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THE EFFECT OF GIVING TURMERIC EXTRACT *(Curcuma longa* linn*)* ON THE GROWTH RATE OF SALIN NILE FISH FRY *(Oreochromis niloticus)*

Pengaruh Pemberian Ekstrak Kunyit (*Curcuma longa* linn) Pada Laju Pertumbuhan Benih Ikan Nila Salin (*Oreochromis niloticus*)

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ABSTRACT

The purpose of this study was to determine which dose of turmeric (*Curcuma longa* linn) extract had the greatest impact on the growth rate of tilapia (*Oreochromis niloticus*) fry. The approach used was experimental, with direct observation used to collect data. Four levels of turmeric extract treatment were used in a completely randomized design (CRD): treatment (A) commercial feed (control), treatment (B) turmeric extract 20 ml/kg feed, treatment (C) turmeric extract 50 ml/kg feed, and treatment (D) turmeric extract 80 ml/kg feed. The results showed that the best treatment was treatment D (80 ml/kg feed) with an average specific growth rate of 19.83%. Water quality observations indicate that overall water quality remains at optimal levels to support the life of saline tilapia (Oreochromis niloticus) fry, with temperatures ranging from 27.2 to 31.1ºC, salinity ranging from 0.16 to 3.5 ppt, pH ranging from 4.7 to 8.63, and dissolved oxygen ranging from 9.4 to 15.08 mg/L.

Keywords: saline tilapia, growth rate, turmeric extract administration

ABSTRAK

Tujuan penelitian ini ialah untuk mengetahui dosis ekstrak kunyit (*Curcuma longa* linn) mana yang mempunyai dampak terbesar pada laju pertumbuhan benih nila salin (*Oreochromis niloticus*). Pendekatan yang dipakai ialah eksperimental, serta pengamatan langsung dipakai untuk mengumpulkan data. Ada 4 tingkat perlakuan ekstrak kunyit dipakai dalam rancangan acak lengkap (RAL) penelitian ini: perlakuan (A) pakan komersial (kontrol), perlakuan (B) ekstrak kunyit 20 ml/kg pakan, perlakuan (C) ekstrak kunyit 50 ml/kg pakan, dan ekstrak kunyit 80 ml/kg pakan. Hasil penelitian menunjukkan bahwa perlakuan terbaik yaitu terdapat pada perlakuan D (pemberian ekstrak kunyit 80 ml/kg pakan) dengan hasil rata-rata laju pertumbuhan spesifik 19,83%. Hasil pengamatan kualitas air menunjukkan bahwa kseluruhan masih dalam kadar yang optimal untuk mendukung kehidupan benih ikan nila salin (*Oreochromis niloticus*) dengan suhu 27,2-31,1ºC, salinitas 0,16-3,5 ppt, pH 4,7-8,63 dan oksigen terlarut 9,4-15,08 mg/L.

Kata kunci: ikan nila salin, laju pertumbuhan, pemberian ekstrak kunyi

INTRODUCTION

Nationally, fisheries cultivation has an estimated potential of 15.59 million hectares: 2.23 million hectares in freshwater, 1.22 million hectares in brackish water, and 12.44 million hectares in the sea. One of the commodities with the highest market demand is tilapia. Tilapia (*Oreochromis niloticus*) has thick flesh and a delicious flavor, making it highly sought after by the public to meet animal protein needs (Indriati & Hafiludin, 2022).

Ikan Tilapia (*Oreochromis niloticus*) is a commodity that can tolerate and adapt to various levels of salinity. To increase tilapia production, a transformation into saline tilapia has been implemented. Saline tilapia can be cultivated in brackish and marine waters at salinities up to 20 ppt. Furthermore, saline tilapia grows quickly, can survive both low and high temperatures, and is resistant to disease (Angriani *et al*., 2020).

One way to increase tilapia production is by understanding how to raise them to increase their growth rate. Water quality and feed management are crucial, as these significantly impact tilapia survival. Therefore, alternative supplements based on biodegradable, environmentally friendly, and abundant plants are needed. One plant that can be used as a supplement is turmeric (Nurfaidah *et al*., 2024).

According to Wahyuningtyas *et al*. (2017), turmeric contains several chemical compounds, including fructose, glucose, protein, essential oils, and curcumin, along with its derivatives, desmethoxycurcumin and bidesmethoxycurcumin, at 50-60%. Curcumin can improve the digestion of proteins, fats, and carbohydrates, thus increasing nutrient absorption. This is because curcumin stimulates the gallbladder wall to release bile into the small intestine. The essential oils in turmeric help accelerate gastric emptying, increasing fish feed consumption. An empty stomach sends signals to the brain to increase fish feeding behavior (Santika *et al*., 2021).

The results of research conducted by Nurfaidah *et al*., (2024) namely the use of turmeric at a concentration of 75% provided an optimum effect on the survival and growth of tilapia. This can be seen from the specific weight growth rate of "2.27%, 2.50%, 2.72% and 1.53%, absolute weight growth rate of 48.23%, 55.4%, 64.62% and 27.28%, SR 80.55%, 91.67, 97.22 and 69.45% and EF = 0.43%, 0.38%, 0.37% and 0.45%."

Furthermore, another study conducted by Santika *et al*. (2021) on turmeric extract treatment in white snapper showed a significant effect on absolute growth, SGR, EPP, and FCR. The most effective dose of turmeric extract for white snapper growth was 20 ml.

Based on the above research, it was found that administering turmeric extract contributes to the growth of both freshwater and saltwater fish. Therefore, this study was conducted on "The Effect of Turmeric Extract (*Curcuma longa linn*) on the Growth Rate of Tilapia (*Orechromis niloticus*) Fry."

One of the problems often experienced by saline tilapia fish farmers is the relatively slow growth rate of seeds, which requires a longer cultivation time. Therefore, this study was formulated to examine the effect of administering turmeric extract (*Curcuma longa Linn.*) on the growth rate of saline tilapia fish (*Oreochromis niloticus*) seeds and to determine the dose of turmeric extract that provides the most optimal effect. The purpose of this study was to determine the effect of administering turmeric extract on the growth rate of saline tilapia fish seeds and to determine the best dose that can increase optimal growth. The benefits of this study are expected to provide information and references for fish farmers and the general public regarding the use of turmeric extract as a feed additive, as well as serve as study material and references for further research.

RESEARCH METHODS

This research was conducted for one month, namely from November 1 to December 1, 2025, at the Aquaculture Production Business Service Center (BLUPPB) Karawang, West Java. The test animals used were 3–4 week old saline tilapia (Oreochromis niloticus) fry with a size of 3–5 cm and an average weight of 0.2–0.5 grams per fry obtained from BLUPPB Karawang. The research materials included saline tilapia fry, turmeric as the main extract ingredient, ethanol as a solvent, and commercial feed used as a treatment medium.

This study used an experimental method with a Completely Randomized Design (CRD) consisting of four treatments and six replications, resulting in 24 experimental units. The treatments provided included commercial feed without turmeric extract as a control, as well as feed with the addition of turmeric extract at doses of 20 ml/kg, 50 ml/kg, and 80 ml/kg of feed. Happa placement was carried out randomly to maintain data homogeneity and minimize research bias. The tools used included happa, concrete tubs, water wheels, digital scales, rulers, thermometers, refractometers, pH meters, DO meters, and other supporting tools.

The preparation of turmeric extract was carried out by maceration method using 96% ethanol solvent with a ratio of 1:3 for 3×24 hours with shaking every 24 hours, then filtered to separate the solution from the dregs. The liquid turmeric extract obtained was applied to fish feed using a spray bottle according to the treatment dose and aired until dry so that the extract was well absorbed and did not easily dissolve in water. Preparation of the container was carried out by installing 24 happa measuring 0.5 × 0.5 × 1 m in a pond that had been cleaned and filled with water to a height of 60 cm, and equipped with an aerator to maintain the availability of dissolved oxygen.

The research implementation included seed distribution after acclimatization for approximately 15 minutes with a density of 125 fish/m³, feeding 5% of the biomass weight four times a day, and sampling every 7 days to measure the growth of fish length and weight. Water quality management was carried out through 40% water changes every week and monitoring of temperature, pH, salinity, and dissolved oxygen (DO). The data obtained were analyzed using analysis of variance (ANOVA) with the help of IBM SPSS Statistics software version 26, and if there were significant differences, it was continued with the Least Significant Difference (LSD) test. The parameters observed included Specific Growth Rate (SGR), absolute length growth, Survival Rate (SR), and Feed Conversion Ratio (FCR).

RESULTS

Observation result

1. Pengaruh The Effect of Turmeric Extract (*Curcuma longa linn*) on the Specific Growth Rate of Tilapia Seed (*Oreochromis niloticus*)

The average initial weight, average final weight, and specific growth rate of tilapia seeds were determined based on research related to the impact of administering turmeric extract (*Curcuma longa linn*) on the growth rate of tilapia seeds (*Oreochromis niloticus*) for ± one month. Table 1 below shows the range of values, averages, and standard deviations of the impact of administering turmeric extract (*Curcuma longa linn*) on the growth rate of tilapia seeds (*Oreochromis niloticus*) for each treatment and replication.

Table 1. Range of values, average and standard deviation of the effect of administering turmeric extract (*Curcuma longa linn*) on the specific growth rate of saline tilapia (*Oreochromis niloticus*)

Treatment	Specific Growth Rate Range (%)	Average (%)	*Standard deviation*
A	11,57 – 14,77	13,55	1,25
B	15,30 – 22,33	18,01	3,21

C	15,47 – 22,93	18,79	3,23
D	15,47 – 21,90	19,83	2,29

Based on table 4.1 above, the results obtained that treatment A (control) distributed the average results of the specific growth rate value of 13.55% at a standard deviation of 1.25. Treatment B (giving turmeric extract 20 ml / kg of feed) distributed the average results of the specific growth rate value of 18.01% at a standard deviation of 3.21. Treatment C (giving turmeric extract 50 ml / kg of feed) distributed the average results of the specific growth rate value of 18.79% at a standard deviation of 3.23. Treatment D (giving turmeric extract 80 ml / kg of feed) distributed the average results of the specific growth rate value of 19.83% at a standard deviation of 2.29. For more details, the graphic image of the specific growth rate of saline tilapia seeds for ± 1 month of research can be seen in figure 1 namely.

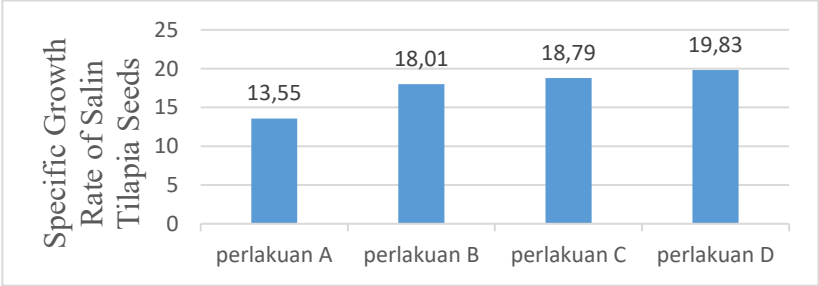

Figure 1. Graph of Specific Growth Rate of Salin Tilapia Seed

The highest level of specific growth of saline tilapia seeds throughout the study was in treatment D (giving turmeric extract 80 ml/kg feed) at an average specific growth rate of 19.83%, followed by treatment C (giving turmeric extract 50 ml/kg feed) at an average specific growth rate of 18.79%, treatment B (giving turmeric extract 20 ml/kg feed) at an average specific growth rate of 18.01%, and treatment A (control) which was 13.55%.

To understand whether there is a real difference in each treatment, an ANOVA test was carried out and the results are presented in table 4.2, namely.

Table 2. ANOVA Test Results (F Test) of the effect of administering turmeric extract (*Curcuma longa linn*) on the specific growth rate of saline tilapia (*Oreochromis niloticus*) fry

ANOVA

Laju Pertumbuhan Spesifik

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1376850.000	3	458950.000	6.680	.003
Within Groups	1374104.000	20	68705.200		
Total	2750954.000	23			

Based on table 2 above, a sig value of 0.003 was obtained below α 0.05, meaning that the administration of turmeric extract had a real effect on the specific growth rate of saline tilapia (*Oreochromis niloticus*) seeds.

Next, to understand the level of difference in each treatment on the specific growth rate of saline tilapia (*Oreochromis niloticus*) seeds, it was continued with a 5% BNT test, while the differences in the notation of the BNT test results can be seen in Table 4.3, namely.

Table 3. Results of the BNT test of the effect of administering turmeric extract (*Curcuma longa linn*) on the specific growth rate of saline tilapia (*Oreochromis niloticus*) fry.

Laju Pertumbuhan Spesifik

Perlakuan	N	Subset for alpha = 0.05	
		1	2
perlakuan A	6	1355.0000	
perlakuan B	6		1801.0000
perlakuan C	6		1879.0000
perlakuan D	6		1983.0000
Sig.		1.000	.269

Based on table 3 above, it can be explained that the administration of turmeric extract (*Curcuma longa linn*) on the specific growth rate of saline tilapia (*Oreochromis niloticus*) seeds in treatment A is significantly different from treatments B, C and D, then between treatments B, C and D there is no significant difference and a significant difference in treatment A.

2 Absolute Length Growth

Based on the research results, we obtained data on the average absolute length of each different treatment. The absolute length growth rate, along with the standard deviation, is shown in Table 4 below.

Table 4. Range of values, mean and standard deviation of absolute length growth

Treatment	Absolute Length Growth Range (cm)	Average (cm)	*Standard deviation*
A	1,92 – 2,77	2,32	0,29
B	2,23 – 3,35	2,61	0,40
C	2,26 – 3,43	2,78	0,48
D	2,55 – 3,01	2,83	0,16

Based on table 4 above, it can be explained that treatment A as a control achieved a mean absolute length of 2.32 cm at a standard deviation value of 0.29, treatment B by administering 20 ml/kg of turmeric extract to feed achieved a mean absolute length of 2.61 cm at a standard deviation value of 0.40, treatment C by administering 50 ml/kg of turmeric extract to feed achieved a mean absolute length of 2.78 cm at a standard deviation value of 0.48, in treatment D by administering 80 ml/kg of turmeric extract to feed achieved a mean absolute length of 2.83 at a standard deviation value of 0.16. For more details on the growth in the absolute length of saline tilapia seeds due to the effect of administering turmeric extract can be seen in figure 2.

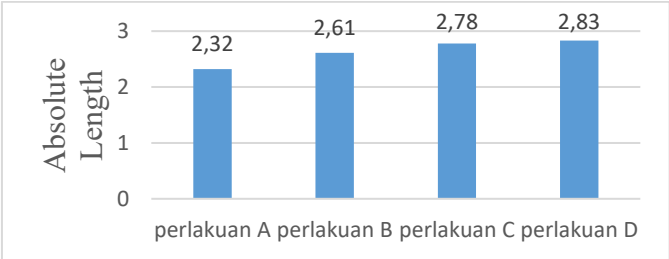

Figure 2 Absolute Length Growth Graph

Based on the image above regarding the effect of turmeric extract on the absolute length growth of saline tilapia seeds, it can be explained as follows. The highest length growth was shown in treatment D (giving turmeric extract 80 ml/kg feed) at a mean length increase of 2.83 cm, followed by treatment C (giving turmeric extract 50 ml/kg feed) at a mean length increase of 2.72 cm, continued by treatment B (giving turmeric extract 20 ml/kg feed) at a mean length increase of 2.61 cm, ending with treatment A (control) at a mean length increase of 2.32 cm.

To understand whether there are significant differences between each treatment in the test, an ANOVA test is needed, as shown in Table 5. This condition is carried out to analyze

groups within a population by sorting diversity based on a set of criteria as a comparison of the sources of diversity.

Table 5. ANOVA Test Results (F Test) of absolute length growth

ANOVA

Panjang Mutlak

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	59118.000	3	19706.000	4.869	.011
Within Groups	80947.333	20	4047.367		
Total	140065.333	23			

Turmeric extract treatment had a significant impact on the absolute length growth of tilapia (*Oreochromis niloticus*) fry, an example of which is shown in table 5 above, where the sig value is 0.011 exceeding 0.05. In addition, a 5% BNT test was conducted to determine the level of variation in each treatment on the absolute length growth of tilapia (*Oreochromis niloticus*) fry. Table 6 below shows the variation in the notation of the BNT test results.

Table 6. Results of the BNT test for absolute length growth

Panjang Mutlak

		Subset for alpha = 0.05	
Perlakuan	N	1	2
perlakuan A	6	161.0000	
perlakuan B	6		261.3333
perlakuan C	6		278.0000
perlakuan D	6		283.0000
Sig.		1.000	.584

Based on table 6 above, it can be explained that the administration of turmeric extract (*Curcuma longa linn*) on the specific growth rate of saline tilapia (*Oreochromis niloticus*) seeds in treatment A is significantly different from treatments B, C and D, then between treatments B, C and D there is no significant difference between each other and is significantly different from treatment A.

3. Survival Rate (SR)

Based on the research results, we obtained data on the average SR results for each different treatment. The resulting data, in the form of average SR values and standard deviations, can be seen in Table 4.7 below.

Table 7. Range of values, mean and standard deviation of Survival Rate

Treatment	Survival Rate Range (%)	Average (%)	*Standard deviation*
A	32,26 – 48,39	41,40	8,01
B	32,26 – 74,19	51,08	14,91
C	41,94 – 83,87	58,60	15,73
D	48,39 – 93,55	65,59	15,76

Based on table 7 above, it can be explained that treatment A as a control achieved a mean SR of 41.40% at a standard deviation value of 8.01, treatment B by administering 20 ml/kg of turmeric extract to feed achieved a mean SR of 51.08% at a standard deviation value of 14.91, treatment C by administering 50 ml/kg of turmeric extract to feed achieved a mean SR of 58.60% at a standard deviation value of 15.73, in treatment D by administering 80 ml/kg of

turmeric extract to feed achieved a mean of 65.59% at a standard deviation value of 15.76. For more details on the SR of saline tilapia seeds due to the effect of administering turmeric extract can be seen in figure 3.

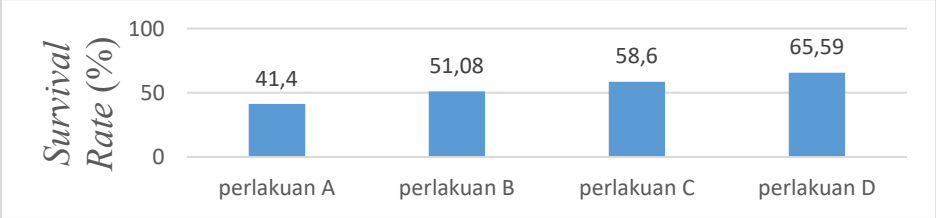

Figure 3. Survival Rate Graph

Based on the image above regarding the effect of giving turmeric extract on the Survival Rate of saline tilapia seeds, it can be explained as follows. The highest Survival Rate was shown in treatment D (giving turmeric extract 80 ml/kg of feed) at a mean SR of 65.59%, followed by treatment C (giving turmeric extract 50 ml/kg of feed) at a mean SR of 58.60%, continued by treatment B (giving turmeric extract 20 ml/kg of feed) at a mean SR of 51.08%, and ended by treatment A (control) at a mean SR of 41.40%.

To understand whether there is a real difference in each treatment, an ANOVA test was carried out and the results are presented in table 4.8, namely.

Table 8. ANOVA Test Results (F Test) Survival Rate

ANOVA

Survival Rate

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	19367933.792	3	6455977.931	3.302	.041
Within Groups	39104014.167	20	1955200.708		
Total	58471947.958	23			

Based on table 8 above, a sig value of 0.041 exceeds α 0.05, meaning that the administration of turmeric extract contributed a significant effect on the SR of saline tilapia (Oreochromis niloticus) fry. Next, to understand the level of difference in each treatment on the SR of saline tilapia (Oreochromis niloticus) fry, it was continued with a 5% BNT test, while the differences in the notation of the BNT test results can be seen in Table 4.9, namely.

Table 9. Results of the BNT Survival Rate Test

Survival Rate

		Subset for alpha = 0.05	
perlakuan	N	1	2
perlakuan A	6	4140.0000	
perlakuan B	6	5107.5000	5107.5000
perlakuan C	6	5860.3333	5860.3333
perlakuan D	6		6559.3333
Sig.		.056	.103

Based on table 9 above, it can be explained that the administration of turmeric extract to the SR of saline tilapia seeds in treatment A was significantly different from treatments C and D, then treatment B was significantly different from treatment D. In treatment C it was significantly different from treatment A, finally treatment D was significantly different from treatments A and B.

4. *Feed Conversion Ratio (FCR)*

Based on the research results, we obtained data on the average FCR for each different treatment. The resulting data, in the form of an average FCR range and standard deviation, can be seen in Table 10 below.

Table 10. Range of values, mean and standard deviation of FCR

Treatment	Feed Conversion Ratio Range	Average	*Standard deviation*
A	1,55 – 13,79	6,44	4,27
B	0,97 – 4,90	2,49	1,40
C	0,95 – 2,59	1,63	0,72
D	0,89 – 1,93	1,46	0,38

Based on table 10 above, it can be explained that treatment A as a control achieved a mean FCR of 6.44 with a standard deviation value of 4.27. Treatment B by administering 20 ml/kg of turmeric extract to feed achieved a mean FCR of 2.49 with a standard deviation value of 1.40. Treatment C by administering 50 ml/kg of turmeric extract to feed achieved a mean FCR of 1.63 with a standard deviation value of 0.72. In treatment D by administering 80 ml/kg of turmeric extract to feed achieved a mean FCR of 1.46 with a standard deviation value of 0.38. For more details on the FCR of saline tilapia fry due to the effect of turmeric extract administration can be seen in Figure 4.

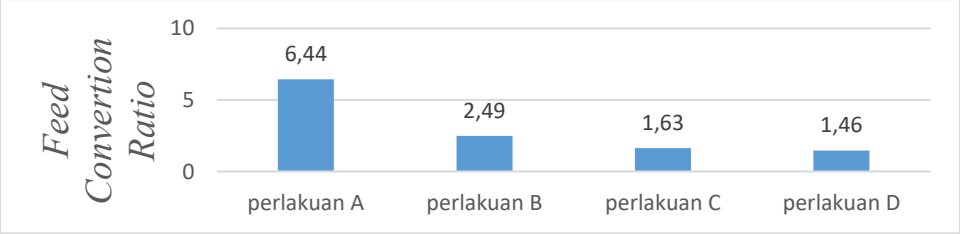

Figure 4. FCR Graph

Based on the image above regarding the effect of turmeric extract on the FCR of saline tilapia fry, it can be explained as follows. The best FCR was shown in treatment D (80 ml/kg of turmeric extract given) at a mean FCR of 1.46, followed by treatment C (50 ml/kg of turmeric extract given) at a mean FCR of 1.63, followed by treatment B (20 ml/kg of turmeric extract given) at a mean FCR of 2.49, and ending with treatment A (control) at a mean FCR of 6.44.

To understand whether there is a real difference in each treatment, an ANOVA test was carried out and the results are presented in table 11, namely.

Table 11. ANOVA Test Results (F Test) FCR

ANOVA

Feed Convertion Ratio

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	980562.167	3	326854.056	6.259	.004
Within Groups	1044441.667	20	52222.083		
Total	2025003.833	23			

Based on table 11 above, a sig value of 0.004 was achieved below α 0.05, meaning that the administration of turmeric extract contributed a significant effect on the FCR of saline tilapia (Oreochromis niloticus) fry. Next, to understand the level of difference in each treatment on the FCR of saline tilapia (Oreochromis niloticus) fry, it was continued with the 5% BNT test, while the differences in the notation of the BNT test results can be seen in Table 12, namely.

Table 12. BNT FCR Test Results

Feed Convertion Ratio

perlakuan	N	Subset for alpha = 0.05	
		1	2
perlakuan D	6	145.5000	
perlakuan C	6	163.0000	
perlakuan B	6	249.3333	
perlakuan A	6		643.8333
Sig.		.466	1.000

Based on table 12 above, it can be explained that the administration of turmeric extract to the SR of saline tilapia seeds in treatment A was significantly different from treatment D, then treatment B was significantly different from treatment D. In treatment C, it was significantly different from treatment D, and finally, treatment D was significantly different from treatments A, B and C.

5. Water Quality Monitoring

Water quality in aquaculture is one of several factors contributing to the success of fish farming. Water quality observations throughout the study showed that salinity, temperature, and dissolved oxygen were within normal limits and well tolerated by tilapia fry. However, pH measurements showed less than optimal results. The detailed water quality measurement data are as follows:

a. Temperature

Based on the research results, the water temperature ranged from 27.2 to 31.1ºC. Referring to the National Standardization Agency (BSN), 1999, the optimum temperature for fish is 25–30ºC. Temperature fluctuations in the water tank throughout the study can be seen in Figure 5.

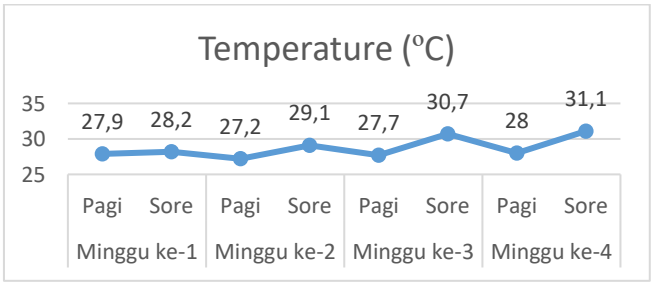

Figure 5. Temperature Graph

The results of Figure 4.5 above show that the fluctuations in morning and evening temperatures in weeks 2, 3 and 4 increased.

b. Salinity

Based on the results of the water salinity study, the results ranged from 0.16 to 3.5 ppt. According to Angriani *et al*. (2020), the optimum salinity for fish is between 0 and 35 ppt. The increase in salinity in the water tank throughout the study can be seen in Figure 4.6.

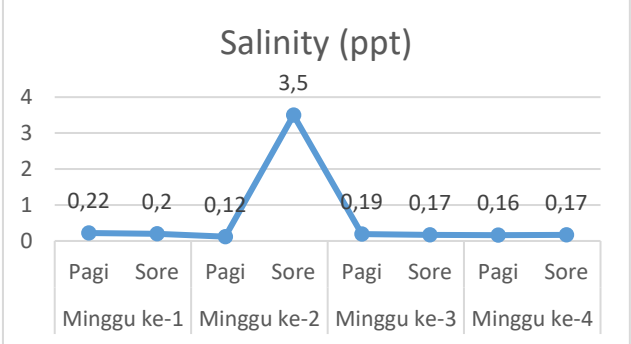

Figure 6. Salinity Graph

The results of Figure 4.5 above show that an increase in salinity occurred in the afternoon in the 2nd week.

c. pH

The obtained pH values varied, ranging from 4.7 to 8.63. The optimum pH for fish seed growth is set at 7 (National Standardization Agency, 1999). To see the differences and increases in pH, see Figure 7.

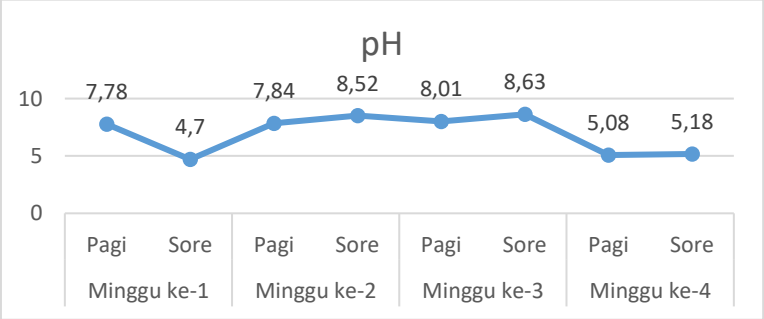

Figure 7. pH Graph

The difference in morning and evening pH values each week can be seen in Figure 4.7 above, which shows a significant decrease in pH in the first week due to rainfall. In weeks 2, 3, and 4, there was no significant decrease or increase in morning and evening pH.

d. DO

Berlandaskan Based on the research results, it can be concluded that the dissolved oxygen levels in the waters within the research container are still within the appropriate limits for rearing saline tilapia fry. To understand the differences in DO values throughout the study, see Figure 4.8.

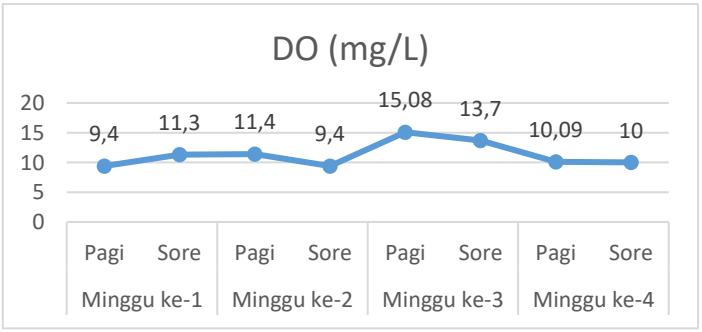

Figure 8. DO Graph

In this study, the weekly dissolved oxygen produced ranged between 9.4 and 15.08 mg/L. Dissolved oxygen is necessary for living organisms to respire, decompose organic matter, and support growth and metabolism. According to the National Standardization Agency (National Standardization Agency, 1999), the normal dissolved oxygen level for tilapia is around 5 mg/L

DISCUSSION

1. The Effect of Turmeric Extract (*Curcuma longa linn*) on the Growth Rate of Tilapia Seed (*Oreochromis niloticus*)

The results of the study showed that compared to saline tilapia fry not given turmeric extract, the administration of turmeric extract in feed tended to increase the specific growth rate of fish, which is thought to be related to turmeric's ability to increase appetite and digestive efficiency (Rubai *et al*., 2024). Based on the results of the ANOVA analysis, the administration of turmeric extract at various doses had a significant effect on the specific growth of saline tilapia fry, so that further LSD tests were continued to determine the best treatment. The test results showed that treatment D, namely the administration of turmeric extract at a dose of 80

ml/kg of feed, produced the highest specific growth value. The high growth in this treatment is thought to be due to the content of active compounds in turmeric, especially curcumin and essential oils, which play a role in improving digestion and absorption of nutrients such as protein, fat, and carbohydrates, so that energy from feed can be optimally utilized for growth (Wahyuningtyas *et al*., 2017; Santika *et al*., 2021). In contrast, treatment A as a control without the addition of turmeric extract showed the lowest growth value, which is thought to be because the absorption of nutrients from commercial feed is not optimal without the addition of supporting herbal supplements, as reported that commercial feed without additional combinations has not been able to maximize the growth rate of fish (Rambo *et al*., 2018).

2. Absolute Length Growth

The BNT test results showed that turmeric extract significantly affected the absolute length growth of saline tilapia fry. The treatment with the highest dose of turmeric extract (80 ml/kg of feed) produced the best length growth, while the treatment without turmeric extract showed the lowest results. This was due to the more optimal consumption and utilization of feed energy in fish fed turmeric extract, thus supporting optimal metabolism and growth.

3. *Survival Rate* (SR)

The high SR value in treatment D was due to the turmeric extract concentration in the treatment being within the acceptable range for the fish. ANOVA results showed that the administration of turmeric extract on SR only had a significant effect in treatment D (80 ml of turmeric extract/kg of feed). This condition is suspected because the saline tilapia fry can adapt well to the feed provided. Although the turmeric extract was administered at different doses in each treatment, the SR of the saline tilapia fry did not differ significantly between treatments. The SR of saline tilapia fry depends on "the conditions of the waters where they live, namely the ratio of feed amount, density, and water quality including temperature, salinity, pH, and DO" (Riana *et al*., 2021).

4. *Feed Convertion Ratio* (FCR)

The amount of feed converted into fish body biomass is indicated by the feed conversion value. Referring to the research results (Figure 4.4), treatment D (distributing 80 ml of turmeric extract/kg of feed) had the lowest FCR value, namely 1.46, indicating that the feed could be used as efficiently as possible for growth. On the other hand, treatment A (control) had the highest FCR value, namely 6.44, indicating that the feed was not used effectively for fish growth. A lower feed conversion rate indicates that the amount of feed distributed is more beneficial for fish growth, referring to Anriyono, et al., (2018). On the other hand, a higher feed conversion value indicates that the amount of feed distributed is less beneficial for growth.

5. Water Quality Monitoring

Water quality during the study was normal and supported the growth of saline tilapia fry. Water temperature ranged from 27.2–31.1ºC, which is still suitable for tilapia fry cultivation, although the ideal temperature is around 25–30ºC. Salinity ranged from 0.16–3.5 ppt and was still within the tolerance limits for saline tilapia fry. The water pH ranged from 4.7–8.63, which is still tolerable, although the optimal pH is around neutral. Meanwhile, the dissolved oxygen (DO) content ranged from 9.4–15.08 mg/L, well above the minimum limit required by saline tilapia, thus strongly supporting the survival and growth of the fish during the study.

CONCLUSION

Based on the results of research on the effect of administering turmeric extract (Curcuma longa linn) on the growth rate of saline tilapia (Oreochromis niloticus) seeds, the following conclusions can be drawn:

1. Administration of turmeric extract (*Curcuma longa linn*) has a significant effect on the growth rate of saline tilapia (*Oreochromis niloticus*) seeds.
2. The treatment that had the highest effect was treatment D (giving 80 ml/kg of turmeric extract/feed), while the lowest was treatment A (control).

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