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EFFECT OF NATURAL FEEDING *Daphnia* sp. RESULTS OF DIFFERENT CULTURE MEDIA ON THE GROWTH AND SURVIVAL OF TILAPIA (*Oreochromis niloticus*) FRY

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ABSTRACT

This study aims to determine the effect of giving *Daphnia* sp. the results of different culture media on the growth and survival of tilapia fish seeds. This research was conducted from November 2021 to January 2022. The method used in this study is the Complete Randomized Design (CRD) method with four treatments and three replicates, namely P1 (*Daphnia sp.* cabbage vegetable culture results), P2 (*Daphnia sp.* banana peel culture results), P3 (*Daphnia* sp. chicken egg culture results), and K (Control). The results showed the highest growth in the P3 treatment with a weight gain of 0.90 g and a length gain of 1.72 cm, followed by treatment P1 of 0.49 g with a length gain of 1.09 cm, and the lowest in the P2 treatment of 0.33 g with a length increase of 1.13 cm. The highest survival rate during rearing was found in the P3 treatment at 91.1%, and the lowest survival rate in the P1 and P2 treatments at 87.8%. Water quality parameters obtained were temperature ranging from 25 - 29^{o} C, pH ranging from 7.32 - 8.56, DO ranging from 3.1 - 5.3 mg/l, and ammonia ranging from 0.15 - 0.25 mg/l.

Keywords: Tilapia fry, *Daphnia* sp., Survival, Growth

1. INTRODUCTION

Tilapia (*Oreochromis niloticus*) is one of the freshwater fish commodities favoured by the public in fulfilling their animal protein needs. Tilapia has promising business prospects. In terms of rapid growth and can reach a much larger body weight with a fairly high level of productivity. In addition, in playing an important role in the prospect of tilapia is the distinctive taste of meat with a pure white colour and no spines with a fairly high nutritional content[1].

Factors that can affect the sustainability of tilapia aquaculture both in growth and survival besides water quality are feed factors. Feed is one of the factors that play an important role in aquaculture activities. According to Yanuar[2], feed is a source of material and energy to support the survival and growth of a cultured fish but on the other hand feed is the largest component, namely 50-70% of production costs.

In the fry phase, fish have a fairly small body size and mouth opening, so feed is needed that is smaller than the mouth opening. Feed given in the fry phase is generally natural feed such as *Daphnia* sp., *Tubifex,* and bloodworms. The natural food that will be used in the study is *Daphnia sp*. from different culture media. *Daphnia* sp. is one type of natural food that is *non-selective filter feeder,* easy to culture, and can be enriched with certain ingredients. The shape and size of *Daphnia sp. is* very suitable with the mouth of tilapia seeds. The existence of *Daphnia* sp. in nature is not always available because of its limited nutritional needs[3]. *Daphnia* sp. culture as live food has been done through various techniques with different feeds such as *spirulina* flour[4], cassava peel[5], banana

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fronds, cabbage, and water hyacinth[6], and *azolla*[7].

Based on the description above, in order to accelerate growth and increase the survival value of tilapia fish in the seed phase, it is necessary to conduct research with the aim of determining the best natural food from *Daphnia* sp. the results of different media cultures (cabbage vegetables, banana peels, and chicken eggs) to support the growth and survival of tilapia fish fry.

2. RESEARCH METHOD

Material and Methods

This research was conducted in November 2021 - January 2022. The tools used in this research are Aquarium (40 cm x 20 cm x 20 cm), bucket (30 L), pH meter, DO meter, thermometer, aerator, siphon hose, millimeter block paper, digital scales, net, tarpaulin pool, table paper, socket, heater, ammonia test kit, measuring cup (1 L and 5 ml). The materials used were *Daphnia* sp., tilapia fry size 2.5 cm as many as 360 fish, clean water sediment, cabbage vegetables, banana peels and chicken eggs.

The design used was a completely randomized design (CRD) with 4 treatments and 3 replications, namely P1 (*Daphnia sp.* cabbage vegetable culture results), P2 (*Daphnia sp.* banana peel culture results), P3 (*Daphnia* sp. chicken egg culture results) and K (Control).

Procedure

Culture of *Daphnia* sp

Daphnia sp. which will be cultured stocked in each container in the form of a 30-litre bucket with a water volume of 25 litres and aerated. In each treatment *Daphnia* sp. stocked as much as 20 ind/L[8]. Total *Daphnia* sp. which is stocked on all containers of culture media is 3000 tails. *Daphnia* sp. which has been stocked is not fed for 2 days, after which it will be given a fermentation solution with each treatment three times a day as much as 5 ml/L. The treatment refers to the research of Meilisa et al.[8] in which the culture of *Daphnia* sp. which is fed three times a day as much as 5 ml/L produces the highest population density reaching 1,615 fish. During maintenance, water quality measurements were taken in the form of temperature, pH, dissolved oxygen (DO) and ammonia and no water changes were made, only the addition of water due to evaporation.

Fish Rearing

The test fish used were 2.5 cm tilapia fry from the Ambarawa Fish Health and Environmental Testing Laboratory (LPKIL). The total number of fry used was 360. Feeding in each treatment was 3% of body weight with a frequency of 3 times a day during maintenance[9].

Growth observations were made every 7 days and the survival rate was observed every day. Absolute weight growth was calculated using the formula:

$$W = W_t - W_o$$

Description:

W = Absolute weight (g)
W_t = Final Weight (g)
W_0 = Initial Weight (g)

Absolute Length Growth:

$$Pm = Lt - Lo$$

Description:

Pm = Absolute length (cm)
Lt = final length (cm)
L0 = Initial Length (cm)

Survival Rate: $SR = \frac{Nt}{No} x\ 100\%$

Description:

SR = Larval Survival (%)
Nt = Number of larvae at the end
N0 = Number of larvae at the start

Data Analysis

The parameters that will be observed in this study are the population of *Daphnia* sp., the growth of tilapia fry, the survival rate of test fish, and water quality which includes temperature, pH, DO, and ammonia. Variables obtained during the study were analyzed statistically and descriptively. Statistical analysis used one-way ANOVA with an error rate of α = 5%

and 1%. If there is a difference between treatments, it is continued with the DMRT test. The statistical data processed were the growth and survival rate of the test fish seeds, while the water quality data were described descriptively.

3. RESULT AND DISCUSSION

Population Growth of *Daphnia* sp.

Population growth of *Daphnia* sp. the results of different culture media in the form of cabbage vegetables (SK), banana peels (KP), and chicken eggs (TA) with a concentration of 5 ml/L every one feeding produces a fairly high population marked by the abundant population in each treatment. Average population growth of *Daphnia* sp. from each culture media obtained during 14 days of maintenance there is the highest population growth. Graph of the average population of *Daphnia* sp. presented in Figure 1.

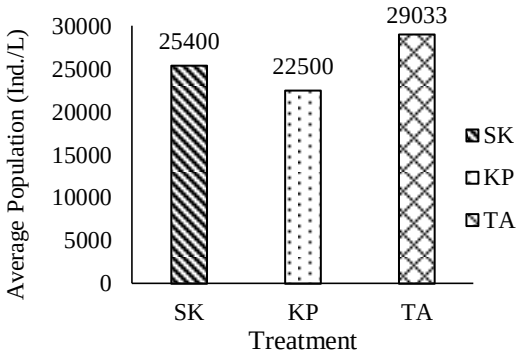

Figure 1. Average Population of *Daphnia* sp

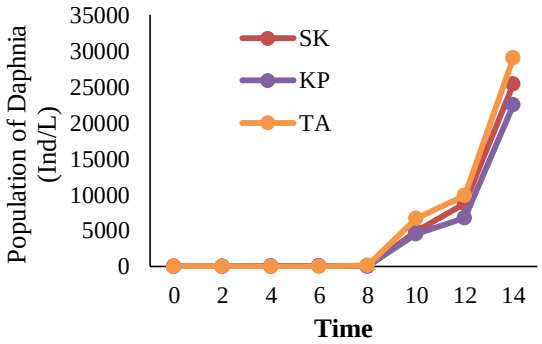

Figure 2. Population Graph of *Daphnia* sp.

The results showed the form of population growth of *Daphnia* sp. on different culture media seen from the addition of the number of individuals of each culture media maintenance against the time in the growth cycle. Based on observations of the abundance of *Daphnia* sp. population in each treatment, which is done at intervals of two days showed a growth pattern consisting of the adaptation phase, and the exponential phase. The adaptation phase occurs for 8 days after the deployment of *Daphnia* sp., on the 8th day to the 14th day of population growth of *Daphnia sp*. is in the exponential phase, it is marked by the presence of *Daphnia* sp. looks abundant in real terms. At this stage, *Daphnia* sp. has passed the adaptation phase, so it can reproduce asexually or sexually which will produce individuals continuously until certain point or often referred to as the stationary phase.

In this study, the culture medium of *Daphnia* sp. was treated with the fermentation results of SK, KP, and TA which were used as fertilizers in increasing the growth of microorganisms in the culture medium which were used as food sources for *Daphnia* sp. This is in accordance with Endar et al.[10] which states that the decomposition process can produce bacteria and other microorganisms that will be used as food for *Daphnia* sp., while according to Fahmi et al.[11], the growth of *Daphnia* sp. requires nutrients that can come from suspended organic matter and bacteria obtained from culture media.

Fertilization in the process of culture *Daphnia* sp. has the aim of adding food sources in the maintenance media. The results of research that has been done, TA media is a medium that produces the highest population compared to SK and KP media. This can be caused by the TA culture media has phytoplankton content, nutrients and nutrient content is quite high compared to the other two culture media. Feed nutrients provided can meet the needs of *Daphnia* sp. to live and develop[5]. The high content of phytoplankton and the provision of the right dose in the culture medium cause the availability of sufficient

food for *Daphnia* sp. in breeding, thus providing the highest population results. One of the factors affecting the growth of *Daphnia* sp. is the high and low content of nutrients or nutrients provided because it can produce food availability for *Daphnia* sp. The statement is in accordance with Darmawan[12], based on the nature of non-selective filter feeder, the higher the abundance of phytoplankton, the growth rate of *Daphnia* sp. can take place quickly. Prastya et al.[3] also explained that the availability of phytoplankton populations is directly proportional to the availability of food so that it affects the growth of *Daphnia* sp.

KP media on the maintenance of *Daphnia* sp. gives the lowest result of 22,500 ind/l. It is possible that the amount of nutrients is only sufficient in the adaptation phase but when entering the peak phase of *Daphnia* sp. nutritional needs are not met, resulting in competition for food and resulting in fewer populations. Food needed in the growth of *Daphnia* sp. in the form of bacteria, protozoa, detritus, and suspended organic matter. Growth of food sources *Daphnia* sp. depends on the decomposition of organic matter content in the culture medium. The availability of nutrients in the media is decreasing will cause death in bacteria that can produce toxic and affect the life of *Daphnia sp.* According to Izzah et al.[13], the lack of nutrients in the media can lead to food competition between individuals. The statement is supported by Firnandus[14], the increase in population can take place rapidly if the available food, namely phytoplankton, is abundant and maximally utilized.

The high organic matter from TA fermentation can increase the amount of food in the media so that it can affect the population of *Daphnia* sp. The availability of food in the media can minimize competition for food between individuals, besides that in sufficient food conditions young *Daphnia* sp. will grow into adult individuals and begin to reproduce. According to Meilisa et al.[8], the level of feed utilization can affect the abundance and growth of *Daphnia* sp., but conversely if the nutrient content is less fulfilled can result in eating competition between individuals. The level of nutrients provided also affects the color of *Daphnia* sp. produced. TA treatment produces *Daphnia* sp. which is transparent slightly orange, while the treatment of SK and KP produce *Daphnia* sp. which is more transparent than the TA treatment. Animal nutrition gives more color to *Daphnia* sp. brighter than vegetable nutrition, *Daphnia* sp. vegetable nutrient media culture results tend to have a paler color.

Absolute Growth of Tilapia

The results showed that P3 was the treatment that gave the highest value on the absolute growth of tilapia seeds with an absolute weight value of 0.90 g and 1.72 cm on absolute length growth.

Based on the results of analysis of variance (ANOVA) data in Figure 3 above, it can be seen that the natural feeding of *Daphnia* sp. the results of different culture media have an effect on the growth of tilapia. The results of the DMRT test on different letter notations state that there are significant differences between treatments (Table 1).

The absolute length growth of tilapia fry was highest in the P3 treatment (*Daphnia* sp. from chicken egg culture media) giving a value with an absolute weight of 0.90 g and 1.72 cm. This is thought to be a difference in the amount of consumption, colour and protein given. According to Zulfikar et al.[15] the effect of feed color can affect the attractiveness of fish to eat it, because fish are easy to detect.

Growth in the P3 treatment is faster than the other three treatments, this is due to the treatment of P3 feed given has a high enough protein content. Sufficient protein content can have the opportunity to support the growth of tilapia fish seeds. According to Simbolon[16], one of the nutrients in the feed is the protein contained in the feed

consumed. The nutrients needed for the growth of *Daphnia* sp. are obtained from suspended organic matter, plankton and bacteria from the feed given[17].

Table 2. Statistical results of absolute growth of tilapia (*O. niloticus*)

Treatment	Repeat (g)			Total (g)	Average (g)	F	Sig.	DMRT
	U1	U2	U3					
P1	0,43	0,53	0,50	1,46	0,49			B
P2	0,30	0,31	0,37	0,98	0,33			A
P3	0,85	0,93	0,91	2,69	0,90	155,626	0,000	B
K	0,44	0,44	0,48	1,36	0,45			C
Total	2,02	2,21	2,26	6,49				
Treatment	Repeat (cm)			Total (cm)	Average (cm)	F	Sig.	DMRT
	1	2	3					
P1	1.1	1.16	1	3.26	1.09			A
P2	1.12	1.12	1.14	3.38	1.13			A
P3	1.68	1.7	1.78	5.16	1.72	90,289	0,000	B
K	1.62	1.68	1.78	5.08	1.69			B
Total	16.88	5.63	5,7	16,88	5,63			

Notes: Treatments followed by the same symbol are not significantly different;

High and low protein *Daphnia* sp. can depend on the nutritional content of the feed given; this is due to the basic properties of *Daphnia* sp. namely filter feeder. The nutritional content of the feed given is directly proportional to the nutrients in *Daphnia* sp, where the more nutrients in the feed given, the higher the nutrients that can be absorbed by *Daphnia* sp. This is in accordance with Fahmi et al.[11], the nutritional content of *Daphnia* sp. varies greatly depending on age and food consumed.

The difference in results can be influenced by several factors such as water quality factors, heredity, age and feed factors. Feed factors can be in the form of the type and amount given. Hartami et al.[18] explained that not all feed given can be used in growth. Most of the energy obtained will be used for maintenance, and the remaining energy will be used in growth. The utilization of protein in feed for growth can be influenced by fish size, protein quality, energy content and feeding rate.

The right feeding for fish fry is one of them is natural feed. The advantages of natural food for fish seeds are that it has a high nutritional content, is always moving, and is relatively small in size so that fish seeds are easier to eat. This is in accordance with Aziz & Febrinaldy[19] which states that natural feeding can increase survival in maintenance containers, because it can maintain environmental conditions during maintenance. *Daphnia* sp. has advantages such as small body size, can move and has a fairly high nutritional content. According to Meilisa et al.[8], *Daphnia* sp. body size ranges from 0.3 - 1 mm and has a fairly good nutritional content.

Survival Rate

Data from the observation of the average survival rate of tilapia fry during maintenance can be seen in Table 3.

The results of ANOVA calculations show that each treatment given does not affect the survival rate of tilapia fish fry so that the results of the ANOVA test are not followed by the DMRT test to see differences between the treatments given. Based on the results of water quality measurements, it is still classified as good in the maintenance of tilapia fish fry because in the maintenance media, syphoning is carried out every 3 days.

Table 3. Statistical data of tilapia (*O. niloticus*) fry survival rate

Treatment	Repeat			Total	Average	F	Sig.
	1	2	3				
P1	83,3	90,0	90,0	263,3	87,8		
P2	86,7	90,0	86,7	263,4	87,8		
P3	93,3	86,7	93,3	273,9	91,1	1,998	0,193
K	96,7	93,3	90,0	280,0	93,3		
Total	360,0	360,0	360,6	1080,6	360,2		

One of the survival factors of tilapia fish fry is feed. *Daphnia* sp. the results of different culture media do not have a significant effect on the survival rate of tilapia fish seeds, this is thought to be the nutritional content of *Daphnia sp.* which is different in each culture media, so that *Daphnia* sp. given in each treatment can still meet the needs of tilapia fish to survive. The high and low survival rate in fish can be influenced by internal factors such as sex, offspring, age, reproduction, disease resistance, and external factors such as water quality, stocking density, amount and completeness of nutrients in feed. Inappropriate feed nutrition is one of the factors determining the high survival rate of aquaculture biota[20].

4. CONCLUSION

Based on the results of the research that has been carried out, the following conclusions can be drawn: 1) Feeding *Daphnia* sp. from different culture media gives a very significant effect on the growth of weight and length of tilapia fry. 2) *Daphnia* sp. from chicken egg culture media (P3) gave the best results in increasing the growth rate of tilapia fry, 3) Natural feeding of *Daphnia* sp. the results of different culture media did not give a very real influence on the survival of tilapia fry.

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