Probiotic Effectiveness in Artificial Feed Predigest on The Rearing of Tilapia (*Oreochromis Niloticus*) Larvae

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Abstract- The main problem in the hatchery of tilapia (Oreochromis niloticus) is the low survival rate, especially in the larval to juvenile stages. One of the causes of the low survival rate is caused by the digestive organs of the larvae themselves which are still not perfect to digest the artificial feed given. This study aims to determine the optimum dose of the probiotic in rearing the best tilapia larvae. The study was carried out at the Aquatic UMK Fish Nursery Unit Widya, Tamalanrea, Makassar using a 30 L capacity green plastic basin filled with 25 L of media water. The test animals used were Tilapia larvae aged 7 days and kept for 30 days. The feed used was artificial feed in the form of powder and pellets mixed with probiotics. The study was designed using a completely randomized design consisting of 4 treatments with 3 replications each, thus this study consisted of 12 experimental units. The results of analysis of variance showed that the administration of the probiotic had a very significant effect ($p < 0.01$) on survival, daily growth rate, and stress resistance index of Tilapia larvae. The best survival and growth, and the best stress resistance index were produced at doses of 30 mg/100 g of feed by 79.77%, 14.37%/day, and 71.67, respectively.

Index Terms- growth, probiotic, stress resistance index, survival, tilapia larvae

I. INTRODUCTION

Tilapia is one type of fishery commodity with economic value, favored by the community because of its savory taste and nutritional value (Mapenzi and Mmochi, 2016; Nakkina, 2016; FAO, 2020). *Tilapia* has several advantages, among others: it has a fast growth rate and can reach a much larger body weight with a fairly high level of productivity. *Tilapia* fish also has a distinctive meat taste, the color of the meat is clean and white, without thorns with a fairly high nutritional content, so it is often used as a source of protein that is cheap and easy to obtain, and the selling price is affordable by the public (Hasyim et al., 2019; Mile et al., 2021). Judging from the productivity aspect, *Tilapia* is very potential and productive if it is cultivated in various fields, not only in lowland ponds but also in higher ponds.

The main problem in the development of *Tilapia* is the availability of seeds continuously and of good quality. Currently, efforts are being made to produce *Tilapia* seeds through hatcheries. However, the main problem faced in hatchery efforts is the low survival rate, especially in the larval phase (Jalaluddin, 2016). One of the causes of the low survival rate in larvae is that the digestive organs of the larvae themselves are still not perfect to digest the feed given. The larval phase is the most critical phase in the fish life cycle (Martinez et al., 2021). In general, the most suitable feed for larvae is natural food, but on a large scale, natural feed is not effective, so it needs to be substituted with artificial feed (Das et al., 2012; Kujawa et al., 2016). To make effective use of artificial feed for *Tilapia* larvae, it is necessary to predigest the artificial feed before giving it to the larvae.

Predigest is a simplification of feed nutrients from complex compounds to simpler ones, so that they can be maximally absorbed by larvae. Predigest artificial feed can be done using probiotics. Probiotics are additives that contain a number of bacteria (microbes) that can change the intestinal micro-colonies in such a way that beneficial microbes can thrive (Wuertz et al., 2021). Probiotics have the benefit of increasing appetite and spurring fish growth, increasing body resistance from virus and disease attacks, preventing stress and reducing mortality rates, eliminating bad odors in pond water, saving feed and accelerating the harvest period (Nai, 2015; Mesquita et al, 2021). Research on the use of probiotics in artificial feed predigest has been carried out on finned fish (Jahangiri and Esteban, 2018), vaname shrimp larvae (Ramadhani and Sukenda, 2019), sangkuriang catfish (Manoppo et al., 2019). The results of this study indicate that the use of probiotics in feed can increase the survival and growth of fish and shrimp larvae. However, the role of probiotics on *Tilapia* larvae is not known for certain. Based on the description above, in order to evaluate the effect of giving probiotics on survival, growth, stress resistance, and quality of tilapia larvae, it is necessary to conduct research on this matter.

The purpose of this study was to determine the optimum dose of probiotics that resulted in the best survival, growth, and stress resistance levels of *Tilapia* larvae.

II. RESEARCH METHODS

The research was carried out at the Widya Aquatic UMK Fish Nursery Unit, Tamalanrea Jaya District, Makassar City. The study used a container in the form of a black plastic basin with a

capacity of 30 L filled with 25 L of media water. The test animals to be used were *Tilapia* larvae aged 7 days with an initial weight of 0.05 ± 0.01 g with an initial length of 1.2 ± 0, 1 cm maintained for 30 days. The larvae were imported from a *Tilapia* hatchery in Yogyakarta.

The feed used is artificial feed in the form of powder and pellets. Feeding started on days 1 to 14 using MS Prima feed PF 0, and entering the 15th day until the end of the maintenance was given MS Prima Feed PF 500. The probiotic used was Bio-7 which was given by mixing it into the feed according to the treatment dose. Mixing is done by spraying probiotics into the feed. In order to maintain the root water quality is maintained according to the needs of the larvae, water changes are carried out. Water changes are carried out every day as much as 20% of the volume of media water.

The study was designed using a completely randomized design consisting of 4 treatments with 3 replications each, so that in this study there were 12 experimental units. The experiment that will be applied is the difference in the doses of the probiotic Bio-7 in rearing *Tilapia* larvae, namely doses of 0, 15, 30, and 45 mg/100 g of feed. The parameters studied were survival, growth, and the level of stress resistance of tilapia larvae. In addition, the water quality of the maintenance media was reduced, namely: temperature, pH, dissolved oxygen, and ammonia. The data obtained were analyzed using analysis of variance followed by further W-Tuckey test. To determine the evenness of the relationship as a treatment used regression analysis techniques. The water physicochemical data will be analyzed descriptively based on the viability of *Tilapia* larvae.

III. RESULTS AND DISCUSSION

Result

The average value of survival rate, growth, and level of stress resistance of *Tilapia* larvae fed with probiotics in artificial feed predigest is presented in Table 1.

Table 1. Survival, growth, and stress resistance of tilapia larvae fed various doses of probiotics in artificial feed predigest

Probiotic Dosage (mg/100 g Feed)	Survival Rate (%)	Growth		CSI
		Daily Weight (%/day)	Absolute Length(cm/tail)	
0	57.67 ± 4.48^{c}	13.25 ± 0.19^{c}	1.17 ± 0.06^{c}	95.33 ± 5.03^{a}
15	73.44 ± 0.84^{b}	13.68 ± 0.17^{b}	1.60 ± 0.26^{b}	79.33 ± 1.53^{b}
30	79.77 ± 0.19^{a}	14.37 ± 0.10^{a}	2.83 ± 0.06^{a}	71.67 ± 1.53^{c}
45	78.33 ± 0.67^{ab}	14.25 ± 0.09^{a}	2.67 ± 0.15^{a}	73.67 ± 2.08^{bc}

Note: different letters in the same column indicate significant differences significantly
Between treatments at the 5% level ($p < 0.05$)

The results of the analysis of variance showed that the administration of probiotics had a very significant effect ($p < 0.01$) on the survival, growth, and stress resistance of tilapia larvae.

The relationship between the dose of probiotic and survival, daily growth rate, absolute body length growth, and stress resistance level of tilapia larvae with a quaternary pattern is shown in Figures 1, 2, 3, and 4.

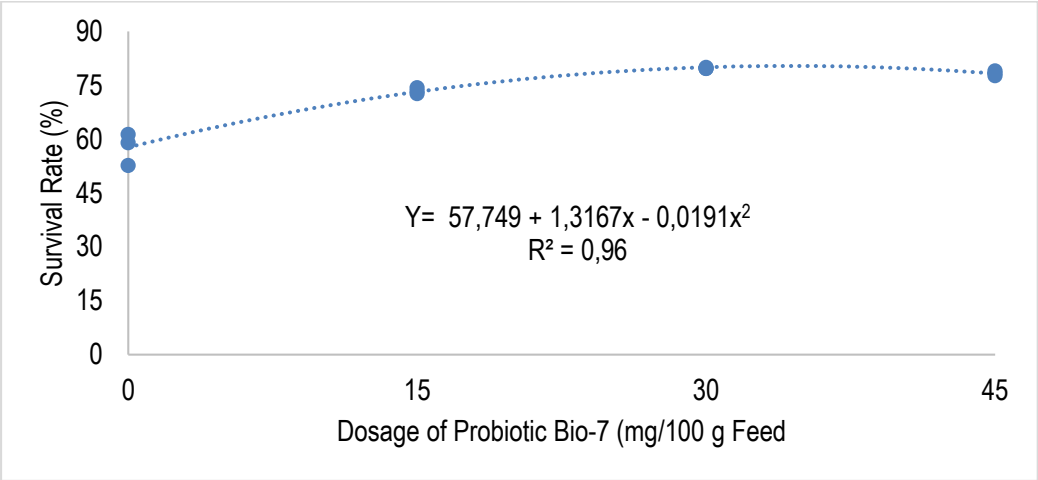

Figure 1. Curve of relationship between probiotic dose and larval survival rate of *Tilapia* larvae

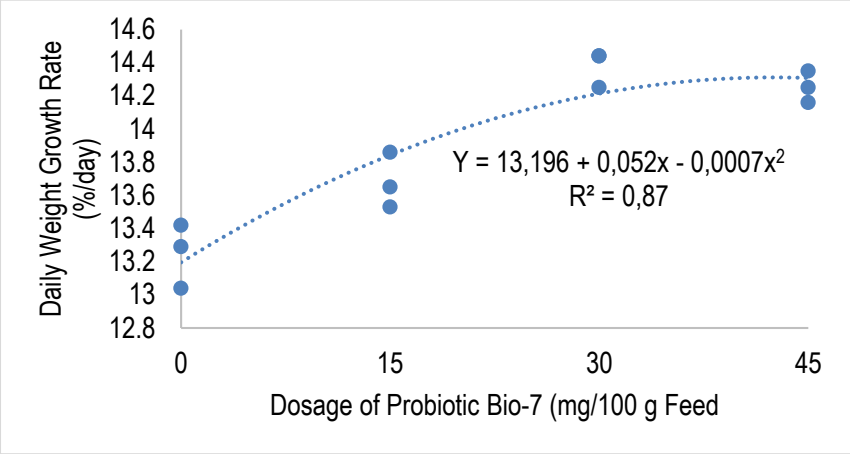

Figure 2. Curve of relationship between probiotic dose and growth rate of *Tilapia* larvae

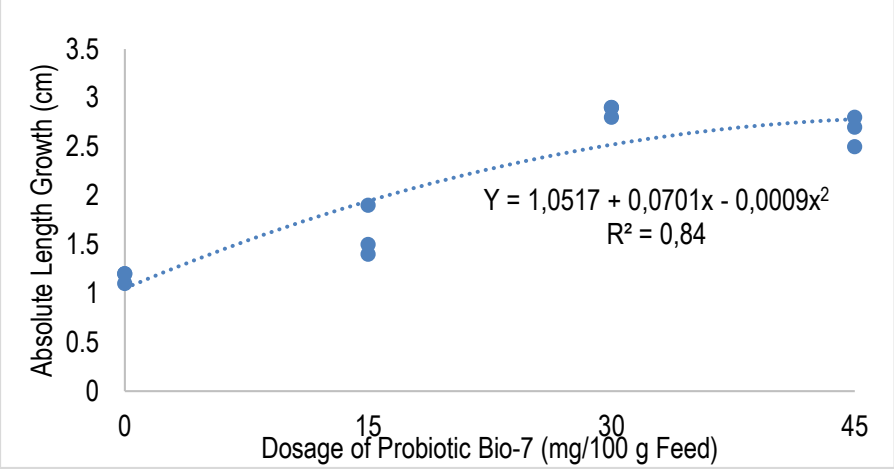

Figure 3. Curve of relationship between probiotic dose and growth length absolute *Tilapia* larvae

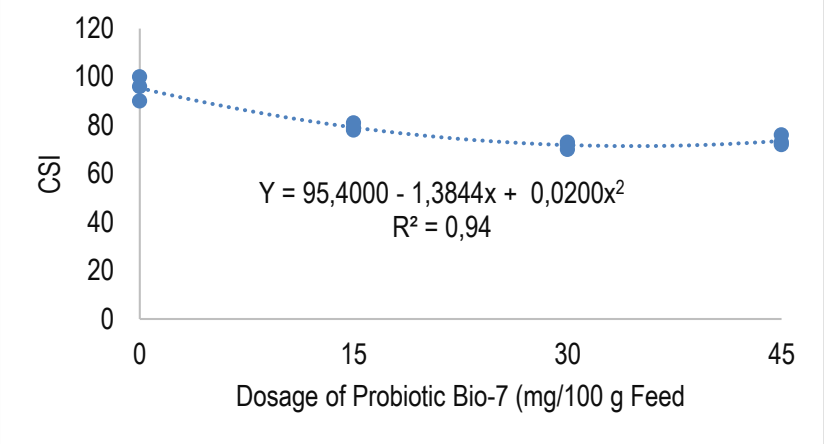

Figure 4. Curve of relationship between Bio-7 probiotic dose and CSI of *Tilapia* larvae

Based on the regression equation, it is predicted that the optimum probiotic dose for survival rate, daily weight growth rate, absolute length growth, and stress resistance level of *Tilapia* larvae were achieved at doses of 34.67; 37.14; 38.94; and 34.61 mg/100 g of feed.

As supporting data, during the research, measurements of several water quality parameters of the maintenance media were carried out as presented in Table 2 below.

Table 2. Range of water quality parameter values for tilapia larvae rearing media

Parameters	Value Range
Temperature (°C)	28-31
pH	7.2-7.8
Dissolved Oxygen (ppm)	4.0-5.1
Ammonia (ppm)	0.03-0.09

IV. Discussion

The use of artificial feed predigested with probiotics in this study showed a positive response to survival, growth rate, absolute growth in body length, and stress resistance of tilapia larvae with a certain dose compared to the use of unpredigested feed. This is due to the work of probiotics which can simplify the composition of the feed used. Predigestion using probiotics is an effort to simplify the nutritional content of feed before being given to larvae. Predigest feed using probiotics has been carried out by several previous researchers, namely (Lara-Flores, 2011; Arig et al., 2013; Abidi, 2014, Valipour et al., 2018; Borger et al., 2021) in that study showed that the use of probiotics in artificial feed predigest gave a significant effect on fish larvae.

Predigested feed is easier for fish to digest than unpredigested feed so that the energy needed by fish to digest food is less and the excess energy can be used to maintain fish life and growth. After predigestion, materials that most of the components are already in the form of simple compounds can be given as fish feed so that fish do not need to digest it anymore, but can already absorb it directly (Qazi et al., 2022; Herdiyanti et al., 2018).

Differences in survival, growth in weight and length, and levels of stress resistance between treatments can be influenced by the dose of probiotics given to the feed. Spraying probiotics on feed affects the speed of predigest feed in the digestive tract of larvae, thus helping the process of digestion and absorption of food essence. Predigest feed is able to break down complex compounds into simple ones so that they are ready for use by fish and a number of microorganisms are able to synthesize vitamins and amino acids needed by aquatic animal larvae (Sharma et al., 2020; Lein et al., 2022). The simpler form is expected to be more easily digested in the digestive tract and absorbed into the blood circulation even though the digestive organs of tilapia larvae are not yet perfect.

Probiotics are able to balance the digestive tract microbes so that they can increase the digestibility of fish by converting carbohydrates into lactic acid which can lower pH, thereby stimulating the production of endogenous enzymes to increase nutrient absorption, feed consumption, growth, and inhibit pathogenic organisms (Cauhan et al., 2018; Allameh et al., 2021). The results of this study showed that the administration of probiotics up to a dose of 30 mg/100 g of feed was able to increase survival, growth, and stress resistance. The high dose treatment (45 mg/100 g of feed) showed stagnant results in survival, growth and stress resistance of tilapia larvae even lower than the treatment (30 mg/100 g of feed) which was the best result. This is due to the imbalance between the bacteria that already exist in the digestive tract and the bacteria that enter. The concentration of bacteria required in the amount must be right. If the number of bacteria is too much it will cause overgrowth. High bacterial density causes competition for high substrate or nutrient uptake so that bacterial activity is inhibited. Too many bacteria cause bacteria to rapidly sporulate (form spores) so that the function and activity of bacteria is not optimal. Based on the regression equations (Figures 1, 2, 3, and 4) it can be predicted that the optimum probiotic dose for survival, daily weight growth rate, absolute length growth, and stress resistance level of *Tilapia* larvae were achieved at doses of 34.67; 37.14; 38.94; and 34.61 mg/100 g of feed.

Probiotic microbes are microbes that are safe and relatively beneficial in the digestive tract of fish, these microbes produce substances that are not harmful to fish but instead destroy pathogenic microbes that interfere with the digestive system so that fish will be healthy and avoid diseases that can reduce the percentage of survival rates. Energy derived from feed is used for basic life activities such as basal metabolism, growth, gamete production, movement, breathing, digesting feed, temperature regulation and after that energy is used to sustain life. The survival rate of fish is influenced by good aquaculture management, including stocking density, feed quality, water quality, parasites or diseases and feed that has good nutrition plays an important role in maintaining the survival rate of fish (Mannan et al., 2012; Sultana et al. ., 2018).

With the presence of probiotic bacteria in the feed which then enters the digestive tract of the fish, it is able to suppress the pathogenic bacteria in the intestines, thus helping the digestion of feed faster. If the presence of probiotic bacteria in the digestive system of fish is lacking, the feed consumed by fish cannot be utilized optimally. In order for feed to be utilized optimally, it requires bacterial activity in digestion that enters through feed which causes a balance in the number of bacteria in the intestine so that it can suppress pathogenic bacteria (Mannan et al., 2021; Ronnested et al., 2013). By suppressing pathogenic bacteria in the digestive system of fish, it will prevent fish from diseases that can cause stress and affect fish growth and survival rates.

The results of measurements of several water quality parameters of the maintenance media showed that the temperature values of the maintenance media were 28-31°C, pH 7.2-7.8, dissolved oxygen 4.0-5.1 ppm, and ammonia 0.03-0.09 ppm. The range of water quality parameter values is still in a reasonable range for tilapia larvae. According to Alfia et al. (2013) and Siniwoko (2013) that a good temperature for tilapia ranges from 25-30°C, pH 7.0-7.5 (Khairuman and Amri, 2013; Siniwoko, 2013), dissolved oxygen ranges from 4-7 ppm, and ammonia < 0.1 ppm water (Khairuman and Amri, 2013).

V. CONCLUSION

Based on the results of this study, it is concluded that the dose of probiotics in predigest artificial feed of 30 mg/100 g of feed resulted in survival, growth and stress resistance of 79.77%, 14.37%/day, 2.83 cm; and 71.67.

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