Original Research Article

Effect of Addition of soybean oil, coconut oil, and corn oil to commercial feed on the growth of red tilapia (*Oreochromis niloticus*)

ABSTRACT

This study aims to determine the appropriate addition of vegetable oil to see the best growth of Red Tilapia (*Oreochromis niloticus*) without reducing feed consumption. This study used a completely randomized design with four treatments and four replications. Treatment A (Control), Treatment B (4% soybean oil), Treatment C (4% coconut oil), and Treatment D (4% corn oil). Parameters observed were Specific Growth Rate (SGR), and water quality (Temperature, pH and DO). The results showed that treatment B (4% soybean oil) gave significantly different results on the parameters of SGR, while treatments C and D increased the fat content of red tilapia compared to the control treatment. The water quality parameter values are in good condition for the growth and survival of Red Tilapia. The highest SGR value in treatment B was 1.51%, treatment D was 1.10%, treatment A was 1.07%, and treatment C was 0.89%.

Keywords: Red Tilapia, soybean oil, coconut oil, corn oil, growth rate.

1. INTRODUCTION

Red Tilapia (*Oreochromis sp*) is a type of fish that was introduced from abroad. These fish seeds were officially imported to Indonesia by the Freshwater Fisheries Research Institute in 1969[1].After going through a long adaptation with the help of research, this fish is disseminated to fish farmers throughout Indonesia. So far, the development of red tilapia cultivation has not experienced many problems, but there is one problem that needs to be considered, namely the problem of feed. This feed plays a very important role in its growth. In juvenile conditions, these fish require feed that has a high protein content of 25-35%.while the need for fatty acids of tilapia, according to [2] is from unsaturated fatty acids of the omega 6 group, which is as much as 0.5-1 percent. Materials that contain lots of fatty acids, both saturated and unsaturated, one of which is PUFA omega 6 are from seeds and vegetable plants. PUFA is one type of essential fat, because the body cannot synthesize it while the body needs PUFA for normal growth and function of all tissues. Apart from being an easily available source, there are also various commercial sources of vegetable fats, such as coconut oil, corn oil, and soybean oil.

World consumption of vegetable oil in 2011-2012 reached ± 150 million tons. 114.2 million tons are used in the food sector and 35.8 million tons in the non-food sector [3]. Based on data from Oil Word, the total production of 17 types of vegetable oils and fats in the world reached 236 million tons in 2020, this figure increased from 2013 which amounted to 189.5 million tons [4]. Therefore, the addition of vegetable oil to feed to meet the fat needs of red tilapia needs to be done and also vegetable oils can be better absorbed by fish body tissues

and can also affect fish growth. If the feed given is of low quality, one of which is a lack of fatty acids, it will cause disturbances to the growth and health of fish, such as reduced resistance of seeds to environmental changes, seed growth becomes slow and the seeds are very susceptible to diseases that often cause death [5]. This is because fat can be a source of energy that produces 9 kcal. per gram and the amount is greater than protein and carbohydrates which are only about 4 kcal. This essential fatty acid is a lipid component that plays a role in its nutritional value and cannot be formed by any animal but can only be obtained from consuming food directly so that animal protein needs can be met. Meanwhile, fat in the feed also has various important roles in fish nutrition, including as a source of energy, phospholipids and steroid components as vital organs, and when fish maintain balance in the water [6].

There are various ways in making feed, one of which is by adding vegetable oil to meet the fat needs of red tilapia. Fat is one source of energy that must be available in feed. Because fat is a source of high energy that can be used for fish daily activities such as swimming, foraging for food, avoiding enemies, growth, and endurance.Determination of the source of fat in the feed becomes important in terms of the efficiency of the feed used. Oil is a source of fat that is still widely used in feed. Different types of oil have different effects on fish. This study aims to determine the effect of adding vegetable oil (soybean oil, coconut oil, corn oil) in feed to the growth of red tilapia, the oil was chosen because it is easier to obtain in the market and also contains high levels. of fatty acids efficient use of oil can also be a source of energy. The total dose of animal and vegetable oils at the same protein content in the feed or also known as the protein energy ratio (E/P) can affect growth. If the utilization of protein by fish is not optimal, other sources of energy are needed, namely those obtained from fat, so that protein can be utilized optimally for growth. Fat in feed acts as a source of energy and is also important as a source of essential fat for the process of growth and body defense [7]. The use of fat in fish feed is very important in supporting the growth of fish. Because fat is an energy source that has a high enough value compared to protein and carbohydrates [8]. Meanwhile, according to The Culinary Institute of America [9], the content of omega-6 in soybean oil is higher than in other types of vegetable oil such as corn oil, cottonseed oil, coconut oil and peanut oil.

2. METHODS

This research was conducted from February 2022 to March 2022 in Aquaculture LaboratoryFaculty of Fisheries and Marine Sciences, Padjadjaran University. The research used was experimental with a Completely Randomized Design (CRD). Parameters specific growth rate (SGR) were tested using analysis of variance/F test and further tests using Duncan's test to see the effect of treatment on each parameter to be tested, at a 95% confidence level. Water quality parameters were analyzed descriptively.

Treatment A: Control (without the additionoil), Treatment B: Addition of 4% soybean oil, Treatment C: Addition of 4% coconut oil, and Treatment D: Addition of 4% corn oil

2.1 Test Feed

Preparation of the test feed was started by mixing the feed for treatment B was given the addition of soybean oil as much as 4%, while treatment C was given the addition of 4% coconut oil and finally treatment D was given the addition of corn oil 4% using Progol feed adhesive, after that it was dried in the oven.

2.2 Pisciculture

The test fish used in this study was Red Tilapia from Bandung, West Java. Red Tilapia sized 12-14 cm with an average weight of 40.41 ± 0.43 g/head.The fish are adapted to the new environment first and the feed will be given in a fiber tub with a volume of 250liters. Then transferred to the rearing container as many as 5 test fish per tank with a volume of 20 liters which had previously been weighed. Feeding as much as 3% of fish biomass was carried out at 08:00 West Indonesian time and 16:00 West Indonesian time. Siphoning is carried out every day, while water changes are carried out 4 times a day as much as 35% of water with water that has been deposited first. Maintenance was carried out for 40 days of observation.

2.3 Observation Parameters

2.3.1 *Specific Grow Rate* (SGR)

The test fish were calculated using the following equation [10]:

$$\text{SGR} = \frac{\ln Wt - \ln Wo}{t} x\ 100\%$$

Information:
Wt = Average weight of fish at the end of rearing (g)
Wo = Average weight of fish at the beginning of rearing (g)
t = Length of time of rearing

2.3.2 Survival Rate (SR)

The formula used to determine the survival percentage of the test fish according to [11]:

$$\text{SR} = \frac{Nt}{No} x\ 100\%$$

Information:
SR= Survival Rate (%)
Nt=Number of fish at the end of rearing
No = Number of fish at the beginning of maintenance

2.3.3 Water Quality

Observation of water quality consisted of pH, dissolved oxygen (DO), and temperature. Water quality measurements in this study were carried out at the end of each observation period.

3. RESULTS AND DISCUSSION

3.1 Specific Growth Rate

Based on the results of research on Red Tilapia seeds during the 40-day rearing period, it was found that differences in the addition of soybean oil, coconut oil, and corn oil to commercial pellets resulted in an increase in the average weight of individuals in different Red Tilapia. the average initial biomass of tilapia was 157.32 g – 192.30 g and at the last

observation, the biomass of catfish was 272.40 g – 300.17 g. The highest increase in the average growth value was in treatment D with an average final biomass of 253.31 g (Fig. 1).

Figure 1. Diagram of Red Tilapia Biomass

The SGR result is greater than the research conducted by [12] of 0.7% and is still relatively good >0.72% [13]. Meanwhile, the highest result in treatment B was 1.51% (Fig. 2).This shows that the application of fish oil to commercial feed is still in a good range for the specific growth rate, where the results obtained are 0.89%-1.51%.showed that the better value for Red Tilapia consumed feed supplemented with soybean oil (Treatment B), the increased growth rate occurred because the feed provided had a balance of nutrients needed by red tilapia, such as saturated fatty acid levels of around 15%, while for coconut oil around 8-10% and corn oil only 1.4-2.2%.

Figure 2. Diagram of Red Tilapia Specific Growth Rate (SGR).

In treatment B (soybean oil) the daily weight gain (SGR) was the highest compared to other treatments, this could also be due to the fat content of soybean oil to meet the nutritional needs of red tilapia. The fat requirement of tilapia is at least 6% with the fatty acids it needs,

especially from the omega 6 group, while for the lowest treatment in treatment A (Control) this is because there is no addition of fat content in the feed so that the daily growth of weight in treatment A (Control) to be the lowest among the other treatments. Because the control only contains 3-5% fat while the nutritional needs of red tilapia range from 6-8%.

The difference is because, in addition to protein from the feed, fat can also affect growth as mentioned by [14] where it is stated that the use of fat in feed is very important in supporting growth, because fat is an energy source that has a high enough value compared to protein and also carbohydrate. The use of fat is also a "protein sparing effect" which is a substitute for protein as an energy source, so that the use of energy derived from protein can be used to support growth.The total oil content in feed will determine energy utilization, efficient use of oil as an energy source can increase protein efficiency for growth. Soybean oil has good fat quality and can support optimal growth in fish, namely the content of essential fatty acids [15].

3.3Survival Rate (SR)

Until the end of the research data obtainedthe survival of the tilapia servedin Figure 3.

Figure3. Diagram of Red Tilapia Survival Rate(SD)

Adjustment to the new environment and with the treatment given can still be tolerated and have a positive impact on Red Tilapia fish. The survival rate according to [16] there are three categories to describe the survival range, including: SR > 50% fall into the good category, 30% > SR > 50% fall into the medium 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 that was fed with the addition of vegetable oil was in the good category.

3.3 Water Quality

Water is one of the factors in the environment of fish living media that affects the quality of life and growth of fish. Water quality aims to see that some parameters are still within tolerance and support the growth of good red tilapia. The results of air quality measurements in each treatment were relatively the same, this shows that feeding with the addition of fish oil did not change the quality of the maintenance media (Table 1).

Table 1. TreatmentParameters Details.

Parameter	Treatment			
	A	B	C	D
Temperature	27-29°C	27.9-29.7°C	27-29°C	27-29.5°C
pH	6.78-8.10	7.1-8.35	7-8.10	7-8.2
Dissolved oxygen	4.2-5.1	3.2-5.1	3.2-5.1	3.2-5.1

The average water quality during the study was in the appropriate range for the growth of tilapia fry. The temperature during the study ranged from 27.9 -29.7 ^{o}C. Still within the feasibility level for rearing red tilapia fry. Red tilapia can live in a temperature range of 14-38 ^{o}C. The optimum temperature for tilapia fry ranges from 25-30 ^{o}C[17]. At temperatures less than 14 C or more than 30 ^{o}C, the growth of red tilapia is inhibited. The lethal temperature was at 6 ^{o}C and 42 ^{o}C[18].

The results of pH measurements during the study ranged from 6.78-8.35 while tilapia grew optimally at pH 6-8.5 [17]. The pH range during this study was still within the feasibility level for rearing red tilapia fry.

Meanwhile, the dissolved oxygen content during the research was in the range of 3.2 – 5.1 mg/L. The dissolved oxygen range is suitable for the growth of red tilapia fry, where dissolved oxygen tilapia for red tilapia fry ranges from 4-10 mg/L [17].Water quality during the research was quite good and supported the growth of Red Tilapia.

4. CONCLUSION

Based on the results of the study, it was concluded that the addition of soybean oil to commercial feed provides good growth performance and the highest feed utilization efficiency (66.06%) in Red Tilapia. The addition of 4% vegetable oil to commercial feeds increases the fat content of red tilapia meat.

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