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EFFECT OF FISH HERBS WITH DIFFERENT CONCENTRATIONS ON FEED FOR GROWTH AND SURVIVAL OF BONYLIP BARB (*OSTEOCHILUS HASSELTI*)

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fish herbs, growth rate, Osteochilus hasselti, feed convertion ratio, protein efficiency ratio, survival rate.

ABSTRACT

This research aims was to analyse and determine the concentration of fish herbs that were optimal for growth and survival rate of bonylip barb juvenile. The research method used was the experimental Complete Random Design (CRD) with 5 treatments and 3 replications. The treatment applied were A (control), B (concentration fish herbs 25 ml Kg^{-1}), C (concentration of fish herbs 50 ml Kg^{-1}), D (concentration of fish herbs 75ml Kg^{-1}), and E (concentration of fish herbs 100 ml Kg^{-1}). Observed parameters were specific growth rate, feed convertion ratio, protein efficiency ratio, survival rate and water quality. The results showed that highest SGR value were on treatment C (0.65%), treatment B (0.36%), treatment D (0.28%), treatment A (0.25%), treatment E (0.14%). The lowest FCR values were at treatment C (0.51), treatment B (0.59), treatment D (0.66) while treatments A and E were (0.75). The highest PER value were on treatment C (1.29), treatment B (0.77), treatment D (0.69), treatment A (0.53) and treatment E (0.29). The optimum concentration of fish herbs for the growth of bonylip barb is treatment C (50 ml Kg^{-1}).

PREFACE

Bonylip barb (*Osteochilus hasselti*) is one of the aquaculture species that is important as one of the food security commodities that are of interest to the Indonesian people. The national production of bonylip barb has been seen from year to year where the production target has increased from 2015 at 31,900 tons and rised to 55,800 tons in 2019[1]. In order to increase the production of bonylip barb and meet the above objectives, various efforts can be made through the efficient and effective utilization of nutrients in fish feed. Feed is one of the components that reaches 60-70% of the total production cost and is one of the determinants of the success of a cultivation business [2] so it needs effective and efficient management. Effective and efficient use of feed can be increased, among others, by utilizing herbal supplements in the form of fish herbs.

Herbal supplements are food additives that are beneficial for the organisms that consume them. This study uses herbal supplement ingredients such as turmeric, ginger, Javanese ginger, greater galingale, noni, tropical almond leaves, betel leaves along with the stalk, molasses and yeast. The use of yeast (*Sacharomyces cereviceae*) in fish herbs gives a good impact on fish growth, because the nucleotide content in yeast is able to repair intestinal damage quickly and increase microflora in intestinal mucosa[3]. *S. cerevisiae* cell wall extracts (glucan, mannoprotein, and chitin) are natural immunostimulants and also act as growth promoters [4]. Some other benefits obtained by herbal supplements include increasing the fish immunity to disease, making the digestive system healthy, saving the use of feed, increasing fish appetite and is expected to increase the daily growth rate of fish [5].

This study aims to analyze the effect of fish herbs and determine the optimal concentration of fish herbs for growth and survival of bonylip barb.

METHODOLOGY

Ingredients used in making fish herbs are turmeric, ginger, Javanese ginger, greater galingale, noni, tropical almond leaves, betel leaves along with the stalk, molasses and yeast. The tools used in the study include aquariums, aerators, thermometers, pH meters, DO meters, scales, millimeter blocks, and ammonia test kits. The duration of the study was 45 days and observations were made with a span of 7 days. The study used a completely randomized design with 5 treatments and 3 replications. Treatment A (Control), Treatment B (25 ml Kg^{-1} feed), Treatment C (50 ml Kg^{-1} feed), Treatment D (75 ml Kg^{-1} feed), and treatment E (100 ml Kg^{-1} feed).

The experiment conducted used 20 bonylip barb juveniles per replication, with the length of 7 cm, weight between 4.00 - 5.00 g and a density of 1 fish in 2 liters of water. Experimental feed preparation was carried out by weighing 3% of the total fish weight, mixed with fish herbs using a disposable syringe according to treatment, then stored for 12 hours before feeding. Feeding was done 2 times in a day (8.00 am and 3.00 pm).

The parameters observed were:

Spesific Growth Rate [6]

$$SGR = \frac{Ln(Wt) - Ln(W0)}{T} x\ 100\%$$

Explanation:

SGR = Daily growth rate (% day^{-1})
Wt = Fish weight at the end of the study (g)
Wo = Fish weight at the beginning of the study (g)
T = Duration of research (days)

Feed Conversion Ratio [7]

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

Explanation :

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

Protein Efficiency Ratio [8]

$$PER = \frac{Wt - W0}{Pi} \times 100\%$$

Explanation:
PER = Protein Efficiency Ratio (%)
Wt = Fish biomass test at the end of the study (g)
W0 = Fish biomass test at the beginning of the study (g)
Pi = The weight of the feed protein consumed (g)

Survival Rate [9]

$$SR = \frac{Nt}{No} \times 100\%$$

Explanation :
SR = Fish Survival Rate (%)
Nt = Number of Fish that Live at the End of the Study
No = Number of Fish that Lived at the Beginning of the Study

The parameters of measured water quality data are as follows:

Table 1. Water Quality

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

The SGR, FCR, PER, and SR data obtained were then analyzed by variance (F test) at a 95% confidence level to see the effect. If the analysis of variance obtained significantly different (P <0.05%), then the Duncan multiple region test is performed to determine differences between treatments. Water quality data and feed characteristics are analyzed descriptively.

RESULT AND DISCUSSION

- Specific Growth Rate (SGR)

Growth of living things can be defined as an increase in weight and length over time. The results of observations of the increase in the weight of bonylip barb in each treatment during 45 days of treatment showed that the addition of fish herbs to feed with different concentrations had different effects on the growth of bonylip barb.

Based on Figure 1, it can be seen that during 45 days of treatment, each treatment showed an increase in different average weights. The initial average weight of bonylip barb is 4.30 g - 4.50 g and at the last observation, the weight of bonylip barb increased to 5.87 g - 6.76 g. The highest increase in average growth rate is in treatment C with an average final weight of 6.76 g.

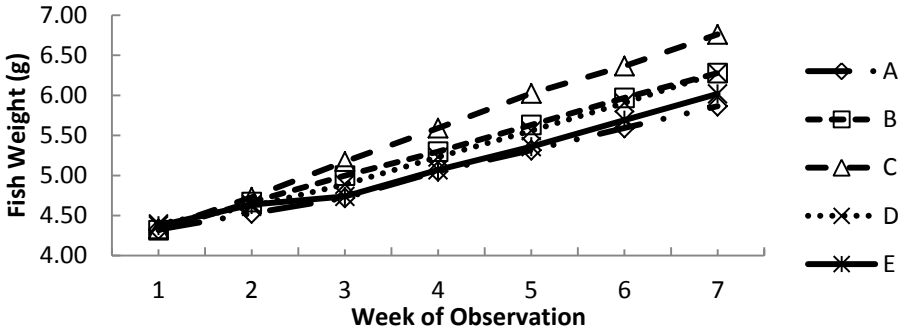

Figure 1. Increased weight average of bonylip barb.

The result of bonylip barb average growth during the study was then continued with the calculation of SGR (Specific Growth Rate). SGR value in each treatment can be seen in Figure 2.

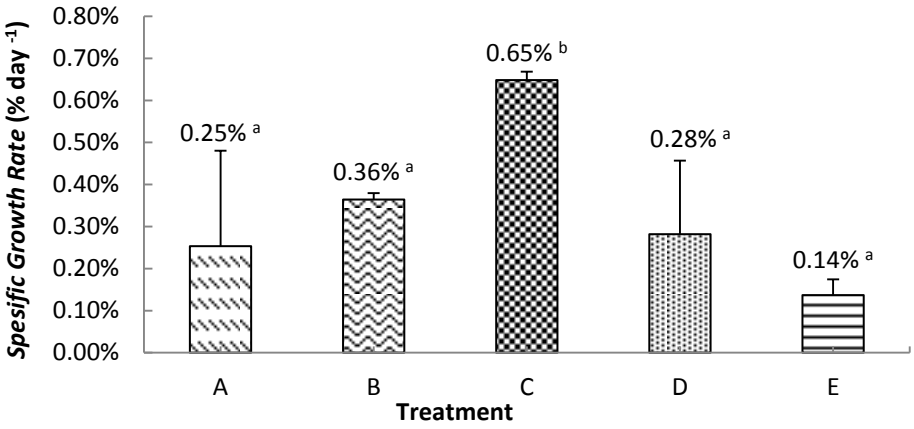

Figure 2. SGR Value of Each Treatment

SGR value of each treatment namely, A (Control) of 0.25%, treatment B (25 ml Kg^{-1}feed) of 0.36%, treatment C (50 ml of Kg^{-1} feed) by 0.65%, treatment D (75 ml of Kg^{-1} feed) by 0.28% and treatment E (100 ml Kg^{-1} feed) by 0.14%. Based on the results of the Duncan multiple distance test at 95% confidence level, treatment C (50 ml Kg^{-1} feed) produced the highest SGR value, and is significantly different from other treatments. SGR value indicates an increase from treatment A to treatment C. This indicates that the content of active substances in fish herbs was responded well by bonylip barb to a concentration of 50 ml Kg^{-1} feed. Meanwhile, treatment D and treatment E showed a decrease in the value of the SGR. This can occur due to changes in the characteristics of the feed as a result of the addition of fish herbs, such as feed clotting that occured in treatment E (100 ml Kg^{-1} feed). Feed clot was caused because fish herbs in large quantity can soften and make the food stick to one another. This causes the feed to be difficult to consume by fish and tends to drift to the edge of the maintenance container. In addition to the characteristics of the feed, the aroma of the pellets mixed with the herbs at a concentration of 75 ml Kg^{-1} feed and at a concentration of 100 ml Kg^{-1} decreases, good feed for fish was not only determined by its nutritional value, but was also influenced by the aroma of the feed, because the aroma was able to stimulate fish appetite[10].

The curcumin content in fish herbs influences the activity of digestive enzymes, such as lipase enzyme, protease enzyme, and amylase enzyme. It is known that the curcumin content of 0.05% and 0.1% in gouramy feed causes a decrease in enzyme value, this was thought to be due to inhibitors in the feed that affect digestive enzymes and alkaline properties in the intestine which are thought to not support digestive enzyme activities. However, the addition of curcumin by 3% in sand goby fish feed (*Oxyeleotris marmoratus*) showed an increase in enzyme value[11]. This shows that curcumin has a good effect on digestive activity to a certain amount. Curcumin extract in feed can increase the digestibility of food substances in the digestive tract, because curcumin can stimulate the gallbladder wall to secrete bile fluid and essential oils to prevent excessive gastric acid release[12].

The content of flavonoids, anthraquinones, and terpenes can stimulate glucose uptake in cells, reduce insulin resistance so as to increase glucose utilization by the body, besides, the noni fruit extract can stimulate the pancreas in secreting serum insulin so as to reduce glucose levels in the blood [13]. Anti-microbial content in fish herbs such as flavonoids plays a role in eliminating negative microbes in the digestive tract of fish. Addition of leaf flower flour that contains flavonoids in the feed can increase the amount of LAB (Lactic Acid Bacteria) and reduce the number of *Eschericia coli* bacteria in the digestive tract[14]. In general, the composition of microbes in the digestive tract is non pathogenic microbes (*Lactobacillus sp., Pseudosomonas sp.*) and pathogenic bacteria (*Eschericia coli*).

- **Feed Convertion Ratio (FCR)**

Feed Conversion Ratio is the ratio between the amount of feed given to the amount of fish weight produced. The smaller the value of feed conversion, the better the utilization rate of feed, and vice versa. The greater the value of feed conversion indicates the lower level of feed utilization.

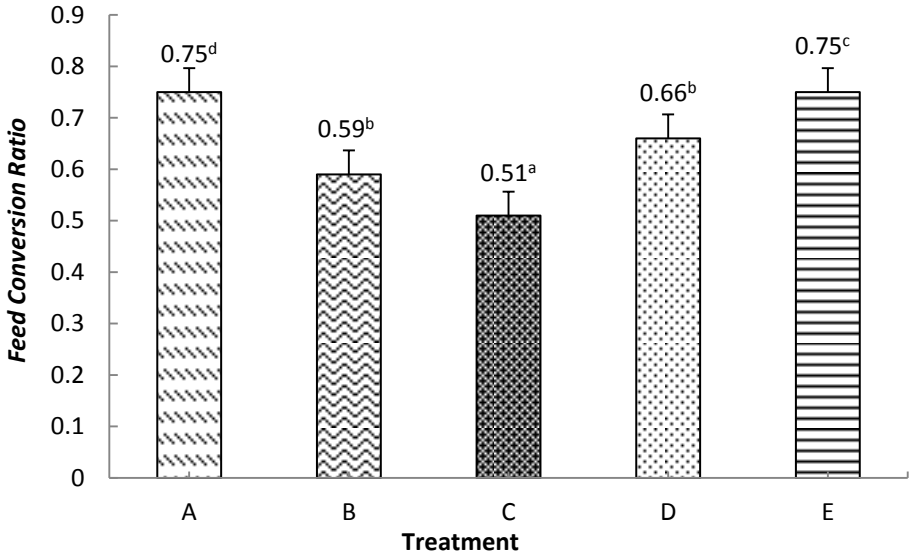

Figure 3. FCR values of each treatment

Based on Figure 3, it is known that the values of FCR for each treatment are as follows; Treatment A (0.75), treatment B (0.59), treatment C (0.51), treatment D (0.66) and treatment E was 0.75. Treatment C produced the lowest FCR value. Based on analysis of variance, it was known that the addition of fish herbs to commercial feed gives a real difference to the FCR value. Differences between treatments were analyzed using Duncan's multiple range test at 95% confidence level and the results obtained that the best FCR value was from the treatment C (50 ml Kg^{-1} feed).

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 additives in feed consumed by bonylip barb can increase the activity of digestive enzymes, such as lipase, amylase, and protease enzymes. Increased 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 feed consumed can increase the amount of substrate for enzymes, so that enzyme activity increases [15]. Apart from increasing enzyme activity, the addition of fish herbs also makes the texture of the pellets softer, making them easier to digest.

- **Protein Efficiency Ratio (PER)**

The results of the calculation of Protein Efficiency Ratio during the study can be seen in Figure 4.

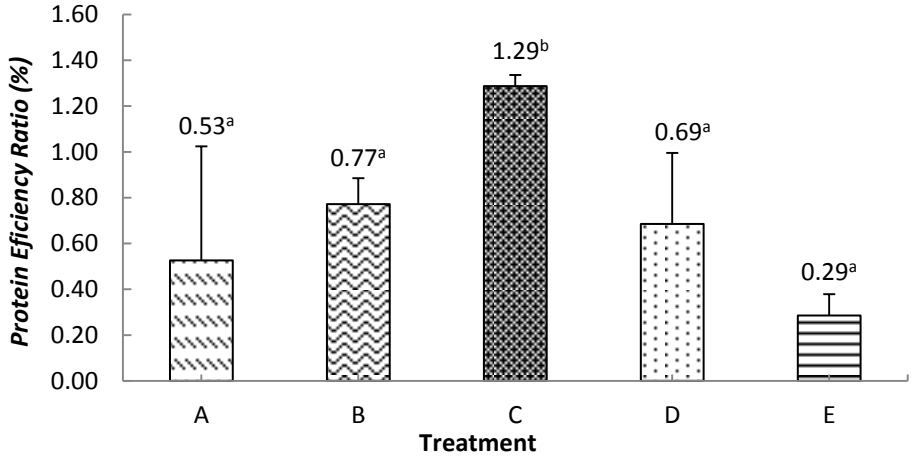

Figure 4. The Value of Protein Efficiency Ratio for each Treatment

Based on Figure 4, it was known that the PER values for each treatment are as follows; Treatment A (0.53), treatment B (0.77), treatment C (1.29), treatment D (0.69) and treatment E was 0.29. Treatment C produced the highest PER value compared to other treatments. Based on analysis of variance, it was known that the addition of fish herbs to commercial feed makes a significant difference to the PER value. Duncan's multiple range test at 95% confidence level and the results obtained that the best FCR value was from the C treatment (50 ml Kg^{-1} feed).

The PER value during the study increased from treatment A to treatment C but decreased in treatment D to treatment E. This shows the use of fish herbs that can be optimized by bonylip barb is in the amount of mixture 50 ml Kg^{-1} feed. The use of fish herbs above the concentration of 50 ml Kg^{-1} feed began to decrease, presumably due to increased activity of the enzymes in the digestive tract by fish herbs triggering the mechanism of feedback inhibition. This can occur because of the accumulation of amino acids in the cell, so automatically the performance of the first enzyme related to amino acid synthesis will be inhibited as a form of regulating the energy supply in the cell [16].

The use of *S. cereviceae* in fish herbs aims to change the cellulose in the components of fish herbs into glucose so that the ability of fish to utilize nutrients other than protein as a source of energy is increasing. This can occur because *S. cereviceae* is able to produce cellulose enzymes that play a role in the hydrolysis of cellulose to glucose [17] so that with the presence of *S cereviceae* in fish herbs can reduce the content of crude fiber in fish herbs-fed fish. *S. cereviceae* also produces other metabolite products such as; amylase enzyme and proteolytic peptidase [18].

- **Survival Rate (SR)**

The results of survival rate calculations during the study can be seen in Figure 5.

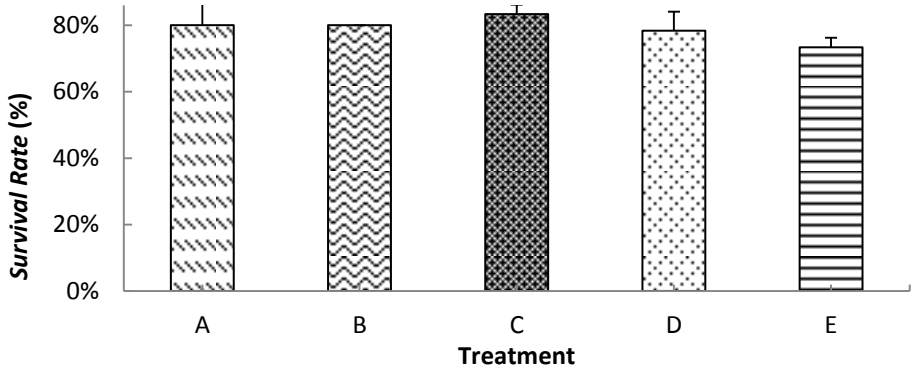

Figure 5. The Survival Rate Values for Each Treatment

The bonylip barb survival rate after 45 days of maintenance in each treatment is ranged from 73% -83%. Based on the analysis of variance conducted, the increase in the concentration of fish herbal medicine did not have a significant effect on survival rates ($p > 0.05$). The value of survival rates that did not differ greatly in this study at each density showed that bonylip barb could adapt to various active substances present in fish herbs. Bonylip barb can still survive despite showing different growth performance in each treatment.

There are three categories to describe the range of survival, including; SR> 50% fall into the good category, 30%> SR> 50% fall into the average category, and SR <30% were categorized as unprofitable[19]. Based on the value of survival rate in the study, it is thus known that the survival rate of bonylip barb fed with fish herbs was in the good category.

- **Water Quality**

Data on the measurement of water quality is as follows:

Table 2. Results of water quality measurements

Treatment	Parameter			
	Temperature(°C)	pH	DO(mg L^{-1})	Ammonia (mg L^{-1})
A	22.5-23.9	7.3-7.6	7.7-8	0.0014-0.00313
B	24.7-26.6	7.3-7.6	7.9-8.1	0.00227-0.00313
C	24.8-26.6	7.4-7.6	7.8-8	0.002267-0.00313
D	24.8-26.5	7.4-7.6	7.8-7.9	0.002267-0.00313
E	24.8-26.3	7.6-8.2	7.8-8.1	0.004-0.0100
Optimum Value	**25-32**	**6.5-9**	**5-8**	**0.02**

The results of water quality measurement parameters show that the water quality of the maintenance media during the study

was in the optimum range for the growth of bonylip barb. The average temperature in the maintenance media is in the range of 22.5 ° C - 26.6 ° C, pH in the range 7.3-8.2, DO is 7.7-81 mg L^{-1}, and ammonia is 0.0014-0.01 mg L^{-1}.

CONCLUSION

Based on the results of the study it can be concluded that:

1. Addition of fish herbs to commercial feed has a good effect on growth, feed conversion ratio and protein efficiency ratio on bonylip barb, but does not affect the survival rate.
2. The optimal addition of fish herbs to feed is 50 ml Kg^{-1} of feed.

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