Original Research Article

Utilization of Fermented Coconut Epidermis Using Oncom Mushroom (*Neurosporasitophila*) on the Growth Performance of Red Tilapia (*Oreochromisniloticus*) Fingerlings

ABSTRACT

This study aims to analyze the effect of feed based on coconut husk waste fermented oncom mushrooms on the growth of red tilapia, and to determine the optimal dose of coconut husk waste. This research was carried out in May – June 2021, at the Aquaculture Laboratory Building IV, Faculty of Fisheries and Marine Sciences, Padjadjaran University. This study used a completely randomized design with four treatments and four replications. Treatment A (Control), Treatment B (feed containing 25% coconut husk filler), treatment C (feed containing 50% coconut husk filler), and treatment D (feed containing 75% coconut husk filler). Parameters observed were Specific Growth Rate, Feed Conversion Ratio, Survival Rate, Feed characteristics and water quality (Temperature, pH, DO, Ammonia). The results showed that treatment C(feed containing 50% of coconut husk filler) gave significantly different results in the parameters of SGR and FCR, but not significantly different in survival rates. Water quality parameter values are in good condition for the growth and survival of red tilapia. The highest SGR value in treatment C was 1.26%. The lowest FCR value was in treatment C of 1.90. The most optimal dose of fermented coconut husk for the growth of red tilapia is treatment C.

Keywords:red tilapia; coconut husk; growth; survival

1. INTRODUCTION

One of the most popular types of freshwater ornamental fish is the Red Tilapia (Oreochromis niloticus) because it has high economic value and is an important commodity in the world's freshwater fish business. The advantages of tilapia compared to other consumption fish are that tilapia can grow fast only with low-protein feed, spawn all year round, are omnivorous, have thick flesh, and the taste of meat similar to red snapper [2]. Red tilapia is widely cultivated because it is easy to maintain and breed and has a high tolerance of changes in water quality. Cultivating tilapia, especially in enlargement activities, has the most important factor, namely the availability of feed in sufficient quantities.

Fish feed is one of the most important factors in a fish farming business. Feed must contain all the necessary nutrients such as carbohydrates, fats, proteins, minerals and vitamins and essential amino acids in sufficient and balanced quantities. About 50% or even more of production costs is determined by feed [3].

The weakness in making fish feed so far is not optimizing the potential of local feed [4]. Utilization of alternative materials as raw feed materials is one solution to this problem. Raw fee materials must have good nutritional value, be easy to obtain, easy to process, not contain poisons, relatively cheap prices, and not constitute human staple food [5].

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Comment [s2]: The number of repetitions in this study was too small.

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Coconut husk is the inner skin of coconuts whose waste is found in many traditional markets. The presence of coconut shell waste in the feed formulation is predicted to have a good response by red tilapia because it contains a metabolic energy of 3328 kcal/kg or equivalent to the gross energy content. The high content of fat and crude fiber makes the content of coconut husk not ideal to be used as a feed ingredient. Coconut husk must be fermented so that it can be used as fish feed, the fermentation process can break down complex components into simple substances, so that the feed is easily digested and increases protein. The fermentation process can be done by giving microorganisms.

Fermentation is a process of chemical change in an organic substrate through the activity of enzymes produced by microorganisms [6]. Fermented fiber materials are usually fermented using microorganisms in the form of mold, because this type of fungus is capable of breaking down crude fiber. One of the molds that has high cellulolytic activity and is often used in the fermentation of fiber materials isNeurospora sithopila or better known as oncom mushrooms [7].

Neurospora sitophila is a mold that belongs to the subdivision Eumycophyta, class Ascomycetes, order Sphriales and family Sordoriaceae. This mold grows on media containing cellulose and produces the enzyme β-glucosidase. This mold also has high lipolytic activity which hydrolyzes triglycerides into free fatty acids.

Based on this discussion, in this research it is necessary to examine the effect of adding fermented coconut husk by Neurospora sitophila asfiller on red tilapia feed. The right dose in the addition of fermented coconut husk by Neurospora sitophilais expected to promote good growth in red tilapia.

Comment [s6]: Why use coconut hush? what are the advantages and disadvantages of being given more and also what are the limitations of giving? As well as state what the content of the active substance is and what percentage it contains, for example, the content of fat and fiber and so on. Added new references about coconut hush

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Comment [s8]: Add references to fermentation. why use fermentation and what are the advantages and disadvantages? And why use fermentation Using Oncom Mushrooms (Neurosporasitophila). explained in detail.

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2. MATERIAL AND METHODS

The tools and materials used in this research were aquariums with a size of 30 x 40 x 40 cm^3 as many as 16 pieces, 1 unit fiber tub with a size of 70 x 70 x 70 cm^3, aerator pump, hose, aeration hose, aeration stone, scoop, digital scale, tray, plastic zip lock, thermometer, pH meter, Dissolved Oxygen meter, Ammonia test kit, Red Tilapia (*Oreochromisniloticus*) measuring 7-12 cm, Oncom Mushroom (*Neurosporasitophila*), coconut husk.

The method used in this research is a laboratory experimental method, using a completely randomized design (CRD) consisting of four treatments and four replications. The treatment given was basal feed containing fermented coconut husk filler*Neurosporasitophila*, with the following combination or composition: (A) Basal feed with 100% bran filler, (B) Feed containing 25% coconut husk filler, (C) Feed containing 50% coconut husk filler, (D) Feed containing 75% coconut husk filler.

Parameters observed in this research include absolute body weight growth, survival and water quality. Observation of weight growth and water quality was observed once every 7 days for 42 days. This research did not use recirculation, so the water in the aquarium was cleaned by a third every day. The parameters observed were the increase in the weight of red tilapia as the main data. The water quality measured was temperature, degree of acidity (pH), dissolved oxygen content (DO), and ammonia content (NH).

Data analysis in this research uses test*Analysis Off Varians*(ANOVA) for data on weight gain and survival. While the data on water quality results were analyzed in a descriptive-comparative way.

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2.1 Procedure

2.1.1 Preparation of rearing containers

Preparation of the container begins with cleaning the aquarium from dirt or scale that sticks to the walls and bottom using soap. After the aquarium is clean, check for leaks and then dry it in the sun. Furthermore, the tanks and aquariums were disinfected using potassium permanganate (PK) solution for about 24 hours, then filled with water with a

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volume of 40 liters and given sufficient aeration. The aquarium can be used after one day of water filling.

2.1.2Preparation of Test Feed

The feed formulation is prepared in advance. Then do the fermentation on the coconut husk by*Neurosporasitophila*for 5 days [8]. After that, the fermented coconut husk is ground into flour, put it into the ration formulation that was previously designed. Each feed ingredient is weighed according to the formulation, then mixed and pelletized by the machine*pelleting*, the last is drying using the oven.

2.1.3Maintenance of Test Fish

The test fish to be used in this research were red tilapia with a length of 7 - 12 cm and weighing between 9-16 g as many as 7 in an aquarium containing 42 liters of water volume, with a density of 1 fish / 6 L. After acclimation, the tilapia were stocked in an aquarium. Furthermore, tilapia are reared by feeding as much as 3% of the fish's body weight with a frequency of 2 times, namely in the morning at 08.00 and in the evening at 15.00 WIB.

2.1.4Research Implementation

The research was carried out for 42 days. Observations on fish growth, survival and water quality (pH, temperature, ammonia and DO) were carried out every seven days. Aquarium siphoning was carried out daily and the water was changed periodically during the observation period. The amount of feed given is adjusted to the total weight of fish in each maintenance container. The resulting red tilapia seed weight data will be used to measure the feed weight for each period.

2.2Observation

2.2.1Survival Rate

Survival rates were observed every day during the study. If at the research implementation stage there are dead fish, the weight of the fish is measured and then recorded and discarded. Survival rate (SR) is calculated to determine the mortality rate of the test fish during the study, survival can be calculated based on formula [9]:

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

Explanation:
SR = Survival rate
N_t = Number of fish at the end of the study
N_0 = Number of fish at the beginning of the study

2.2.2Feed Convertion Ratio

Feed conversion is calculated using theformula:

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

Explanation:
FCR = *Feed Convertion Ratio*
W_o = Weight of test fish at the beginning of the research(g)
Wt = Weight of test fish at the end of research(g)

Comment [s15]: Explain why it is fermented for 5 days.?add appropriate references.

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D = Weight of dead fish during rearing (g)
F = Amount of feed given(g)

2.2.3Spesific Growth Rate

Observation of daily growth rate was carried out once every 7 days during the study. The formula used in calculating the Daily Growth Rate (LPH) uses the formula [10]:

$$\alpha = \frac{(\ln Wt - \ln W0)}{t_1 - t_0} \times 100\%$$

Explanation:
α = Daily Growth Rate of weights
wt = average weight at the end of treatment (day t)
wo = initial average weight of treatment (day 0)

2.2.4Water Quality

Observation of water quality consists of temperature, pH, DO (*Dissolved Oxygen*), and ammonia. Measurement of water quality in this study was carried out every observation period.

2.2.5Data Analysis

Data on water quality and feed characteristics were analyzed descriptively. SR data (*Survival Rate*), SGR (*Spesific Growth Rate*), and FCR (*Feed Convertion Ratio*) obtained then analyzed the F-test variance at 5% level. If in the analysis of variance there is a significant difference (P <0.05), then the test is continued with Duncan's test to determine differences between treatments. The following is the F-test formula:

$$F_{hit} = \frac{KTP}{KTG}$$

$H_0$is homogeneous data, while it is non-homogeneous data. If there is a significant difference in the analysis of variance, then the test is continued with the Duncan test with the following formula:

$$D = d_{a.p.v}\, x \frac{\sqrt{KTG}}{n}$$

Explanation:
p = the distance between the two levels of treatment p
v = error free degrees
a = real level
KTP = the middle square of the treatment
KTG = middle square error

3. RESULTS AND DISCUSSION

3.1 Feed Convertion Ratio

One of the factors that affect the feed conversion ratio is the digestibility of the feed. Feed digestibility is affected by crude fiber content. Crude fiber has very low nutrition, but in certain amounts it is recommended to use it to accelerate peristalsis in the intestines and

Comment [s20]: Explain how water quality measurement works. add new references as appropriate.

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help feces clot [11]. Based on the results of the research, it was shown that treatments A, B and C had a range of crude fiber requirements that were suitable for red tilapia [12]. Whereas treatment D had a range of fiber requirements that were not suitable, thus reducing the quality of the feed structure which caused absorption to also be reduced.

Crude fiber content of more than 8% in the feed can reduce the quality of the feed structure [13]. This shows that the feed treatment D (feed containing 75% coconut husk filler) is beyond the crude fiber limit for tilapia because it has 8.2% fiber, thereby reducing the quality of the feed structure which causes absorption to decrease.

Comment [s24]: What is the crude fiber content in this study? is it analyzed? incomplete data.

The results of the statistical analysis showed that feeding with different compositions of coconut husk produced a significant difference in the FCR value. FCR values were then analyzed using Duncan's multiple range test at the 95% level of confidence. The best FCR value results are in treatment C because it has the lowest FCR value and is still within the limits of fat and fiber according to the needs of tilapia (Figure 1).

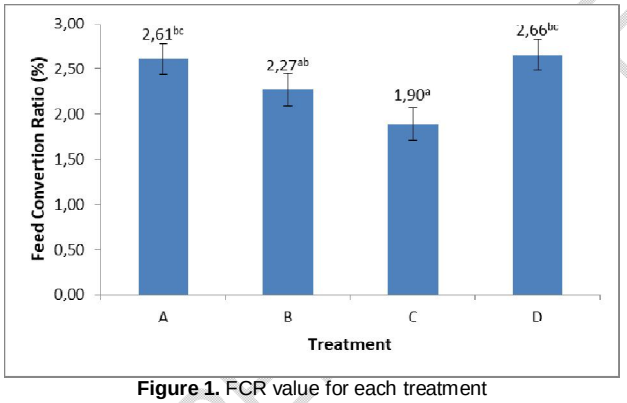

Figure 1. FCR value for each treatment

The results showed that Treatment D (feed containing 75% of coconut husk filler) was the treatment that had the worst FCR among the other treatments. Besides being seen from the fiber content, another component that supports that treatment D is the most difficult treatment for fish to absorb due to the fat content of the feed. Fat is an important component needed by fish after protein. Fish need fat as energy which is used to synthesize fatty acids which cannot be synthesized by the fish themselves. Coconut husk contains organic acids needed by tilapia.

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Coconut husk flour contains organic acids in the form of linoleic acid to help growth and certain hormone presecutors [14]. A 5% fat content in the feed is sufficient for tilapia needs, but a 12% fat content in the feed will produce maximum development [15]. Whereas treatment D (based on 75% fermented coconut husk) had a fat content above 12%.

3.2 Growth

Observation of the growth rate of red tilapia is a supporting parameter observed to determine the effect of adding oncom mushroom fermented coconut husk on the growth of red tilapia. The results of measuring the weight growth of Red Tilapia in this research showed that different feeding treatments resulted in different average values. There was an increase in the average growth from the first observation to the sixth observation in each treatment, indicating that the feed given was able to be eaten and utilized by tilapia (Figure 2).

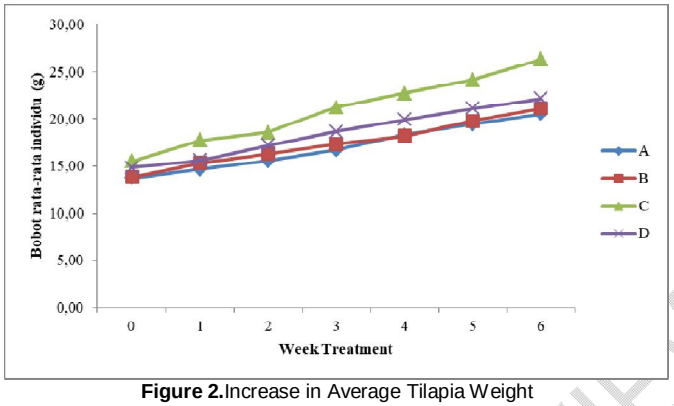

Figure 2. Increase in Average Tilapia Weight

The average yield of tilapia growth during the study was then followed by the calculation of SGR (Spesific Growth Rate). The results of statistical analysis, obtained the average absolute weight of fish in the control treatment (A) which was significantly different from the average absolute weight in the treatment of feed containing coconut husk filler (Figure 3).

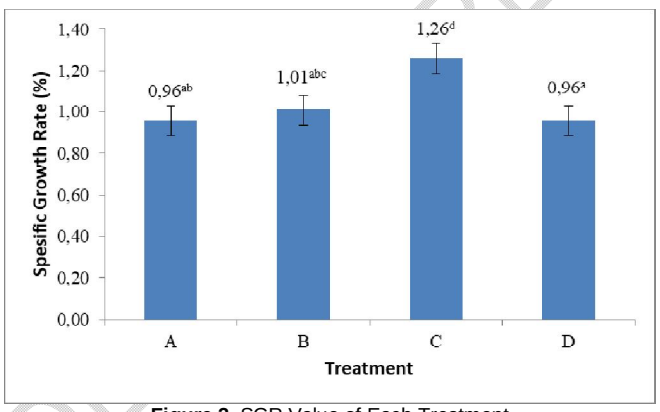

Figure 3. SGR Value of Each Treatment

Red tilapia with the addition of fermented coconut husk had greater weight growth than the one without the addition of fermented coconut husk. Coconut husk flour contains organic acids needed by freshwater fish, such as linoleic acid to help growth and certain hormone precursors. In the treatment of adding 75% coconut husk there was a decrease due to the high fat content exceeding the fat content in the feed requirement, namely 12.6, the 5% fat content in the feed was sufficient for the needs of tilapia but the fat content in the feed of 12% would produce maximum development.

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3.3 Survival Rate

Survival is the ratio between fish that live at the end of rearing with the number of fish that are at the beginning of rearing. In fish farming mortality is a determinant of the success of the business. Supporting factors that produce a high survival value in this research, are supported by the feed given, stocking density settings and environmental conditions in the rearing medium. Giving coconut husk fermented oncom mushroom to the test fish feed can meet nutritional needs and maintain their survival.

Table 1. Red Tilapia Survival for 42 days

Treatment	Survival Rate (%)
A. (Control, Basal feed withfiller bran as much as 100%)	100
B. (Artificial feed containingfiller epidermis coconut as much as 25%)	93
C. (Artificial feed containingfiller epidermis coconut as much as 50%)	96
D. (Artificial feed containingfiller epidermis coconut as much as 75%)	100

The survival rate of red tilapia for 42 days of rearing in each treatment has a range of 93% - 100% (Table 1), this value is still high because it is above the standard value for survival quality of production tilapia, namely 75% [16]. Based on the analysis of variance, the increase in fermented coconut husk on feed did not have a significant effect on the survival rate ($p>0.05$). Treatment A and D feeds had a survival rate of 100%, this indicated that there were no harmful and anti-nutritional compounds that could cause death in fish.

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3.4 Water Quality

Water quality parameters are one of the factors that affect the survival of red tilapia. The role of water quality affects the metabolism and stress level of fish so that it plays an important role in increasing the production of fish farming [17]. The water quality parameters observed in the research were pH, DO, temperature and ammonia. Water quality data collection in the research was carried out every 7 days. The results of observations of water quality parameters are presented in Table 2.

Table 2. Observation Results of Red Tilapia Water Quality

Parameter	Result	Reference (BSNI.2009)
pH	7-7,8	6,5-8,5
DO (ppm)	4,8-5,3	≥3ppm
Temperature (^oC)	25,3-26,1	25-30
Ammonia ($mg.L^{-1}$)	0.0014 - 0.0040	

The pH of water is a determinant of chemical processes in water. pH levels that are too high or too low cause fish to become stressed [18]. The results of pH analysis during the research showed that the average for all treatments ranged from 7-7.7. The measurement results at the beginning of the research on pH levels showed a value of 7 and then increased. This is due to metabolic processes in fish during the research. The optimal pH for rearing Red Tilapia is around 6.5-8.5.

Dissolved oxygen is an important element in metabolic processes which means the amount of oxygen in milligrams contained in one liter of water (ppm). The results of DO observations during the research showed that the average DO for each treatment during the research ranged from 4.8 to 5.3 ppm. Optimal DO for rearing Red Tilapia is around ≥3ppm. Temperature is an abiotic factor that affects the metabolism and growth of fish, including red tilapia. The results of water temperature measurements during the research were 23.6-24.7^{0}C, still within safe limits. The optimum temperature for rearing Red Tilapia ranges from 25-30^{0}C.

Comment [s28]: Add a reference about Water Quality. The discussion is not clear

4. CONCLUSION

Based on the results of research and discussion, the following conclusions can be drawn:
a. Addition of fermented coconut husk Neurosporasittophila to artificial feed with a certain percentage can increase the growth of red tilapia (Oreochromisniloticus)
b. The optimum dose for the use of fermented coconut husk of Neurosporasittophila on artificial feed for good red tilapia is 50%. This dose provided the highest growth increase of 1.26%, the highest survival of 96%.

Comment [s29]: The conclusion is made in one paragraph briefly and clearly.

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Comment [s30]: Too few references. add the latest references and check the writing of references.

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