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HIGH DOSE OF VITAMIN C FOR THE GROWTH OF NILE TILAPIA FISH (*Oreochromis niloticus*)

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ABSTRACT The efforts to increase tilapia production are made using high-nutrient artificial feed, and the feed mixture can use various ingredients, one of which is Vitamin C. This study aims to determine the best dose of Vitamin C with different doses on the growth rate of tilapia and to determine the effectiveness of adding high doses for the survival of tilapia. Daily water quality measurements are temperature, dissolved oxygen, and acidity levels, while weekly measurements are NH3 measurements. The research design used in this study was a Completely Randomized Design (CRD) consisting of treatment (555 mg/Kg) with control (0 mg/Kg). Data analysis used the Normality Test, Homogeneity Test, Anova, and Duncan Test. The results of the Treatment research test were the best treatment for absolute weight growth of 8.5 gr. The highest feed efficiency (EP) was found in the treatment with water quality during the study and was in the feasible range for tilapia life.

***Keywords**: Tilapia, Vitamin C, Growth and Survival.*

INTRODUCTION

Efforts to increase national fisheries production are now increasingly being made to meet the community's animal protein needs, develop agribusiness, and improve the economy of farmers or cultivators. One of the efforts to increase fisheries production is fish farming. Recently, freshwater cultivation has been growing rapidly. Tilapia (*Oreochromis niloticus*) is a type of freshwater consumption fish that is suitable for cultivation with an intensive system because it is one of the superior types of consumption fish commodities in Indonesia that has the potential to support the growth of food security and national economic resilience and improve people's welfare. In addition, tilapia production in 2018 reached 1.12 million tons or around 31.94% of Indonesia's total fisheries production (FAO, 2020) and continued to increase to 16.33 million tons in 2020 (KKP, 2020 in Rizky *et al.,* 2022).

One of the efforts to increase tilapia production is to provide highly nutritious artificial feed. The function of artificial feed can act as a source of energy for fish growth and reproduction. If the feed given is of good quality, sufficient in quantity, and supportive environmental conditions, it is inevitable that the growth rate of fish will be as fast as expected (Ridwantara *et al.,* 2019). Feed is an essential factor that must be considered in efforts to increase the productivity of farmed fish. However, the problem that often arises in fish farming is the high cost of food, which reaches more than 60% of the total production cost of fish farming. (Wairara and Pangaribuan, 2020).

The feed mixture can use various natural ingredients, one of which is vitamin C. Giving vitamin C is very important for fish because it can produce optimal growth and good feed efficiency and help the physiological function of organs (Alfisha *et al.,* 2020). Vitamin C increases normal development, prevents stress, and increases fish immunity (Komalasari *et al.,* 2018). Based on the above, the author wants to research the effectiveness of giving vitamin C doses in artificial feed to increase the growth rate of tilapia at the seed stage.

Vitamins and minerals in feed play a significant role in increasing fish growth and health. Vitamins play an important role in the physiological processes of fish. One of the vitamins that plays a significant role in the physiological processes of fish is vitamin C. Vitamin C is a nutrient present in

micro amounts in feed but must be available. Although needed in small quantities, vitamin C must be obtained from feed because the body cannot make it (Jusadi *et al.,* 2006). Feed efficiency can be increased in various ways, including probiotics, protein, and vitamin supplementation. When combined, probiotics, protein, and vitamin supplementation can synergistically improve feed efficiency. Probiotics help the digestive system function optimally, while high-quality protein ensures that animals have the necessary building blocks for growth. Proper vitamin supplementation ensures the animal's metabolism runs efficiently, promoting better nutrient utilization and reducing waste.

For instance, in poultry production, probiotics like *Lactobacillus* strains might be combined with protein-rich feed (such as soybean meal) and vitamin supplements (like vitamins A and D) to maximize growth and egg production. The result is more efficient use of feed resources, reduced costs, and improved sustainability.

METHODS

Research Design

The study was conducted from November 10, 2023, to December 10, 2023, at the SUPM Lebaksiu Freshwater Seed Center, Tegal. Part of the experimental research tested fish feed given vitamin C to determine its effect on growth rate, feed conversion, and tilapia survival. The design used in this study was a Completely Randomized Design (CRD) consisting of 1 treatment and control with three replications.

Sample and instruments

The data processing method used is quantitative descriptive data, which is processed by describing the data collected to conclude from the data processing results (Sholikhah, 2016). The goal is to provide a picture of the situation by making general, systematic, and appropriate decisions. Data Collection Method. According to Sugiyono (2013), secondary data is collected indirectly, or an in-depth search must first be conducted through the Internet, literature, statistics, books, and others. Primary data has never been collected before and is only for investigation purposes (Sugiyono, 2013). Primary data for this final study was collected through observation and interviews.

Absolute Weight Gain
W = Wt - Wo

Information :
W = Absolute growth (gr)
Wt = Body weight of test fish at the end of the study (gr) Wo = Body weight of test fish at the beginning of the study (gr)

Tilapia Fish Growth

$$SGR = \frac{Ln\ Wt - Ln\ Wo}{T} \times 100\%$$

Information :
SGR = Specific daily growth rate (%)
Wt = Average weight of fish at the end of maintenance (gr/tail)
Wo = Average weight of fish at the start of maintenance (gr/tail) T = Length of maintenance (days)

Absolute Length Growth
$L = L_T - Lo$

Information :
P = Increase in Length (cm)
L_T = Length of test individual at the end of maintenance (cm) Lo = Length of test individual at the beginning of maintenance (cm)
Feed Conversion Ratio Calculation

$$FCR = \frac{F}{(Wt + D) - W0 \times 100\%}$$

Information :
FCR = Feed Conversion Ratio
F = Total amount of feed consumed (g) Wt = Total weight of fish at the end of the study (g) Wo = Total weight of fish at the beginning of the study (g) D = Number of fish that died

Survival of Tilapia Fish

$SR = Nt / No \times 100\%$

Information :
SR = Survival (%)
Nt = Number of test fish surviving at the end of the study (tail)
N0 = Number of test fish released at the beginning of the study (tail)

Data Analysis

This research is descriptive; the data is presented in images and tables, and the collected data is analyzed descriptively. In addition, a correlation analysis was carried out using SPSS 17 to see the relationship between the addition of vitamin C and the growth rate of tilapia.

Before conducting the completely randomized design (CRD) test, a Normality test was conducted using Kolmogrov-Smimov. The Homogeneity test used the Barlett test and the Adj. The identification test used the Turkey test (Sudjana, 1992). Suppose the research data is found to be regular and homogeneous. In that case, the Variance Analysis Statistical Test (Anova) is continued to determine whether the treatment was significantly different (Way Anova). The Duncan Multiple Region test determines the effect of the treatment that gives the best results.

RESULTS AND DISCUSSION

Absolute Weight Gain

Absolute weight gain refers to the total Increase in an animal's body weight over a specific period, regardless of factors such as feed intake or metabolic rate such as:

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

Test	C
1	8.5
2	8.6
3	8.4
Number of Y	25.5

Average	8.5

Based on the Normality test results on the absolute individual weight growth data (grams) carried out, the Shapiro-Wilk Sig Test value was 1,000> 0.05; this shows that the data is standard. The next test is the Homogeneity test, which produces 0.71> 0.05 and has the same data variety (homogeneous data). Then, we continued with the ANOVA test, getting the results of Sig = 0.000 <0.05, which means that the treatment significantly affects the Increase in the absolute weight of tilapia seeds (*Oreochromis niloticus*). Furthermore, the Duncan Multiple Area test was carried out from treatment C, getting the best results on the growth of the absolute individual weight of tilapia during the study, with a result of 8.50 grams.

Daily Growth Rate

Daily growth rate is the average Increase in an animal's body weight per day, used to assess the efficiency of weight gain over a given period, such as:

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

Test	C
1	0.283
2	0.287
3	0.280
Number of Y	0.850
Average	0.283

The results of the Normality and Homogeneity tests show that the data is standard with a Sig value of 0.843> 0.05 and has the same data variety (homogeneous data) with a Sig value of 0.169> 0.05. At the same time, the Analysis of Variance Test (ANOVA) obtained the results of Sig = 0.000 <0.05, which means that it has a significant effect on the daily growth rate of tilapia seeds (*Oreochromis niloticus*). The next test is the Duncan Multiple Area Test, which determines the best results on the daily growth rate of tilapia seeds. The best results are in C, with a result of 0.23 grams.

Absolute Length Growth

Absolute weight gain is the total Increase in an animal's body weight over a specified period, without considering any relative factors such as feed intake or growth efficiency such as:

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

Test	C	
1	3.7	
2	3.8	
3	4.3	
Number of Y	11.8	1.8
Average	3.9	

The normality test (attachment 10) shows that the Shapiro-Wilk test Sig 0.843 > 0.05 shows that the data is usually distributed. Furthermore, testing with the Homogeneity test obtained results with a value of Sig 0.110 > 0.05, meaning it has the same data variety (homogeneous data). Then, continued

with the Sidik Ragam (ANOVA) test, obtained a result of 0.000 < 0.05, which means that it is very significantly different from the absolute length growth of tilapia seeds (Oreochromis niloticus). The Duncan area test showed the best results in treatment C, with a value of 3.93 grams.

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

Both metrics are used to evaluate and improve the productivity of livestock systems by optimizing feed usage, which leads to better economic and environmental outcomes. Both important metrics are used to evaluate the efficiency of feed utilization in livestock production. While they are related, they have slightly different meanings and applications. Here is an explanation of each:

Table 4. Average FCR and EP

Treatment	FCR	EP
C	1.2	0.83

Based on the analysis results in the table above, it can be concluded that the highest Feed Conversion Ratio (FCR) value was found in treatment C (555 mg/Kg) 1.2 followed by B (500 mg/Kg) 1.4; A (388 mg/Kg) 1.6; then K (0 mg/Kg) 2.0. While the highest Feed Efficiency (EP) was found in treatment C (555 mg/Kg) 0.83; B (500 mg/Kg) 0.69; and A (388 mg/Kg) 0.62; then K (0 mg/Kg) 0.48

Survival Rate (%)

Survival rate is an important metric that helps gauge a population's overall health, success, and viability over time. It is widely used across various fields to monitor progress, evaluate interventions, and ensure the sustainability of populations. Survival rate is a measure used to indicate the proportion of animals, individuals, or organisms that remain alive over a specific period, usually after exposure to certain conditions, treatments, or environments. It is commonly used in animal husbandry, biology, medicine, and research to assess the health, well-being, and success of survival in a population such as:

Table 5. Survival Rate (%) of Tilapia (*Oreochromis niloticus*)

Test	C
1	100
2	100
3	100
Average	100

All treatments in this study produced 100% SR, meaning that the vitamin C dosage difference in each treatment did not affect the survival rate of tilapia seeds (SR).

Water Quality Parameters

Water quality parameters are the characteristics or factors that help determine water's overall health and suitability for various purposes, such as drinking, irrigation, industrial use, or supporting aquatic life. These parameters provide crucial information about water's physical, chemical, and biological conditions. Monitoring and managing these parameters is essential for maintaining safe and healthy water systems such as:

Table 6. Average Measurement of Water Quality Parameters

No.	Parameter	Results	Unit	Literature
1	Temperature	26-28	°C	25-30°C (BSN, 2000)
2	pH	7.1-8	-	6.5-8.5 (BSN, 2000)
3	DO	5.2-6.5	mg/Kg	>5 (BSN,2000)

4	NH_3	0,- 0.2	mg/Kg	<0.5 Mg/Kg (Fazil *et al.*, 2017)

Vitamins are essential micronutrients that help regulate various metabolic processes and play a key role in maintaining the animal's health. Vitamin supplementation can improve feed efficiency and immune function. Increasing feed efficiency through probiotics, protein, and vitamin supplementation optimizes animal production systems. By improving digestion, nutrient absorption, and metabolism, these strategies enhance productivity and contribute to more sustainable and cost-effective livestock farming practices. The ongoing research into these areas continues to uncover more ways to fine-tune these approaches, leading to better feed utilization and healthier animals.

CONCLUSION

Treatment C (555 mg/Kg) was the best treatment for absolute weight growth of 8.5 gr. The best daily growth rate for C is an average of 0.27. FCR of treatment C (555mg/Kg) 1.2. The highest Feed Efficiency (EP) was found in the C 0.83 treatment. During treatment, 100%. Research test results show that vitamin C effectively increases the survival and growth of tilapia with the best dose of C treatment (555 mg/Kg). It takes more money and effort to use vitamin C.

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