Original Research Article

Influence OF supplementing dietary HERBAL CONCENTRATIONS ON GROWTH AND SURVIVAL OF RED TILAPIA (*Oreochromis sp.*) JUVENILES

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ABSTRACT

This study aimed to determine and analyze the concentration of fish herbs optimal for growth and survival of red tilapia juveniles. The Complete Random Design (CRD) was used as the experimental study method with 5 treatments and 3 replications. The to the applied treatments as follows: A (control), B (concentration of fish herbs 25 ml Kg^{-1}), C (concentration of fish herbs 50 ml Kg^{-1}), D (concentration of fish herbs 75 ml Kg^{-1}), E (concentration of fish herbs 100 ml Kg^{-1}). Observed parameters were Specific Growth Rate (SGR), Feed Conversion Ratio (FCR), Protein Efficiency Ratio (PER), Survival Rate, and Water Quality. The results showed that highest SGR value were on treatment C (0,86%), treatment B (0,73%), treatment A (0,69%), Treatment D (0,68%), Treatment E (0,60%). The lowest FCR values were at treatment C (1,34), treatment B (1,56), treatment D (1,72), treatment A (1,79), treatment E (1,93). The highest PER value was on treatment C (0,54), treatment B (0,52), treatment D (0,44), treatment E (0,32). The optimum concentration of fish herbs for highest growth of red tilapia was 50 ml Kg^{-1} fish herbs concentration treatment . The study highlights the efficacy of "herbal" which is an ancient tradition, used in some parts of India. This ancient concept should be carefully evaluated in the light of modern medical science and can be utilized partially if found suitable.

Keywords: Red Tilapia, Herbs, Growth, FCR, SGR, PER

1. INTRODUCTION

Red tilapia which is currently widely developed in Indonesia is a tetrahibri tilapia which is the result of crossing four different species of the *Oreochromis genus*, namely *Oreochromis mossambicus*, *Oreochromis niloticus* (tilapia), *Oreochromis hornorum*, and Oreochromis aureus [1]. Red tilapia (*Oreochromis sp*) is one of the most popular inland fishery products because it has a shape that almost resembles red snapper, and the taste of the meat is not much different from that of red snapper.

Haetami et al [2] stated that feed is one component that reaches 60-70% of the total production cost and is one of the determinants of the success of aquaculture, which needs effective and efficient management. Feed quality is one of the main factors in determining the success rate of cultivation . If the quality of fish feed, the growth of fish will increase so that aquaculture production will also increase. To improve the quality of the feed, one way that can be done is by adding fish herbs to the feed.

Fish herbs are plant-based supplements that are beneficial for living organisms consumumption. This study used herbal supplements, namely turmeric, ginger, temulawak, kencur, noni, ketapang leaves, betel leaves and stems, molasses and yeast. The use of yeast (*Saccharomyces cereviceae*) in herbal medicine has a good impact on fish growth, because the nucleotide content in yeast can quickly repair intestinal damage and increase the flora of the intestinal mucosa [3]. Some of the other benefits obtained by giving herbal supplements include increasing the body's resistance to disease, launching the digestive system, saving on the use of feed, increasing fish appetite [4].

2. MATERIAL AND METHODS

2.1 Time and Place

The research was carried out from November to December 2020 at the Ciparanje Wet Laboratory and Experimental Pond, Faculty of Fisheries and Marine Sciences, Padjadjaran University, India.

2.2 Materials and Methods

2.2.1 Materials

The materials used in this research activity are as follows:

1. Juveniles of red tilapia as test fish were obtained from the stock of red tilapia at the Ciparanje Wet Laboratory and Experimental Pond, Faculty of Fisheries and Marine Sciences, Padjadjaran University. The fish used was 5-7 cm with a weight range of 4.00 – 5.00 g as many as apparently healty 300 fish.Commercial pellets PF^{-1}000 Prima Feed "Matahari Sakti" with a protein content of 40% as a test fish feed.Fish Herb

The tools used in this research are as follows:

Aquarium measuring 60×29.5×35.5 cm3 as many as 15 pieces as a container for rearing test fish

1. I-2000 digital scale with an accuracy of 0.01 mg totaling 1 piece to measure the weight of fish and feed.
2. Millimeter block for measuring fish body length
3. Each aeration hose and aeration stones are 15 pieces as oxygen supply in each aquarium
4. A Blender to smooth the ingredients for fish herbs.
5. A syringe (Syringe) with a volume of 5 ml for applying fish herbs to the feed.
6. Plastic zip lock as a feed storage container
7. DO meter to measure the dissolved oxygen content
8. pH meter to measure the acidity of the maintenance media water
9. Ammonia test kit to measure the value of ammonia in maintenance media
10. Thermometer for measuring the temperature of the maintenance medium
11. Stationery to record the results of observations and measurements
12. Documentation tool to document activities during research

2.3 Methods

This study used five levels of treatment with triplicates. The treatment that was tested was the difference in concentration of the mixture of fish herbs in commercial feed. The treatments tested in this study were:

1. Treatment A = Control ()
2. Treatment B = 25 ml kg^{-1} feed
3. Treatment C = 50 ml kg^{-1} feed
4. Treatment D = 75 ml kg^{-1} feed
5. Treatment E = 100 ml kg^{-1} feed

Mixing of fish herbs in the feed was carried out by dilution using water and sprayed on the feed using a syringe, then left for 12 hours at room temperature.

2.4 Research Procedure

2.4.1 Container Preparation

The container used is an aquarium measuring 60 x 29.5 x 35.5 cm^3. Preparation of the container begins with cleaning the aquarium of dirt or crust attached to the walls and bottom using soap. After the aquarium is clean, check for leaks and then dry in the sun. Furthermore, the tub and aquarium were disinfected using a solution of Potassium Permanganate (PK) for about 24 hours, then filled with water with a volume of 40 liters and supported with sufficient aeration. The aquarium can be used after one day of water filling.

2.4.2 Pemeliharaan Ikan Uji

The test fish used were tilapia with a length of about 5 - 6 cm and a weight between 2.85 - 3.00 g stocked in 20 fish / aquarium. The tilapia was obtained from tilapia stock in the Ciparanje Wet Laboratory and Experimental Pond. After acclimatization, the tilapia were stocked in the aquarium. Furthermore, tilapia were feed twice daily on commercial feed with 3% of body weight, at 08.00 am and 16.00.pm.

2.4.3 Making Fish Herb

The composition in making this herbal supplement is 1 kg of turmeric, 1 kg of ginger, 1 kg of ginger, 1 kg of *kencur*, 1 kg of noni, 30 pieces of dried *ketapang* leaves, 250 g of betel leaf and stalk, 14 g of yeast (*Saccharomyces cereviceae*), 1 liter of molasses. , and 1000 ml of water. The turmeric, *kencur*, *temulawak*, noni, ginger, and *ketapang* leaves are mashed then transferred to a 30 liter capacity container and added molasses and yeast a little by little while stirring until evenly distributed and slowly adding 30 liters of water while stirring until evenly distributed.The mixture is then stored in tightly sealed jars for 10 days for further use. This is so that the yeast (*Saccharomyces cereviceae*) breeds. The lid of the container is opened once or twice a day to release the fermented gas, then closed and stored again [4]. On the 11th day, this herbal supplement can be used to ferment the feed that will be given to tilapia.

2.4.4 Feed Preparation

Fish herbs that have been prepared previously, mixed with water as a solvent in a ratio of 50 ml of fish herbs + 300 ml of water for 1 Kg of feed. As for the mixing according to the treatment, the amount of the fish herbal mixture was adjusted according to the treatment given. The application of the herbal solution to the feed was carried out with a syringe and sprayed evenly, then allowed to stand for 12 hours at room temperature. Then the Feed ready to be used as an experimental diet.

2.5 Research Method

2.5.1 Red Tilapia Juveniles Growth

2.5.1.1 SGR (Specific Growth Rate)

The daily specific growth rate is calculated based on the formula according to [5] namely:

$$SGR = \frac{Ln(Wt) - Ln(W_0)}{T} x\ 100\%$$

where:
SGR = Daily growth rate (% day^{-1})
Wt = Weight of test animals at the end of the study (g)
Wo = Weight of test animals at the beginning of the study (g)
T = Length of study (days)

2.5.1.2 FCR (Feed Conversion Ratio)

Feed conversion is calculated by the following formula according to [6]:

$$FCR = \frac{F}{((Wt+D) - W0}$$

where
FCR = Feed Conversion Ratio.
Wo = Weight of test animals at the beginning of the study (g)
Wt = Weight of test animals at the end of the study (g)
D = Number of dead fish
F = Amount of feed consumed (g)

2.5.1.3 PER (Protein Efficiency Ratio)

Calculation of Protein Efficiency Ratio is carried out to determine the level of utilization of protein in the feed by fish. PER calculation uses the following formula [7]:

$$PER = \frac{Wt - W0}{Pi}$$

Description:
PER = Protein Efficiency Ratio (%)
Wt = Biomass of test fish at the end of the study (g)
W0 = Biomass of test fish at the beginning of the study (g)
Pi = Weight of protein consumed, derived from protein content in feed (g)

2.5.1.4 SR (Survival Ratio)

The percentage of survival rate of the test fish can be calculated using the formula according to [8], namely:

$$PER = \frac{Nt}{N0}\ x\ 100\%$$

Description:
SR = Survival Rate of Test Fish (%)
Nt = Number of live fish at the end of the study
No = Number of Living Fish at the Beginning of the Study

2.5.2 Water Parameters

The water quality data parameters measured are as follows:

Table 1. Observed water quality

No	Parameter	Unit	Measuring instrument
1	Temperature	°C	Thermometer
2	Dissolved Oxygen	mgL^{-1}	DO Meter
3	pH	-	pH Meter
4	Ammonia	mgL^{-1}	Ammonia test kit

2.6 Data Analysis

Data in the form of percentages include survival rates and daily growth rates. The data obtained in the form of an increase in length and weight were then analyzed for variance (F test) at the 95% confidence level to see the effect. If the analysis of variance obtained a significant difference ($P < 0.05\%$) then Duncan's multiple area tests was conducted to determine the differences between treatments. To estimate the optimal concentration of fish herbs mixing in the feed, manual analysis was performed using Microsoft Excel. Data on water quality and feed characteristics were analyzed descriptively.

3. RESULTS AND DISCUSSION

3.1 Specific Growth Rate (SGR)

The results of observations on increasing red tilapia juveniles weight in each treatment for 42 days of rearing showed that the addition of fish herbs to feed with different concentrations gave different effects on the growth of red tilapia juveniles. An increase in the average growth from the first observation to the sixth observation in each treatment indicated that the feed provided was able to be eaten and utilized by fish juveniles. The increase in the average weight of red tilapia juveniles during the rearing period can be seen in Figure 1.

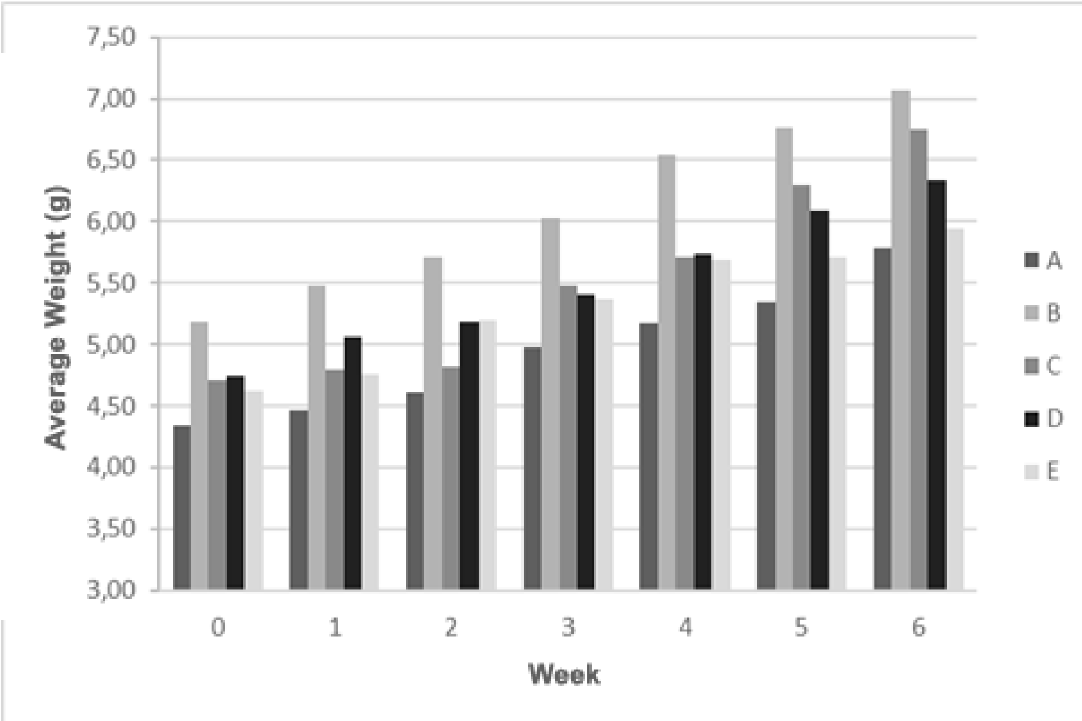

Fig. 1. Increase in the average weight of red tilapia juveniles color of the bars are very faint need to a cleared color combination

Based on Figure 3, it can be seen that during the 42-day maintenance period, each treatment showed a different increase in average weight. The average initial weight of red tilapia juveniles was 4.34 g – 5.19 g and at the last observation, fish juveniles weight reached 5.79 g – 7.07 g. The highest increase in the average value of growth was in treatment B with an average final weight of 7.07 g.

The average yield of red tilapia juveniles growth during the study was then continued with the calculation of the SGR (Specific Growth Rate). The SGR value for each treatment can be seen in Figure 2.

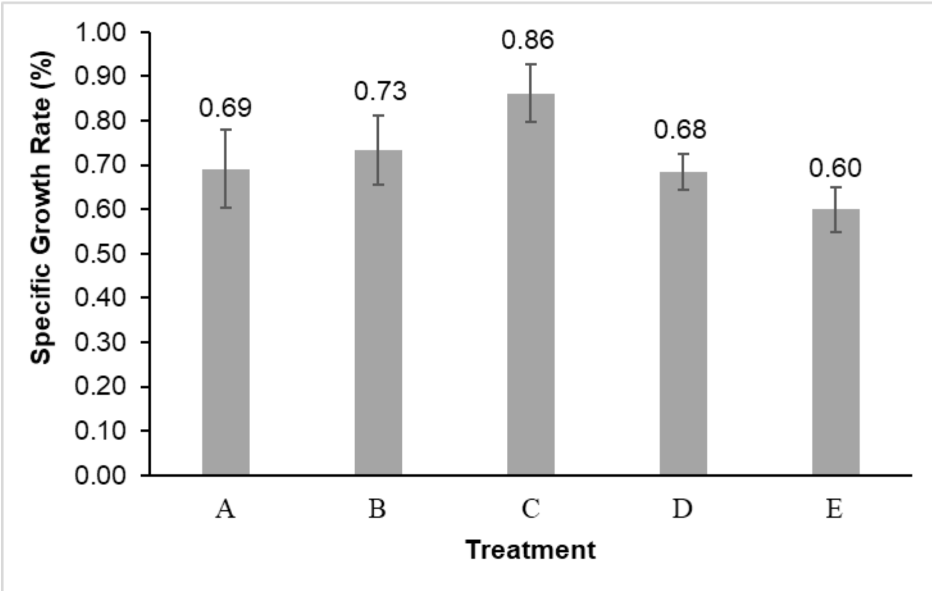

Fig. 2. SGR Value of Each Treatment A (Control), B (25 ml Kg^{-1} feed), C (50 ml Kg^{-1} feed), D (75 ml Kg^{-1} feed), E (100 ml Kg^{-1} feed)

The SGR value of each treatment, namely, A (control) was 0.69%, treatment B (25 ml Kg^{-1} feed) was 0.73%, treatment C (50 ml Kg^{-1} feed) was 0.86%, treatment D (75 ml Kg^{-1} feed) was 0.68% and treatment E (100 ml Kg^{-1} feed) was 0.60%. The SGR value was then analyzed using a variance table and showed a significantly different effect on each treatment (so it was continued with Duncan's multiple distance test. Based on the results of Duncan's multiple distance test at 95% confidence level, treatment C (50 ml Kg^{-1} feed) resulted in the highest SGR value and was significantly different from other treatments.

The SGR value obtained showed that the administration of fish herbs in the feed had a good effect on the growth of red tilapia fish and reached an optimal concentration at a mixing concentration of 50 ml Kg^{-1} of feed. This can happen because of the various active substances present in fish herbs that can improve the quality and digestibility of feed.

The SGR value in Figure 2 in treatment A to treatment C shows an increase. This indicates that the active substance content in the fish herbal medicine was responded well by the fish up to a concentration of 50 ml Kg^{-1} of feed. Meanwhile, in treatment D and treatment E, there was a decrease in the SGR value. This could be due to a change in the characteristics of the feed as a result of the addition of fish herbs, such as clumping of feed that occurred in treatment E (100 ml Kg^{-1} feed). The feed clumps because the large amounts of fish herbs make the feed wetter so it can soften and make the feed stick to each other. This causes the feed to be difficult for fish to consume and tends to be on the edge of the rearing container. In addition to the characteristics of the feed, the aroma of pellets at a concentration of 75 ml Kg^{-1} of feed and a concentration of 100 ml Kg^{-1} of feed began to decrease, the aroma of fish herbs began to decrease. the aroma of feed, because the aroma can stimulate the appetite of fish.

The content of curcumin in fish herbs affects the activity of digestive enzymes, such as lipase enzymes, protease enzymes, and amylase enzymes. Based on research [10], it is known that the curcumin content of 0.05% and 0.1% in carp feed causes a decrease in the enzyme value, this is thought to be due to the presence of inhibitors in the feed that affect digestive enzymes and the alkaline nature of the intestine which is thought to not support digestive enzyme activities. However, the addition of 3% curcumin to the sand goby (Oxyeleotris marmoratus) feed showed an increase in the enzyme value. This shows that curcumin has a good effect on digestive activity in a certain amount. According to [11], giving curcumin extract to feed can increase the digestibility of food substances in the digestive tract, because curcumin can stimulate the gallbladder wall to secrete bile and essential oils to prevent excessive gastric acid from being released. Bile contains several salts as a result of mixing sodium and potassium.

The SGR value which tends to increase up to treatment C (50 ml Kg^{-1} Feed) is thought to be because essential oils and curcumin have the property of stimulating liver cells to increase bile production and facilitate bile secretion/expenditure so that bile fluid increases. This will reduce the solid particles contained in the gallbladder. Bile functions to dissolve fat, with the smooth secretion of bile can reduce cholesterol levels and digestion and absorption of fat go smoothly. The essential oil and curcumin in herbal fish affect the performance of the pancreas in secreting amylase, lipase, and protease enzymes that can improve the digestion of carbohydrates, fats and proteins and increase appetite because they can accelerate gastric emptying, thereby creating hunger and stimulating appetite and increasing appetite. feed palatability [12].

Anti-microbial content in fish herbs such as flavonoids plays a role in eliminating negative microbes in the fish digestive tract. Research [13] showed that the addition of meniran flour containing flavonoids to feed was able to increase the number of LAB (Lactic Acid Bacteria) and reduce the number of Escherichia coli bacteria in the digestive tract. In general, the composition of microbes in the digestive tract is non-pathogenic microbes (*Lactobacillus* sp., *Pseudosomonas* sp.) and pathogenic bacteria (*Escherichia coli*).

The content of anthraquinone in herbal fish derived from noni can affect the pH of the digestive tract to be more acidic. According to [14], in an acidic environment, protein-breaking enzymes can work optimally, so that more feed protein is absorbed by the body which supports optimal growth. Noni fruit produces short chain fatty acids, especially caproic acid, caprylic acid and butyric acid. In addition, in the noni fruit there are also proxeronase enzymes and proxeronine alkaloids, both enzymes can form the active substance xeronine in the body. Proxeronine is a precursor or substance forming xeronine. Xeronine is a substance needed by the fish body to move enzymes, improve the structure and function of body cells [15]. The content of flavonoids, anthraquinones, and terpenes can stimulate glucose uptake in cells, reduce insulin resistance to increase glucose utilization by the body.

3.2 Feed Conversion Rate (FCR)

Based on Figure 3, it is known that the FCR values in each treatment are as follows; Treatment A was 0.75, treatment B was 0.59, treatment C was 0.51, treatment D was 0.66, and treatment E was 0.75. Treatment C produced the lowest FCR value. Based on analysis of variance, it was found that the addition of fish herbs to commercial feed gave a significant difference to the FCR value. The FCR value was then analyzed using Duncan's multiple distance test at a 95% confidence level and the results showed that the best FCR value was in treatment C (50 ml Kg^{-1} feed).

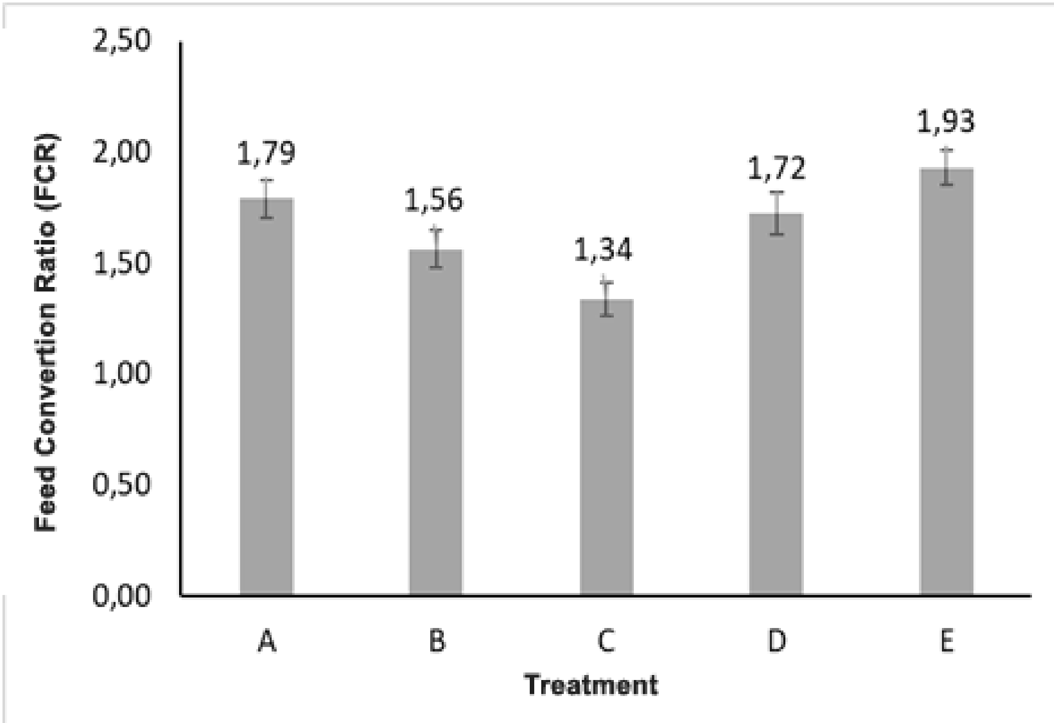

Fig. 3. Nilai FCR pada Masing-masing Perlakuan

The feed conversion value showed a significant difference between each test treatment. The low value of FCR is influenced by the amount of feed, the nutritional content of the feed and the activity of digestive enzymes. The amount of feed used during the study was 3% of the fish biomass with a protein content of 40% and was fed twice a day. Feeding with treatment C (50 ml Kg^{-1} feed) resulted in the smallest FCR of 1.34, while in treatment E (100 ml Kg^{-1} of feed) the largest FCR was 1.93. Based on [11], it is known that the administration of probiotics in the first treatment (I) with a dose of 5 ml, the results obtained for the FCR value are 1.82, in the second treatment (II) the administration of probiotics using a dose of 10 ml, the FCR value obtained namely 1.75 and in the third treatment (III) with the administration of probiotics using a dose of 15 ml. This shows that fish herbs can reduce the feed conversion ratio by increasing feed digestibility.

Fish herbs play a role in increasing the digestibility of feed, so that the level of absorption of nutrients by the digestive tract can be more optimum. This can occur because the addition of fish herbs to the feed consumed by red tilapia fish juveniles can increase the activity of digestive enzymes, such as lipase, amylase, and protease enzymes. The increase in enzyme activity is thought to occur due to the active substance curcumin found in fish herbs which can increase the amount of feed consumption. The higher the feed consumed can increase the amount of substrate for enzymes, so that the activity of digestive enzymes increases [17]. In addition to the increase in enzyme activity, the addition of fish herbs also makes the texture of the pellets softer, so that the pellets become easier to digest.

3.3 Protein Efficiency Ratio (PER)

As shown in Figure 4, it is known that the PER value for each treatment is as follows; Treatment A was 0.42, treatment B was 0.52, treatment C was 0.54, treatment D was 0.44

and treatment E was 0.38. Treatment C produced the highest PER value compared to other treatments. Based on analysis of variance, it was found that the addition of fish herbs to commercial feed gave a significant difference to the PER value. The PER value was then analyzed using Duncan's multiple distance test at a 95% confidence level and the results showed that the best FCR value was in treatment C (50 ml Kg^{-1} feed).

The PER value increased from treatment A to treatment C but decreased in treatment D to treatment E. Optimal protein requirements were influenced by the use of protein for energy, amino acid composition, feed digestibility, and energy-protein balance. To meet protein requirements, during the study, commercial pellets with a protein content of 40% were used. The intake of protein feed in fish must be by the needs of the fish, because if the amount of protein in the feed does not meet the protein needs of the fish, then fish growth will slow down. or repair damaged body cells, while the rest of the protein will be converted into energy [18].

The use of Sacaromyces ceriviceae in fish medicine aims to convert the cellulose in the fish herbal medicine components into glucose so that the ability of fish to utilize nutrients other than protein as an energy source is increasing. This can happen because Saccharomyces cereviceae can produce cellulase enzymes that play a role in the hydrolysis of cellulose into glucose [19] so that the presence of Saccharomyces cereviceae in herbal medicine can reduce the crude fiber content in the feed that is added with fish herbal medicine. Saccharomyces cereviceae also produces other metabolite products such as; amylase and proteolytic peptidase enzymes [20]

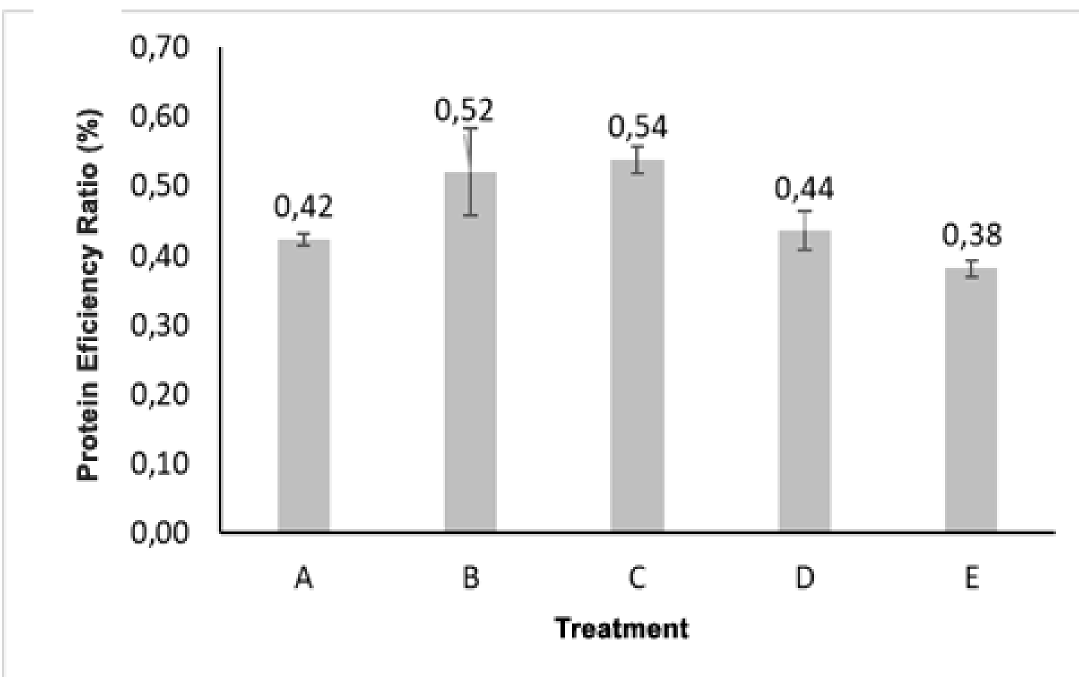

Fig. 4. Value of protein efficiency ratio in each treatment

3.4 Survival Rate (SR)

The survival rate of red tilapia juveniles in each treatment as shown in Figure 5 for 42 days of rearing in each treatment had a survival rate of A (Control) 97.78%, B (25 ml Kg^{-1} feed) 97.78%, C (50 ml Kg^{-1} feed) 97.78%, D (75 ml Kg^{-1} feed) 97.78%, E (100 ml Kg^{-1} feed) 95.56%, ranging from 95.56 – 97.78%. Based on the analysis of variance, the increase in the concentration of fish herbs in the feed did not have a significant effect on the survival rate (p>0.05). Red tilapia juveniles were able to survive even though they showed different growth performances in each treatment.

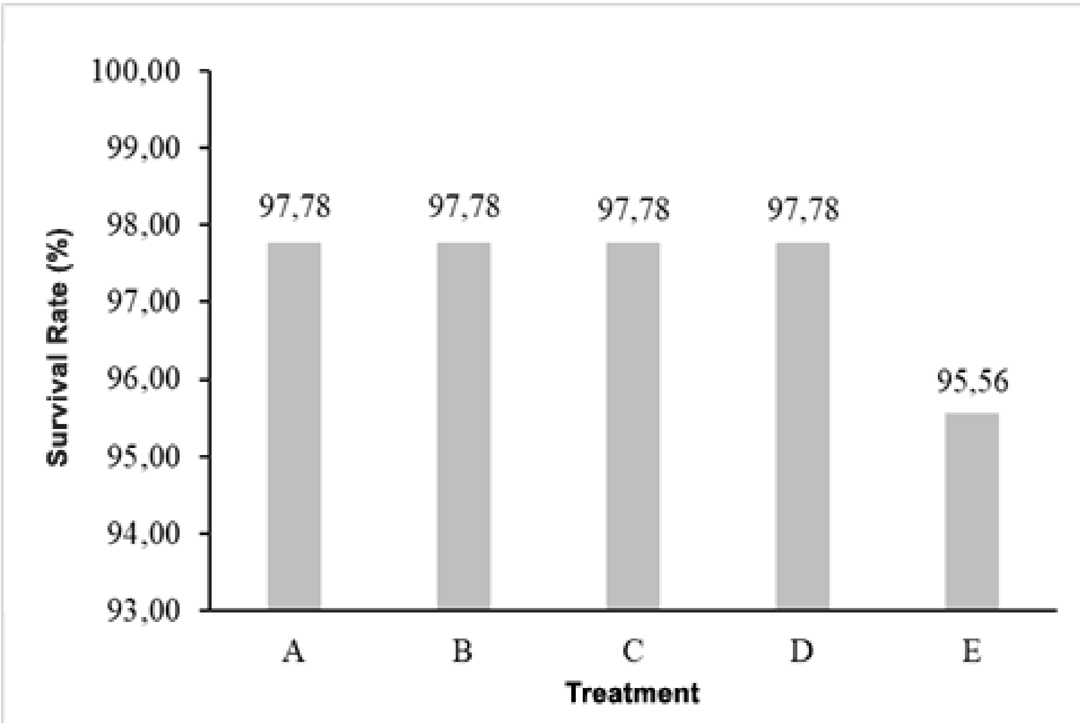

Fig. 5. Survival rate pada masing-masing perlakuan

Survival rates according to [21], there are three categories to describe the survival range, including; SR > 50% is in a good category, 30% > SR > 50% is in the middle category, and SR < 30% is categorized as unfavorable. Based on the survival value during the study, it was found that the survival rate of red tilapia juveniles fed with fish herbal medicine was in the good category

3.5 Water Parameters

<u>3.5.1 Water Temperature</u>

Observations on temperature parameters were carried out twice in one day, namely in the morning at 08.00 (Figure 6) and in the afternoon at 15.00 (Figure 7), the following results were obtained:

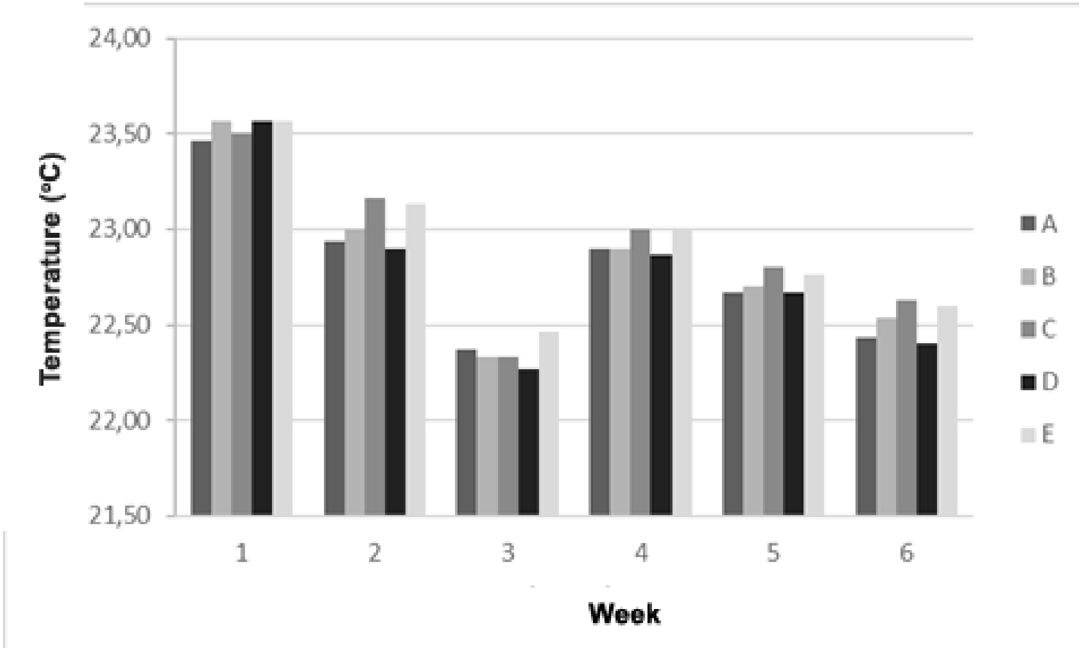

Fig. 6. Results of Measuring Average Temperature in the Morning

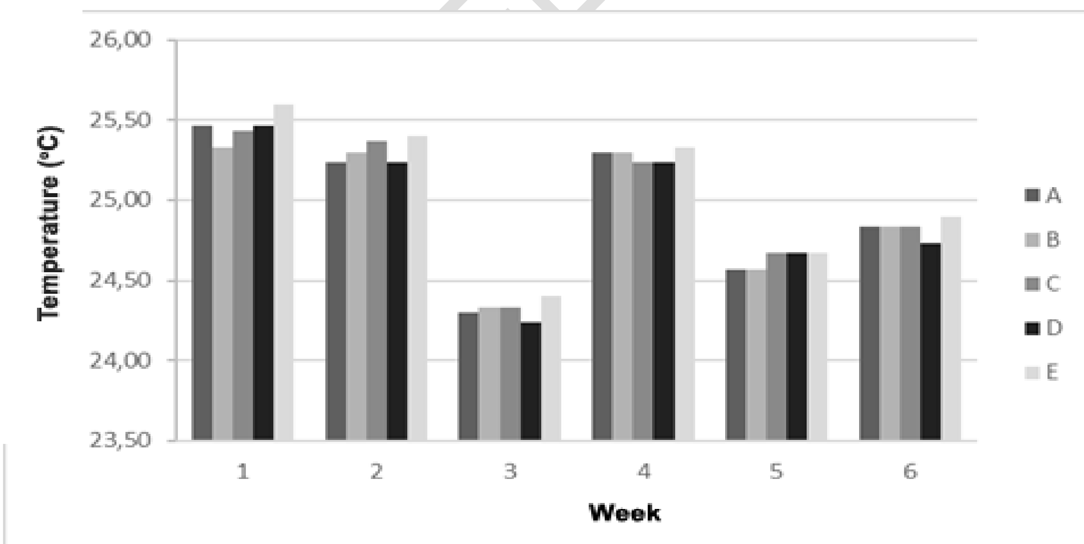

Fig. 7. Results of Measuring Average Temperature in the afternoon

Based on Figure 6, it is known that the lowest temperature in the morning is observed in the third week with an average of 22.26°C and the highest is in the first week with an average of 23.56°C, while the average temperature observed in the morning is 22.84°C.

Based on Figure 7, it is known that the lowest temperature in the afternoon is in the third week of observation with an average of 24.23°C and the highest is in the second week with an average of 25.60°C, while the average temperature of observation in the afternoon is 24.97° C.

Fish are aquatic organisms that are poikilothermic, so the temperature is one of the limiting factors for fish survival. Kelabora and Dominggas (2010) state that water temperatures that are too high or too low can result in most of the energy stored in the fish's body being used for adaptation to a less supportive environment so that it can damage the metabolic system or exchange of substances.

[22] stated that tropical aquatic organisms will grow optimally in a temperature range of 25 - 32°C. The optimal temperature for red tilapia is 18-26ºC. Red tilapia can survive at temperatures of 25-33ºC [23]. The results of temperature measurements in red tilapia juveniles rearing containers ranged from 22.26°C - 25.60°C. This can be categorized as still in ideal temperature conditions and meets the eligibility criteria for red tilapia

3.5.2 Dissolved Oxygen

As shown in figure 8, it is known that the lowest dissolved oxygen value is 6.63 mgL^{-1} and the highest is 7.27 mgL^{-1}. The high and low dissolved oxygen content is influenced by the size of the oxygen supply from the blower and the aeration stone used.

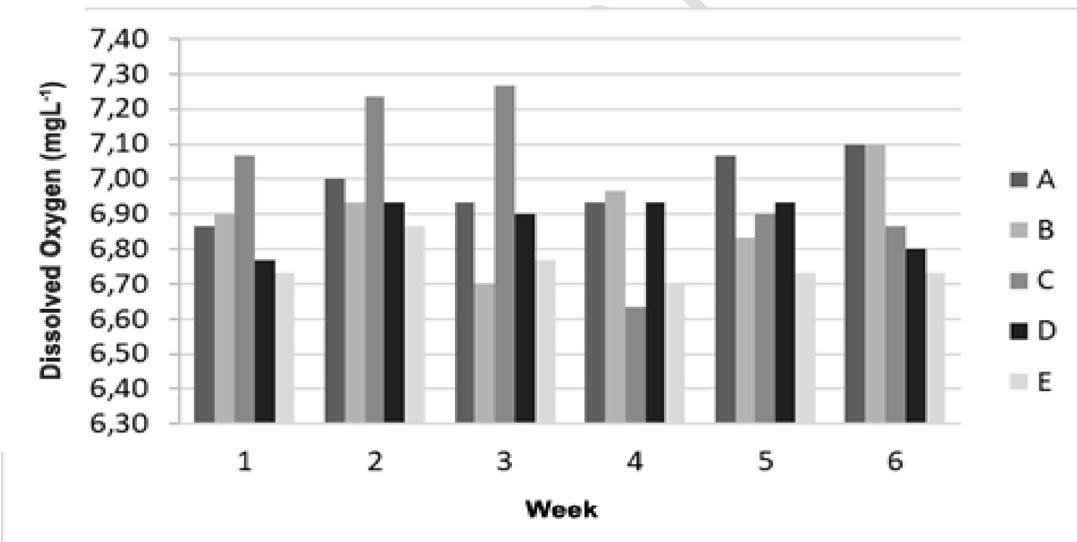

Fig. 8. Measuring Results of Average Dissolved Oxygen

Dissolved oxygen is one of the limiting factors in water. All activities of the biota will be disrupted if the availability of dissolved oxygen is not sufficient for the needs of the aquaculture biota. Low dissolved oxygen levels cause the process of decomposition, reproduction, and growth in the pond not to run well. The minimum value of dissolved oxygen levels for fish farming is 3 ppm [24]. Lack of oxygen will cause fish to lack appetite and the development of bacteria that cause death in fish. Dissolved oxygen content affects the process of oxidation and reduction of organic and inorganic materials [25].

The minimum value of dissolved oxygen levels for fish farming is 3 ppm [24]. The optimal dissolved oxygen content for fish growth is in the range of 5-8 mgL^{-1}. [26]. The dissolved oxygen content in the red tilapia juveniles rearing media is 7.7 mgL^{-1} – 8.10 mgL^{-1}, based on the results of these measurements, it is known that the dissolved oxygen content in the red tilapia juveniles rearing media is in the optimum value..

3.5.3 pH

As shown in figure 9, it is known that the treatment with the highest pH value was treatment E with an average pH of 7.77 and the lowest was treatment B with an average of 7.33. From the average value of the degree of acidity (pH) in each treatment, it can be concluded that the pH value of the red tilapia juveniles rearing media is still at the appropriate threshold for rearing. This is under with the statement [27] that the optimum pH value for water areas is 6.5-9.

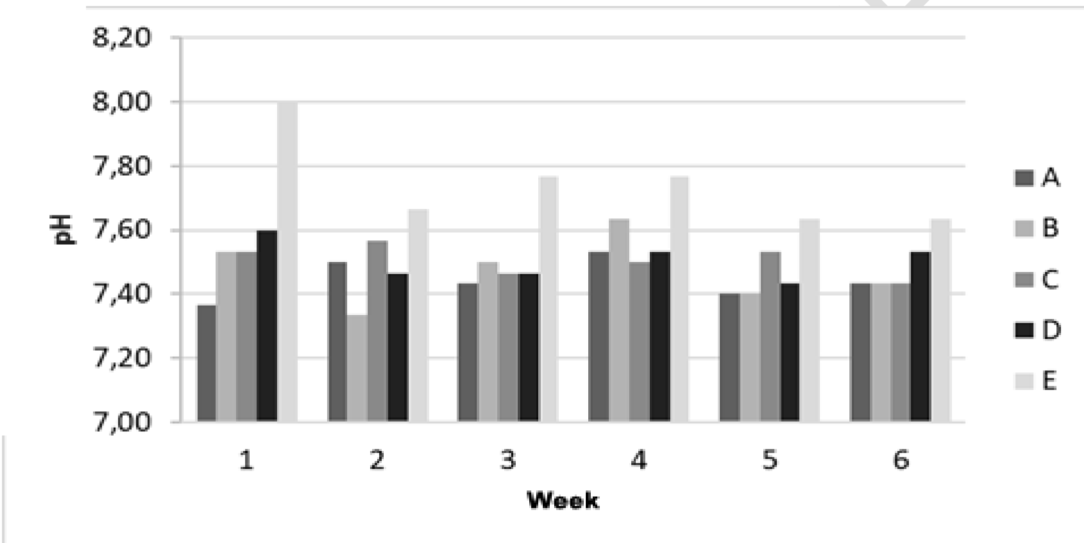

Fig. 9. Results of the average pH

3.5.4 Ammonia total ammonia and where is the unionized ammonia and NO2

As shown in figure 10, the ammonia value in the red tilapia juveniles rearing media is in the range of 0.003 mg L^{-1} – 0.03 mg L^{-1}. The highest ammonia content was in treatment E with an average of 0.03 mg L^{-1}. Fish excrete 80-90% ammonia (N-inorganic) through osmoregulation, while from feces and urine about 10-20% of total nitrogen [28]. Ammonia accumulation in aquaculture media is one of the causes of decreased water quality which can fail in fish culture production.

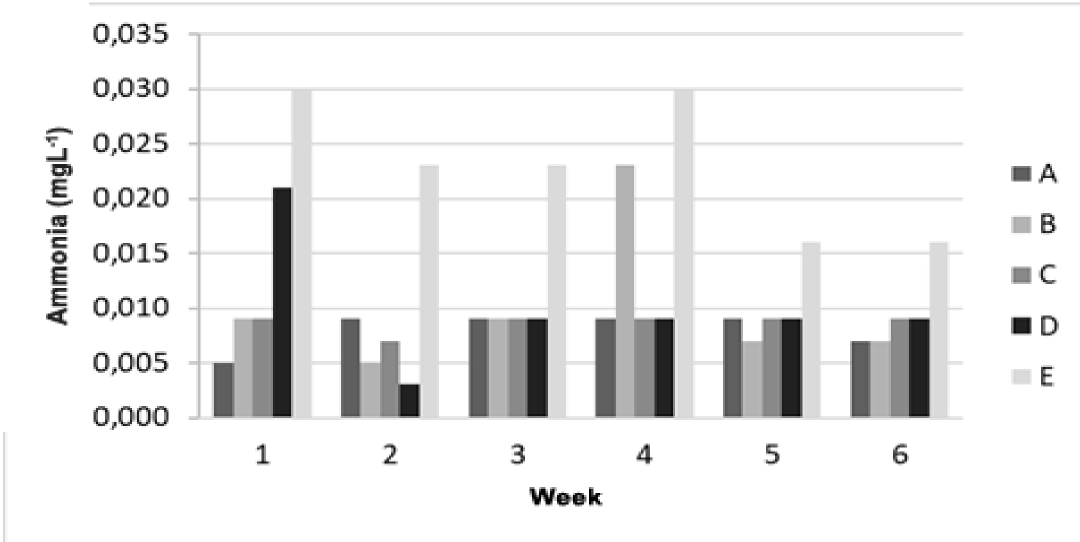

Fig. 10. Ammonia Average Measurement Results

Ammonia accumulation in aquaculture water causes various kinds of damage to organisms, especially damage to organ function and structure. Very low levels of ammonia are less harmful, but as ammonia levels increase, they quickly become harmful to aquatic animals. The sublethal effect of NH3 is the narrowing of the gill surface. The narrowing of the gill surface will result in the speed of the gas exchange process in the gills being decreased. In addition, the sublethal effects of ammonia can also cause a decrease in the number of blood cells, a decrease in oxygen levels in the blood, reduce physical resistance and resistance to disease, and cause structural damage to various types of organs, including the liver parenchyma (Sutomo 1989).

According to [29] ammonia levels should be around < 0.1 mg L^{-1}, but [30] stated that the maximum threshold for ammonia concentration for aquaculture is 0.2 mg L^{-1}. When compared with the ammonia concentration in the study, the measured ammonia concentration was still within the threshold and did not threaten the survival of the fish.

The results of observations of water quality parameters showed that the conditions of the rearing media during the research period were in conditions that were conducive to the growth of red tilapia juveniles. Likewise with other water quality parameters that tend to fluctuate, but if you pay attention to the increase in the average weight every week of observation, there is no decrease in weight. This indicates that the condition of water quality during the study was in optimum conditions to support the growth and activity of the fish herbal medicine in the feed and also did not experience a decrease in quality as a result of fluctuations in water quality.

4. CONCLUSION

Based on the results of the study, it can be concluded that the addition of fish herbs to commercial feed has an effect on growth, feed conversion ratio and protein efficiency ratio in red tilapia juveniles, but has no effect on survival rates. The optimal addition of fish herbs to the feed is 50 ml Kg^{-1} of feed. Feeding with the treatment of 50 ml Kg^{-1} of feed resulted in the smallest FCR of 1.34, so it can be concluded that treatment of 50 ml Kg^{-1} of feed was the best treatment.

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NOTE:

REFERENCES UPDATE REFERENCES (2019, 2020 AND 2021)

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