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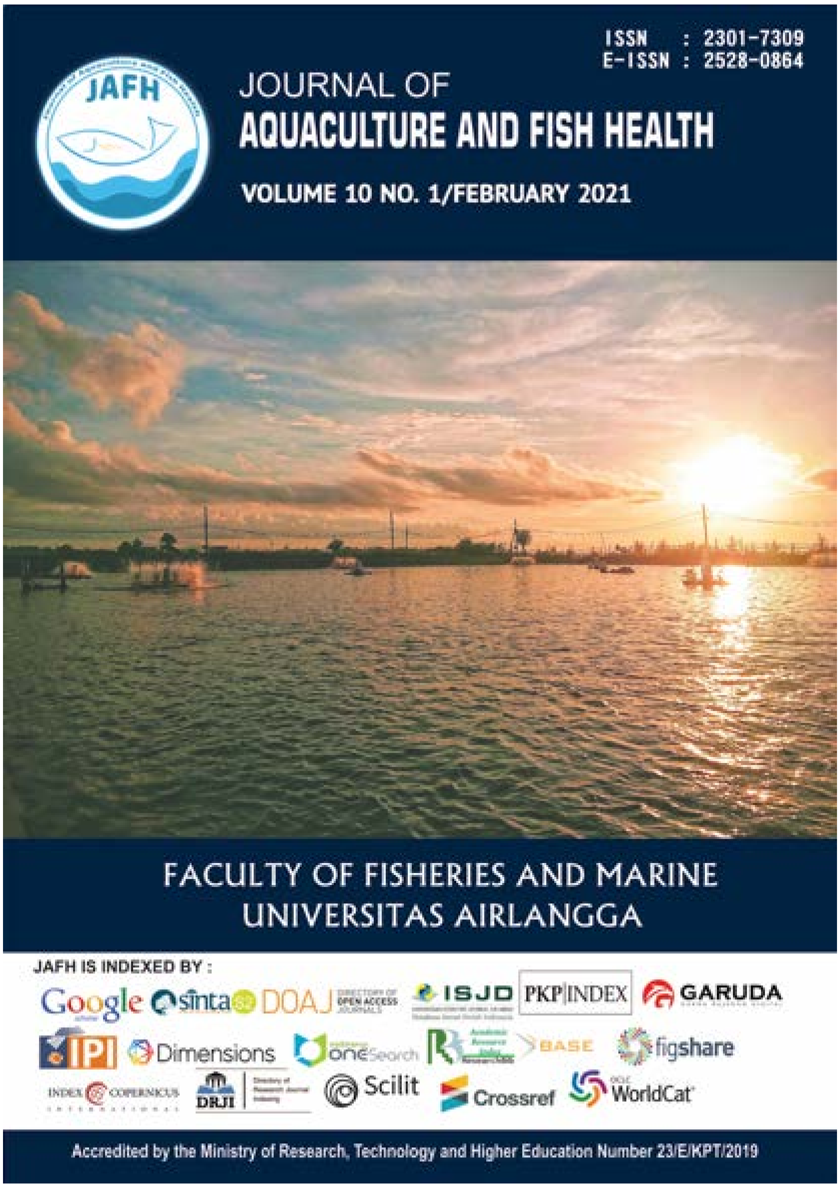
Current Issue



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DOI : 10.20473/jafh.v10i1.18234
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The Digestion Level of Tilapia (*Oreochromis niloticus*) to Different Feed Combination

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Tilapia, Total digestion, Protein digestion, Protein retention

Abstract

Digestibility is food substances from feed consumption that are not excreted into the feces, and the difference between food substances consumed and those excreted in the feces is the amount of food that can be digested. Information about the digestibility value of food is very important as a basis in assessing the quality of food and designing fish feed rations. This research was conducted to determine the level of the feed digestibility in nirvana tilapia (Oreochromis niloticus) feed with a combination of fish meal and maggot flour. This research was conducted at the Hatchery Campus of BAPPL STP Serang, Banten from September-December 2019. This study used a Completely Randomized Design (CRD) with 5 treatments and 3 replications. There were 225 fish used in the testing with an average weight of 0.16 grams. The culture media used was a plastic container with a size of 60 x 41 x 34 cm. Feeding was carried out for 50 days, with a frequency of twice a day, and the dose of feeding was 3% of the biomass. The results showed the total digestibility parameter of feed, protein digestibility of feed and the highest protein retention in the treatment of 50% of the combination feeds , with the highest total digestibility value of 56.97 ± 3.41 and the lowest of 42.08 ± 0.42, the highest protein digestibility with a value of 87.33 ± 0.95and the lowest of 83.11 ± 1.30 and the highest protein retention with a value of 14.83 ± 0.22and the lowest of 11.69 ± 1.05.

INTRODUCTION

Tilapia is one of the freshwater fish that has important economic value and has several benefits when compared to other freshwater fish; it has fast growth, is easy to maintain in various culture media, has high resistance to extreme environments, and has high nutritional value (Murni, 2013; Shofura *et al*., 2017). Feed is one of the most important factors in tilapia culture. Artificial feed is feed made with certain formulations according to the needs of the fish being kept (Wicaksono *et al*., 2013).

Fish feed formulations generally still use fish meal as a source of protein, but at this time local fish meal is only able to meet 60-70% of feed needs which fluctuates in their quality and quantity (Prayogo *et al*., 2012; Marno *et al*., 2016). One of the local raw materials that can

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replace fish meal is maggot flour. Maggot flour has good nutritional value with a protein content of 36.28% (Fish Disease and Environment Inspection Institute-LP2IL Serang, 2019).

The value of digestibility is described by the ability of the fish to eat the given feed and can be described by the quality of the feed consumed by fish (Fujaya, 2004; Handajani and Widodo, 2010). Digestibility is food substances from feed consumption that are not excreted into feces, and the difference between food substances consumed and those excreted in the feces is the amount of food that can be digested (Andriani *et al.*, 2018). In the making process of fish feed made from a combination of fish meal and maggot flour, the digestibility level of the combination of these two flours is unknown. From the description above, it is necessary to conduct research on the digestibility level of artificial feed made from a combination of fish meal and maggot flour. The purpose of this study was to determine the digestibility level of nirvana tilapia (*Oreochromis* sp.) which was fed a combination of fish meal and maggot flour.

METHODOLOGY

Place and Time

This research was conducted at the Hatchery Campus BAPPL STP Serang, Banten. This research was conducted from September-December 2019.

Research Material

The equipment used during this study were cultivation media in the form of plastic containers (Lotus 6900, Indonesia), aeration hoses, aeration stones, 2-inch plastic pipes (Wavin, Netherlands), Amara blowers (HB-100), and pellet presses.

The material used during the study was nirvana tilapia obtained from the Freshwater Fish Seed Development Center (BPBIAT) Purwakarta, Purwakarta Regency, West Java. Raw materials for fish feed rations consisting of fish meal, soy flour, corn flour, rice bran, dried maggot, premix and fish oil were obtained from Indo Feed, Bogor, while the Cr_2O_3 digestibility indicator was obtained from the Fish Nutrition Laboratory of FPIK-IPB, Bogor.

Research Design

This study used an experimental method with the experimental design used was a Completely Randomized Design (CRD) with five treatments and three replications. The treatments used are as follows:

Treatment A = Combination of 100% fish meal with 0% maggot flour; Treatment B = Combination of 75% fish meal with 25% maggot flour; Treatment C = Combination of 50% fish meal with 50% maggot flour; Treatment D = Combination of 25% fish meal with 75% maggot flour; Treatment E = Combination of 0% fish meal with 100% maggot flour.

The parameters observed in this study were total digestibility, protein digestibility and protein retention. The calculation of total digestibility, protein digestibility and protein retention, according to Wattanabe (1988), is:

$$KP = 100 - (100 \times \frac{a}{a'} \times \frac{b}{b'})$$

Note:
KP = Protein digestibility
a = % Cr_2O_3 in feed
a' = % Cr_2O_3 in feces
b = % nutrient (protein) in feed
b' = % nutrient (protein) in feces

$$KT = 100 - (100 \times \frac{a}{a'})$$

KT = Total digestibility
a = % Cr_2O_3 in feed
a' = % Cr_2O_3 in feces

$$RP = (\frac{F - I}{p}) \times 100$$

RP = Protein retention (%)
F = Fish protein content at the end of fish culture (g)
I = Fish protein content at the beginning of fish culture (g)
P = The amount of protein consumed by fish (g)

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Work Procedures

This research was conducted in 4 stages of research, which included the preparation stage, implementation stage, observation stage and testing.

In the preparation stage, the preparation of the fish, the preparation of the culture media that would be used, and the making of maggot flour were made. The feed was made from the following ingredients: maggot flour, fish meal, soybean flour, corn flour, premix, fish oil, and Cr_2O_3 (as an indicator material). The composition of the raw materials used as feed formulations can be seen in Table 1. Preparation of containers and media included a plastic container measuring 60 x 41 x 34 cm with a capacity of 60 L, and then it was filled with water as much as 50 L and equipped with aeration as an oxygen supply.

Table 1. Feed formulation and proximate analysis of feed (STP Chemical Laboratory, 2019).

Raw Material	Treatment (Fish Flour: Maggot Flour)(%)				
	A (100 : 0)	B (75 : 25)	C (50 : 50)	D (25 : 75)	E (0 : 100)
Fish Flour (gr)	494.94	371.19	247.46	123.72	-
Maggot Flour (gr)	-	161.52	323.08	[illegible]	646.16
Soybean Flour (gr)	247.47	247.47	247.47	247.47	247.47
Rice Bran (gr)	171.72	171.72	171.72	171.72	171.72
Corn flour (gr)	85.86	85.86	85.86	85.86	85.86
Fish oil (ml)	20	20	20	20	20
Tapioca flour (gr)	15	15	15	15	15
Premix (gr)	5	5	5	5	5
Results of proximate analysis of feed (dry weight %)					
Protein	35.74	35.45	35.05	34.73	34.81
Fat	5.98	10.06	9.79	11.79	12.19
Carbohydrate	29.93	31.84	38.97	39.58	41.49
Ash	19.24	16.80	16.20	13.90	11.51
Water	9.11	7.36	8.66	7.02	5.97

At the implementation stage, the seeds used were strains of nirvana tilapia. The fish seeds used in this study were 225 fish with a size of 1-2 cm with an average weight of 0.16 grams. As many as 15 Nirvana tilapia seeds were stocked into each container box (Febriyanti *et al.*, 2018). The fish culture was carried out for 50 days with a feeding dose of 3% of the body weight of the fish. The fish were adapted for 7 days beforehand to make the fish adapted to the feed. Feeding was done twice a day.

The parameters observed in this study were total digestibility, protein digestibility and protein retention. Fish feces were collected every day during the fish culture, and the feces were taken by siphoning them and then the feces were stored in a sample bottle. The collected feces were stored in a freezer for the analysis of protein and Cr_2O_3 content.

The measurement of feed digestibility used an indirect method, namely by adding an indicator in the treated feed in the form of Chromium Oxide (Cr_2O_3) as much as 1% of the feed weight (National Research Council, 1993). The measurement of Cr_2O_3 levels was carried out at the Fish Nutrition Laboratory, FPIK-IPB, Bogor.

Data Analysis

The data obtained were tabulated using Ms. Office Excel and analyzed using one- way ANOVA (Analysis of Variant). If there was a significant or highly significant different in the treatment effect, the analysis was proceeded with Duncan's multiple range test.

RESULTS AND DISCUSSION

The results obtained from this study include the value of total digestibility, protein digestibility, and protein retention of nirvana tilapia (Oreochromis sp.) with a combination treatment of fish meal and maggot flour in feed, as can be seen in Table 2. Total digestibility, protein digestibility and protein retention of nirvana tilapia in each treatment can be seen in the graph presented in Figure 1.

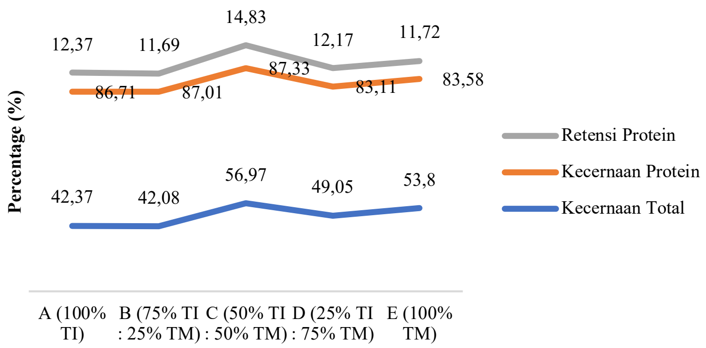

Figure 1. The graph of total digestibility, protein digestibility, and protein retention in nirvana tilapia (*Oreochromis* sp.) during fish culture.

Based on the graph above, it shows that the difference in the combination of fish meal and maggot flour in the feed shows a significant difference ($P < 0.05$) on protein retention and an insignificant different ($P > 0.05$) on total digestibility and protein digestibility. From the Duncan's test, it was found that the highest total digestibility value is in treatment C with a value of 56.97%, and the lowest is in treatment B with a value of 42.08%; the highest protein digestibility is in treatment C with a value of 87.33%, and the lowest is in treatment D with a value of 83.11%; and the highest protein retention is at treatment C with a value of 14.83%, and the lowest is in treatment B with a value of 11.69%. This shows that treatment C gives the best results compared to other treatments.

Table 2. The results of observations of total digestibility, protein digestibility, and protein retention in nirvana tilapia (*Oreochromis* sp.).

Parameter	Treatment				
	A	B	C	D	E
Total Digestibility	42.37±1.55[a]	42.08±0.42[ab]	56.97±3.41[bc]	49.05±3.77[b]	53.80±3.76[bc]
Protein Digestibility	86.71±0.26[b]	87.01±0.10[b]	87.33±0.95[b]	83.11±1.30 [a]	83.58±1.88[a]
Protein Retention	12.37±0.58[a]	11.69±1.05[a]	14.83±0.22[b]	12.17±0.38[a]	11.72±1.13[a]

Note: Different superscripts in each column indicate significant differences ($P<0.05$).

Digestibility is a part of the feed consumed by fish and is not excreted into feces (Selpiana *et al.*, 2013). The digestibility value of feed can show the nutritional composition of the feed that can be used and absorbed by fish for growth and the waste products of metabolism (Andriani *et al.*, 2018), while according to Handajani and Widodo (2010), the digestibility of feed can be explained in the form of dry matter digestibility, nutrient digestibility (protein, carbohydrates and fats) and energy. The digestibility level of feed is divided into two kinds, namely total digestibility and protein digestibility.

Based on Table 2, nirvana tilapia has a good total digestibility level in treatment C with a value of 56.97%. The high digestibility in treatment C is assumed to occur because the protein source is a combination of 50% fish meal and maggot flour, so the feed is easily digested. Previous research has shown that the digestibility level of tilapia is quite good. Selpiana *et al*. (2013) obtained the total digestibility value with the addition of trash fish meal of 540 g with a value of 70.51%, while Usman *et al*. (2010) obtained the highest feed digestibility value with a value of 90.00%. In general, the digestibility of organic matter is influenced by species, age, and feed ingredients. The feed digestibility is influenced by several factors, namely the physical form of the feed, the composition of the feed, the diversity factor between individuals, the physical form of the feed, the amount of feed, and the air temperature (Handajani and Widodo, 2010; Wicaksono *et al*., 2013). In this study, the fish species used were at the same age.

Protein digestibility is the amount of feed protein that can be absorbed by the fish body and is not excreted through feces (Wardani *et al*., 2017). The results of protein digestibility during the study show that the value of treatment C has the highest value (Table 2) of 87.33%, which means that nirvana tilapia seeds can digest 87.33% of feed protein. Thus, it is assumed that with this high protein digestibility value, this treatment feed is the right composition for the feed of nirvana tilapia seeds. The higher the protein digestibility value, the greater the protein that can be used by fish for growth. Andriani *et al*. (2018) stated that the nutrients that have been absorbed and digested will be flown by the blood vessels to the liver and then used for metabolic processes. The increase in the undigested carbohydrate content in feed will affect protein digestibility. Protein digestibility in each treatment is in the range of 80% and is still considered normal. This is in accordance with the opinion of Afzriansyah *et al*. (2014), which stated that the normal protein digestibility range of fish is 75-95%.

Protein retention is some protein that is converted into protein stored in the fish body. protein retention is indirectly a description of how much protein given, can be utilized and absorbed to build and repair damaged body cells and can be utilized by the fish body for daily metabolism (Dani *et al*., 2005; Kurniawan *et al.*, 2018). The highest protein retention value from the research results is found in treatment C of 50% fish meal and 50% maggot flour with a value of 14.83%. The increase in meat weight for growth is closely related to protein retention. The higher the protein retention value, the better the fish growth (Priyadi *et al*., 2009). The protein retention value shows how much the percentage of protein weight stored by fish in the body. Selpiana *et al*. (2013) stated that the feed protein retention value can be determined by the protein source used in the feed ingredients and is related to the quality of the protein which is determined by the amino acid composition and amino acid requirements of the fish being reared. The results of protein retention in this study illustrate that feed using fish meal as a protein source can be combined with maggot flour up to 50%.

The measurement of water quality parameters for 50 days in the rearing of nirvana tilapia with a combination of fish meal and maggot flour formulation can be seen in Table 3.

Table 3. Average water quality during fish culture.

Parameter	Treatment					Reference
	A	B	C	D	E	
Temperature (°C)	26.5-28.2	26.7-28.3	26.5-28	26.5-28.5	26.2-27.8	25-30 (a,b)
pH	7.6-7.7	7.3-7.9	7.7-7.9	7.4-7.8	7.8-7.9	6,5-8,5 (a)
DO (mg/L)	6.6-6.9	6.3-6.8	6.5-7	6.3-6.7	6.2-6.8	> 5 (a,c)
NH_3 (mg/L)	0.23	0.24	0.20	0.21	0.17	<0,20 (d)

Note :a = SNI, (2009); b = Islami & Anna, (2017); c = Salmin, (2005); d = SNI 06-6989.30, (2005).

Based on Table 3, the results of the measurement of water quality parameters show that the value of water quality during the study is still in the appropriate range for nirvana tilapia culture compared to that in the reference and is always maintained within the optimum conditions for cultivation purposes.

The average temperature measurement obtained during the study ranged from 26-28 °C. This is presumably because the fish are kept indoors, so the temperature fluctuations are not too high. Temperature is an important factor in aquaculture activities. A good water temperature for tilapia is 25-32 ° C (SNI, 2009). The results of pH measurements during the study obtain an average value of 7.3-7.9. This shows that this value is still relatively safe for fish culture. The pH value that can kill fish is <4 and> 11. A pH of less than 6.6 or more than 9.5 in a long period of fish culture can affect fish reproduction and growth (Marie *et al*., 2015).

The results of measurements of dissolved oxygen during the study ranged from 6.6 to 6.9 mg/L. This value can be said to be good for nirvana tilapia culture because, according to Suyanto (2005), a good oxygen content for tilapia is at least> 3 mg/L. The results of ammonia measurement in the culture media were quite high, ranging from 0.17-0.24 mg/L. These ammonia levels are very high for the life of tilapia nirvana being reared. This shows that the ammonia level in the culture media is not good because it exceeds the threshold. SNI 06-6989.30 (2005) stated that the ammonia level in water should not be more than 0.20 mg/L, and if the free ammonia level is more than 0.2 mg/L, the water is toxic for several types of fish.

The use of maggot flour is quite suitable as a combination material for fish meal in the feed because it contains calcium, fat and amino acids needed for fish growth, even though the ash content is relatively high. The feed treatment with a combination of 50% fish meal and maggot flour shows better performance than the control, but a combination diet of 100% fish meal and maggot flour, it gives a lower performance in terms of feed digestibility and protein retention. This is thought to be due to the high fat and ash content. Other research also used this testing on pangat catfish (*Pangasius pangasius*) and selais fish (*Ompok hypophthalmus*), with trials of maggot as a feed supplement (Fahmi *et al*., 2009). The utilization of maggot as a fish feed supplement has a significant effect on growth and feed digestibility.

CONCLUSION

Based on the results of the study, it can be concluded that the digestibility level of the combined feed treatment with 50% fish meal and 50% maggot flour in nirvana tilapia (*Oreochromis niloticus*) gives the highest results for total feed digestibility of 56.97, protein digestibility of 87.33 and protein retention of 14.83.

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