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The Effect of Fresh *Lemna* As a Feed for Tilapia (*Oreochromis niloticus*)

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Lemna sp., fresh, level of feeding, growth, tilapia

ABSTRACT

This research aims to determine the level feeding of *Lemna* sp. fresh against the growth of tilapia. The study was conducted in December until February 2020 at the Laboratory Fisheries of Faculty of Fisheries and Marine Sciences, Padjadjaran University. The research method used is the experimental Complete Random Design (CRD) with 4 treatments and 4 replications. The treatment is A (control), B (15% *Lemna* sp.), C (20% *Lemna* sp.), and D (25% *Lemna* sp.). The observed parameters are survival rate, specific growth rate, and water quality. Observations were conducted during 50 days. Data on the survival rate, specific growth rate was analyzed using Test-F and Duncan's advanced test at a confidence level of 95%, while water quality was analyzed descriptively. Based on this research, the giving of 20% fresh *Lemna* sp. resulting in the specific growth rate of tilapia about 0,22%, and survival rate of 83,75%. This value is the same as using a commercial pellet of 3%. Nevertheless, 20% fresh *Lemna* sp. as fish feed is recommended.

1. INTRODUCTION

Tilapia (*Oreochromis niloticus*) is a favorite freshwater fish commodity for Indonesian people, not only because the meat is delicious and the price is affordable, but the nutrients contained in tilapia are quite high, so that it can fulfill the needs of animal proteins for the community[1]. Tilapia production in Indonesia has increased from year to year. Based on data in 2016 the amount of tilapia production was 1.187.812 tons and increased in 2017 with total tilapia production approximately 1.280.124 tons[2]. The problem that are often encountered in an intensive aquaculture process is the provision of commercial feed because its cost can reach 60-70% of the total production cost[3]. The high cost of commercial feed is caused by the usage of imported raw materials for fish feed which leads to high prices of fish feed [4]. Therefore, an alternative feed that is more economical and easy to obtain is needed[5]. The effort made to reduce the costs is by using the forage feed, namely *Lemna* sp.

Lemna sp. is more known as duckweed, a small-sized aquatic plant that floats on water and potentially used as a fresh feed or feed material because it has sufficiently high nutrients. The crude protein content of *Lemna* sp. is 25,22%[6], 7-14% fiber, 35% carbohydrates, 3-7% fat, and high vitamin and mineral content[7]. This aquatic plant has high productivity and in optimal conditions, it can multiply the biomass only in two days[8]. Adding 20% fresh *Lemna* sp. of the body-weight of grass carp gives a better growth rate compared to giving of *Azolla filiculoides* with the same weight[9]. It is required to conduct a test about the provision of fresh *Lemna* sp. as tilapia seed feed which aims to determine the level of provision of *Lemna* sp. which can affect the growth rate of tilapia.

2. MATERIAL AND METHODS

Major This research was conducted in Fisheries laboratory, Faculty of Fisheries and Marine Sciences, Padjadjaran University, Indonesia from December 2019 until February 2020. The materials used in this study was 320 tilapia fish with sized ±5-7 cm are obtained from Fish Farmer in Pangandaran, *Lemna* sp. was planted with bioslurry fertilizer (2,5% from the volume of water), commercial feed with 18% crude protein content, 10 % water content, 4-6% crude ash content, and 4-6 % fat. The research method used is experimental with Complete Random Design (CRD) which is consist of 4 treatments and 4 replications as follows:

Treatment A = commercial feed (control) with a percentage of 3% of the fish weight.
Treatment B = fresh *Lemna* sp. with a percentage of 15% of fish weight.
Treatment C = fresh *Lemna* sp. with a percentage of 20% of fish weight.
Treatment D = fresh *Lemna* sp. with a percentage of 25% of fish weight.

2.1 Observation Procedure

a. Planting *Lemna* sp.

In the first planting cycle, prepared the container then filled with 100 liters of water. Bioslurry was added to the planting media with percentage of 2,5% (v/v), stirred and waited for 30 minutes. Furthermore, *Lemna* sp. with a density of 800 g/m^2 or equal to 261,1 g is put into each culture container and flattened to prevent buildup. After six days, *Lemna* sp. was ready to be harvested[10].

b. Biological Test *Lemna* sp. as Nile Tilapia fish feed

Tilapia seeds are stocked into the aquarium, 20 fishes per aquarium. Fish maintenance is carried out for 50 days. The feed is given to tilapia in accordance with the treatment, for treatment A, is a commercial feed by using Turbo Feed T79 (control) with 18% crude protein content given to fish seed as much as 3% of fish weight with the frequency of giving is three times a day [11]. Then fresh *Lemna* sp. gave once a day on an ad-libitum basis in accordance with treatments B, C, and D (15%, 20%, and 25% of fish weight). Periodically the dose of feed is adjusted by following the addition of tilapia biomass which is calculated every 10 days.

The growth observations are carried out every 10 days by using the sampling methods. Weights and lengths measurements of fish are carried out by taking a sample of five fish from each aquarium. Dead fishes are checked every day, if there are dead fish it will directly take away and recorded the quantities and weights so that at the end of maintenance can be calculated the survival rate of the tilapia. Furthermore, weighing the amount of feed given, aims to adjust the amount of feed given in accordance with the weight of the tested fish. Water quality was observed every 10 days by using the sampling method. Checking water quality parameters (temperature, dissolved oxygen, pH, ammonia) is done in the morning. Water maintenance is carried out by replacing water. Water replacement is done every 4 days.

2.2 Parameters

a. Survival Rate (SR)

Survival Rate (SR) is calculated using the formula[12]:

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

Note :

Nt = number of fish at the end of the experiment (individual)

No = number of fish at the beginning of the experiment (individual)

b. Specific Growth Rate (SGR)

Specific Growth Rate (SGR) is calculated using the formula[13]:

$$SGR\ (\%/day) = \frac{lnWt - lnWo}{t} \times 100\%$$

Note:

SGR = Specific Growth Rate (%/day)

Wt = the average weight of the fish at the end of the study (g)

Wo = the average weight of the fish at the beginning of the study (g)

t = rearing period (day)

c. Water Quality

The measured water quality parameters are temperature, Dissolved Oxygen (DO), pH and ammonia. Observations are performed every 10 days once for 50 days.

3. RESULTS AND DISCUSSION

3.1 Survival Rate (SR)

Survival Rate (SR) is a percentage of the number of biotas that live in a certain period[14]. Based on Anova's variegated analysis, fresh *Lemna* sp. has a real effect on the survival rate of tilapia. Based on the *Duncan* test, there is a noticeable difference between treatment A, treatment B toward treatment A (control) and treatment C. The percentage of tilapia fish's survival rate can be seen in the figure below (Fig.1).

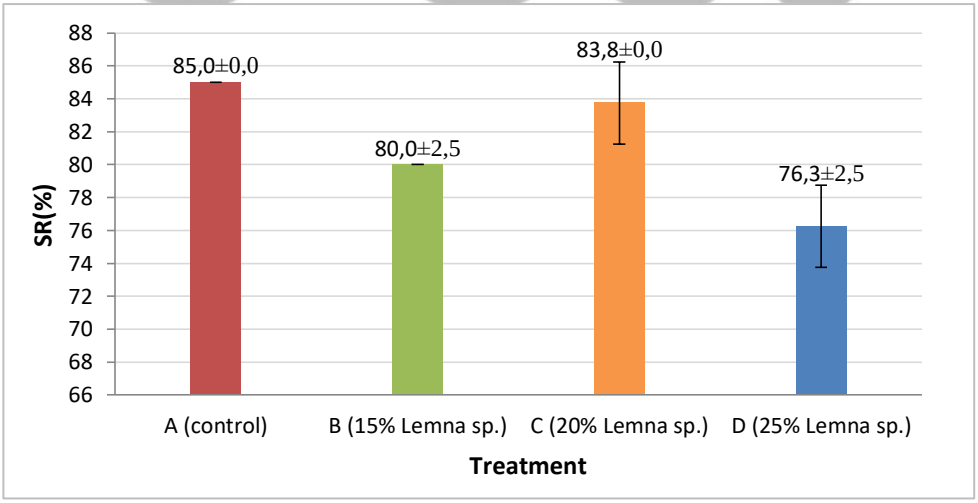

Figure 1. The average survival rate of tilapia during maintenance

Based on the figure above, the survival rate in treatment A is considered as the best treatment (85%). There is no significant difference between treatment A and treatment C. The survival rate in treatment C is 83,75%. Meanwhile, the survival rates in treatment B and D, respectively is 80% and 76,25%. The survival value of Tilapia fed with *Lemna* sp. is lower than the survival value of tilapia fed with pellets. Pellet is tilapia's common feed. So, at the beginning of the research, tilapia was still trying to adapt with fresh *Lemna* sp. The percentage of survival rate of tilapia is 80%[15]. Therefore the survival of tilapia in treatments A, B and C is still within the threshold. This result shows that the given of *Lemna* sp. with bioslurry fertilizers did not have a negative effect on the survival of tilapia.

The survival rate of tilapia fish is supported by good water quality especially the content of DO (Dissolved Oxygen) and ammonia that can still be tolerated by tilapia fish (Table 1). Fish that get low oxygen will easily experience stress until finally death occurs[16]. If the ammonia is too high, it can cause toxic to fish, thus the survival rate is low[17]. Increasing the ammonia concentration exceeds the threshold causing the epithelial lining of the gill filament does not work properly, especially in oxygen diffusion. So that the hemoglobin in the blood does not carry enough oxygen throughout the body. These results cause disrupted metabolic system and the fish looks weak and gathered around in aeration channels to obtain oxygen. *Grass Carp* fish gave fresh *Lemna* sp. as its feed, has a high content of red blood cells, white blood cells and hemoglobin so that it has a good effect on the fish's body power which ultimately has a high level of survival rate [9].

3.2 Specific Growth Rate (SGR)

The growth measurements of tilapia for 50 days show that treatment A (control) by giving commercial feed about 3% produced the highest average weight gain, 16 g (Figure 2).

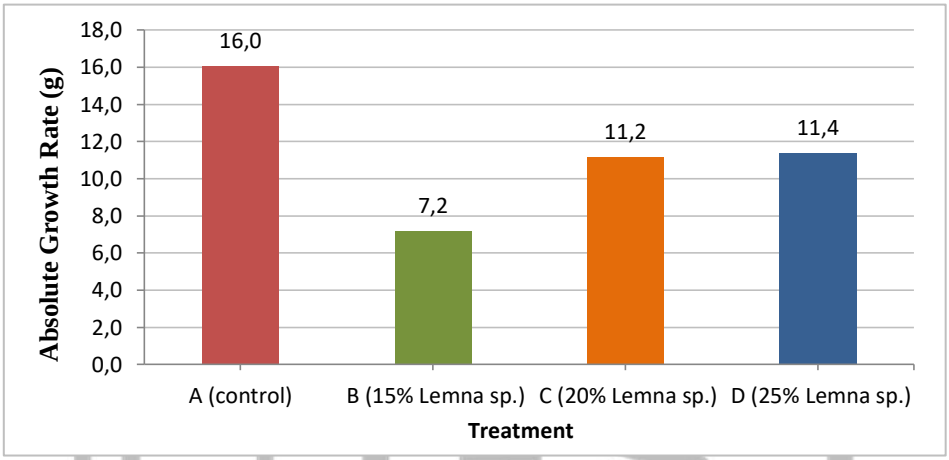

Figure 2. Graphic average absolute weight growth

In Fig.2, the average absolute weight growth of tilapia in treatment A (control) is higher than the treatment with *Lemna* sp. In the treatment with fresh *Lemna* sp. shows that the highest growth of absolute weight is found in treatments C and D. Respectively, their weight are 11,2 g and 11,4 gr. The lowest absolute weight growth was found in treatment B, which was 7,2 g. Based on Anova (Analysis of Variance), *Lemna* sp. as fresh feed on tilapia has a real effect on the daily growth rate of tilapia. Based on Duncan's tests, there is a noticeable difference between all treatments (Fig.3)

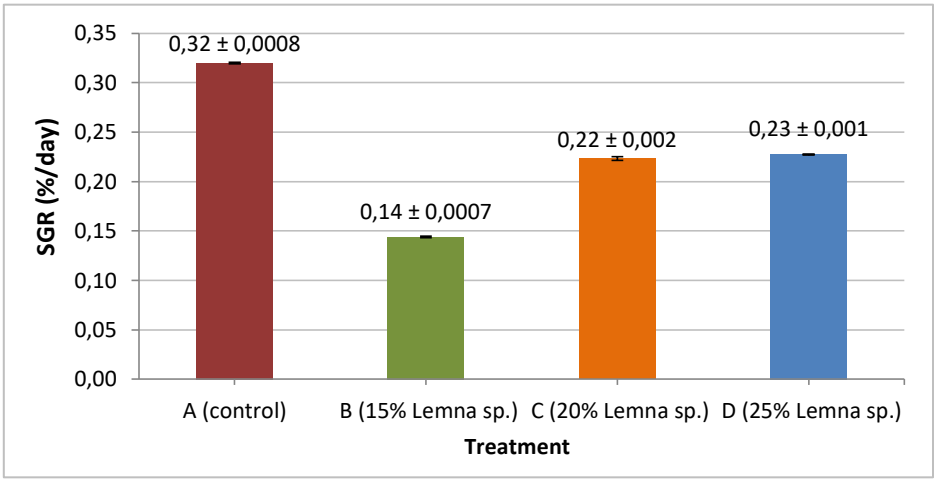

Figure 3. The average specific growth rate of tilapia fish during maintenance

Fig.3 shows that treatment A (control) has the highest specific growth rate (0,32%). It is because the commercial feed (pellets) has 10% water content, so that other content such as 18% crude protein, 4-6% fat, and 4-6% crude ash can be utilized for tilapia growth. During this research, tilapia's growth is low because it only generates a specific growth rate at a range of 0,14-0,32% (Fig.3). Low specific growth rate of nilem fish (*Osteochilus vittatus*) given the *Lemna* sp. (0,11-0,52%)[18]. The low value of specific growth rate of ti-

lapia is caused by the low nutritional value in the feed. High water content factors, especially in vegetable feed causing the feed can be filled up faster so that it can stop the feed consumption, then it caused the feed consumption to be low[19].

Not only containing high water, fresh *Lemna* sp. has lower protein value as well (24,93%) compared to the dry form (27,68%) [18]. One of the important nutritional needs for fish is protein, so the lack of protein in the feed can cause stunted growth[20]. Based on the results of the *Lemna* sp. analysis in the Animal Nutrition Laboratory, Faculty of Animal Husbandry, Padjadjaran University, the water content of fresh *Lemna* sp. is quite high 94,52% so that it can reduce the nutritional intake of feed and subsequently result in a low growth rate of tilapia[18]. The growth rate difference in each treatment is influenced by the quality and quantity of feed consumed by fish. Feed consumption level and fish growth are influenced by the chemical content or nutritional value of plants such as energy content and protein content[9].

3.3 Water Quality

Water quality is an essential thing to be considered in aquaculture activities because it is very influential on fish's survival. The water used for aquaculture activities must fulfill the water quality standard criteria so that fish can grow and develop well. Water quality parameters observed in this research are temperature, pH, DO (Dissolved Oxygen) and ammonia. Based on the research results, water quality values can be seen in the following table (Table 1). The results of water quality measurements show that the temperature range obtained was 27,3-27,9°C. Temperature values in all treatments are still in the optimal range for the tilapia's maintenance. Temperature can affect the life activities of organisms, especially fish. If the temperature increase, it will increase the intake of food by fish and the decrease of temperature causes the digestive process and metabolism will run slowly[21].

Table 1. Water Quality

Treatment	Water Quality			
	Temperature (°C)	DO (mg/L)	pH	Ammonia (ppm)
A (control)	27,5-27,8	5,0-5,2	8,1-8,3	0
B (15% *Lemna* sp.)	27,5-27,9	5,0-5,1	8,1-8,4	0
C (20% *Lemna* sp.)	27,3-27,5	5,0-5,3	8,1-8,3	0
D (25% *Lemna* sp.)	27-4-27,5	5,0-5,1	8,2-8,4	0
SNI (1999)	25-30	>5	6,6-8,5	<0,02

DO (Dissolved Oxygen) in maintenance media is in the range of 5,0-5,3 mg/L. The range of DO can still support good growth and survival for tilapia because the minimum standard dissolved oxygen for tilapia is at least 5 mg/L[11]. Dissolved oxygen is indispensable for respiration and metabolism as well as the survival rate of organisms [21]. Based on the results of observation, the pH of water obtained is 8,1-8,4. The optimal range of pH water for tilapia maintenance ranges from 6,6 to 8,5 [11]. It shows that the pH range of the water is still in the optimal range. The pH value that can interfere with fish life is the pH is too low (very acidic) and the pH is too high (very alkaline), most fish can adapt well to the water environment that has a pH ranging from 5-9 [21]. Ammonia is the irrigation derived from the breakdown of organic nitrogen (protein and urea) and inorganic nitrogen found in soil and water, derived from the decomposition of organic matter (the dead aquatic biota) conducted by microbes and fungi known as ammonification[21]. Ammonia in Tilapia maintenance media for all treatment ranges from 0 ppm (Table 1). Good ammonia for tilapia is <0,02[11]. The value of ammonia in this research is still within the optimal range for tilapia's growth.

4. CONCLUSION

The giving of 20% fresh *Lemna* sp. resulting in the specific growth rate of tilapia about 0,22%, and survival rate of 83,75%. This value is the same as using a commercial pellet of 3%. Nevertheless, 20% fresh *Lemna* sp. as fish feed is recommended.

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