Wilk test on absolute individual weight growth data (grams) which has been carried out, it yields Sig 0.363 > 0.05, this shows that the data is normal. Then a homogeneity test was carried out with the result of 0.72 > 0.05, which means that it has the same variety of data (homogeneous data). Then proceed with the ANOVA test to obtain Sig 0.000 <0.05, which means that the treatment has a significant effect on the absolute weight gain of tilapia (*Oreochromis niloticus*) seeds. The next test used Duncan's Multiple Region Test to obtain the best results from the applied treatment. Based on the graph above it shows that treatment C got the best results on absolute individual weight growth of tilapia (*Oreochromis niloticus*).

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Daily Growth Rate

The daily growth rate of tilapia (*Oreochromis niloticus*) seeds cultured with different doses of probiotics can be seen in Figure 2:

Figure 2. Daily Growth Rate of Tilapia (*Oreochromis niloticus*)

The daily growth rate of tilapia (*Oreochromis niloticus*) seeds by administering local raw material probiotics through feed with different doses showed the highest average daily growth weight of tilapia was shown in treatment C (6 ml/10 g) 0.126%, followed by treatment B (4 ml/10 gr) worth 0.104%, then treatment A (2 ml/10 ml) worth 0.064% and K (0 ml) with a value of 0.018%.

The highest growth of tilapia was in treatment C with a dose of 6 ml/10 g which showed the active role of bacteria in the digestive tract. Bacteria in probiotics, namely *Lactobacillus sp* and yeast (yeast) will move when they enter the digestive tract, namely by growing and then colonizing. *Lactobacillus* will convert carbohydrates into lactic acid, then lactic acid can create a lower pH atmosphere. The acidic atmosphere in the intestine will increase the secretion of proteolytic enzymes (feed digestibility) in the digestive tract and break down proteins into amino acids that are easily absorbed more quickly by the intestine (Mulyadi, 2011). *Lactobacillus* has the ability to inhibit pathogenic bacteria and spoilage bacteria (Arief *et al.*, 2014).

In accordance with the results of the normality and homogeneity tests, it shows that the data is normal with a value of Sig 0.463 > 0.05 and has the same variety of data (homogeneous data) with a value of Sig 1.000 > 0.05 while in the Sig = 0.014 Test of Variety (ANOVA) which means means that it has a significant effect on the daily growth rate of tilapia (*Oreochromis niloticus*) seeds. Subsequent tests were carried out using Duncan's Multiple Region Test to determine the best results on the daily growth rate of tilapia (*Oreochromis niloticus*) seeds and the best results for C treatment.

Absolute Length Growth

Absolute length growth (cm) of tilapia (*Oreochromis niloticus*) seeds reared by the application of local raw material probiotics through feed with different doses, this can be seen in Figure 3.

Figure 3. Absolute Length Growth of Tilapia (*Oreochromis niloticus*)

Based on the normality test that has been carried out, it shows that the Shapiro-Wilk Test Sig 1.000 > 0.05, this shows that the data is normally distributed. Furthermore, testing with a homogeneity test results with a value of Sig 0.330 > 0.05, which means that it has the same variety of data (homogeneous data). Then proceed with the test of variance (ANOVA) to get a result of 0.000 <0.05, which means that it is significantly different from the absolute length growth of tilapia (*Oreochromis niloticus*) seeds. Meanwhile, Duncan's area test showed that the best results were found in treatment C.

Feed Conversion Ratio (FCR) and Feed Efficiency (EP)

Feed conversion ratio (FCR) and feed efficiency (EP) in tilapia (*Oreochromis niloticus*) seeds cultured with the application of local raw material probiotics through feed with different doses, can be seen in Figure 4.

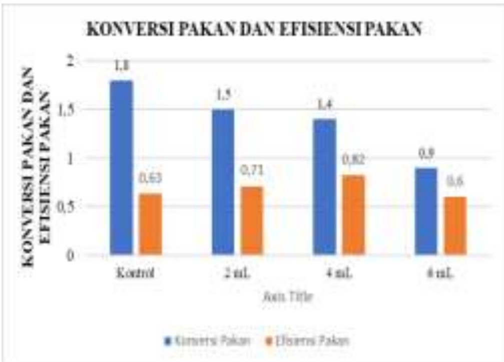

Figure 4. Feed Conversion Ratio (FCR) and Feed Efficiency (EP)
Tilapia (*Oreochromi niloticus*)

Based on the picture above, the value of the highest feed conversion ratio was obtained in the K treatment (0 ml) 1.6; A (2 ml/10 gr) 1.5; B (4 ml/10 gr) 1.4; and C (6 ml/10 gr) 1.2. While the highest feed efficiency was found in treatment C (6 ml) 0.82 followed by treatment B (4 ml) 0.71 and A (0.63) and K (0 ml) 0.60. Based on these results it can be seen that the lower the feed conversion the higher the feed efficiency, and this shows that the value of feed efficiency is related to the growth rate because the higher the growth rate, the greater the body weight gain of the fish and the greater the value of feed efficiency.

According to Arsyad *et al.*, (2015), the value of the feed conversion ratio is influenced by feed protein, and feed protein that matches the nutritional needs of fish makes feed more efficient. Another influencing factor is the amount of feed given, namely the less feed given, the better the feeding. This is because the amount of feed that must be given by farmers to achieve a certain weight in the commodity being cultivated will decrease, thus affecting production costs. Based on the results obtained, it is suspected that the quality of the feed given is influenced by the presence of banana stem probiotic bacteria which is mixed in the feed which then enters the digestive tract and suppresses pathogenic bacteria in the intestine so that it can help the feed absorption process more quickly.

Survival Rate

The survival rate (%) of tilapia (*Oreochromis niloticus*) seeds cultivated with different doses of probiotics can be seen in Figure 5.

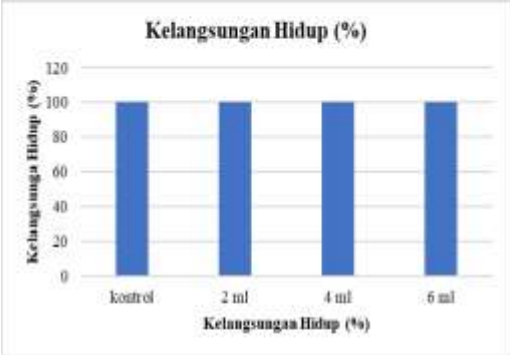

Figure 5. Survival Rate of Tilapia (*Oreochromis niloticus*)

The survival rate or survival rate (SR) is an indicator of the survival of a type of fish during cultivation, from the time the fish are stocked until the fish are harvested. During the study there were no deaths in tilapia (*Oreochromis niloticus*) cultivation, this was because the feed given was sufficient and the quality of the aquaculture water supported the life of tilapia (*Oreochromis niloticus*) seeds 100%.

Water quality

The results of water quality measurements during rearing of tilapia (*Oreochromis niloticus*) seeds showed that the range obtained was still in the good range for the life of tilapia (*Oreochromis niloticus*) seeds. Temperatures range from 25°C - 28°C and are still categorized as good according to the opinion of Monalisa (2010), that a good temperature range for tilapia cultivation is 25°C - 30°C.

The degree of acidity or pH in waters is the high concentration of hydrogen ions contained in these waters, in natural waters the pH value ranges from 4 – 9, this is caused by acidic chemical compounds and CO2. If a waters have a pH below 4 or above 11, there will be mass death of aquatic biota in these waters. While the pH during the study ranged from 7.2 to 8.4, and can be categorized as good for cultivation activities, because it is still in the ideal category. Tilapia can grow well in the range of pH 6.5 - 9 (Arie, 1998).

Dissolved oxygen (DO) is one of the most important water quality parameters when conducting aquaculture activities, but the dissolved oxygen concentration value can change at any time. Dissolved oxygen in waters or cultivation media comes from oxygen diffusion and the process of photosynthesis of chlorophyll biota found in the waters. Dissolved oxygen (DO) measured ranges from 5.2 ppm - 6.1 ppm and is still categorized as good because it is in accordance with the opinion of Monalisa (2010) that the minimum dissolved oxygen (DO) for aquaculture activities is 3 ppm - 5 ppm.

There are 2 types of ammonia in the waters, namely (NH_3 and NH_4), ammonium (NH_4) can be ionized while free ammonia (NH_3) cannot be ionized. Free ammonia is toxic to aquatic organisms, if the free ammonia content in the waters is too high it can result in the death of biota, because ammonia will interfere with the process of transporting oxygen by the blood resulting in obstruction of the respiratory tract (suffocation). The lowest ammonia obtained was in treatment C (0.086 ppm), B (0.162 ppm), A (0.668 ppm), and Control (0.708). Based on the results obtained, giving probiotics to feed is beneficial in reducing the ammonia content in leftover feed,

According to PP water quality standards. No. 82 of 2001 (class II), the BOD value for aquaculture activities ranges from <3 mg/L, while the results obtained range from 0 – 3.25 mg/L. A high BOD value indicates that the amount of oxygen needed by microorganisms to oxidize organic matter in the water is high, and this means that there is already an oxygen deficit in the water. The number of microorganisms that grow in water is due to the large amount of organic matter in the water.

Identification and Isolation of Banana Stem Probiotic Bacteria

The results of identification and isolation of lactic acid bacteria in banana stem probiotics will be seen after 24-48 hours of incubation. If the result is positive, it means that it contains lactic acid bacteria, then the agar media will change its color to bright yellow, because there is a change in the color of the BCP indicator from purple to yellow at low pH, whereas if there is no change in color to yellow, this indicates a negative result and there are no bacteria. lactic acid in it (Fardiaz, 1993).

Lactic acid bacteria are a type of bacteria capable of producing lactic acid, hydrogen peroxide, anti-microbials and other metabolites that provide beneficial effects on the body of fish. According to Djide and Wahyuddin (2008), selection or isolation of lactic acid bacteria is characterized by the formation of a clear zone around the colony after 2-3 days of incubation. This is because lactic acid bacteria produce lactic acid which reacts with CaCO3. Isolation of probiotic bacteria from banana fronds was also carried out on MRSA-BCP media. This ensures the presence of lactic acid bacteria colonies in banana probiotics. The results of the isolation of the MRSA-BCP media showed a change in the color of the media from bluish purple to clear. This indicates the presence of lactic acid bacteria that successfully grow on the media. Probiotics containing *Lactobacillus sp* bacteria and lactic acid bacteria can increase the number of bacteria that enter the digestive tract and can reduce the number of pathogenic bacteria. Banana stem probiotics can also increase fish growth, inhibit the growth of pathogens, improve nutrient digestion and improve water quality.

Conclusion

Probiotics containing *Lactobacillus sp* bacteria and lactic acid bacteria can increase the number of bacteria that enter the digestive tract and can reduce the number of pathogenic bacteria so that the application of probiotic treatment C (dose of 6 ml/10 g) gives the best results due to the high level of feed digestibility caused by the activity of probiotic bacteria *Lactobacillus sp.*

Suggestion

Based on the results obtained, it is recommended for tilapia seed cultivators (*Oreochromis niloticus*) to add probiotics to the feed by spraying it at a dose of 6 ml/10 g, because it has the best effect on the growth and survival of tilapia.

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