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SUPPLEMENTATION OF SUCKERMOUTH CATFISH MEAL (*HYPOSTOMUS PLECOSTOMUS*) ON THE PERFORMANCE OF TILAPIA (*OREOCHROMIS NILOTICUS*)

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ABSTRACT

One component of fish feed that has a high price is fish meal, so efforts are needed to find alternative substitutes from natural sources so that the price of feed becomes more economical. The research was carried out at the Aquaculture Laboratory Hatchery, Faculty of Fisheries and Marine Sciences, Padjadjaran University, while the proximate analysis of feed ingredients and test feed, the manufacture of suckermouth fishfish meal was carried out by the Chemistry and Animal Feed Laboratory, Faculty of Animal Husbandry, Padjadjaran University. The purpose of this study was to use suckermouth fish meal in feed on the growth and use of tilapia (Oreochromis niloticus) as an alternative to providing protein sources in fish feed. The study was conducted using a completely randomized design (CRD), consisting of 5 (five) treatments and each repeated 3 (three) times. The treatment given was the addition of 0, 5, 10, 15 and 20% fish meal in artificial feed. Parameters observed at the end of the study include, the level of consumption, absolute growth and survival. The results showed that the addition of 10% suckermouth fishflour in the feed gave the best results, where it was 6.537 grams, consumption was 0.755 grams/day, and survival was 93.3%. Based on observations, the use of suckermouth fishflour up to a level of 20% in feed does not have a negative effect on the life of tilapia, so it can be used as an alternative fish meal substitute in fish feed.

Keywords: Nile tilapia, Hypostomus Plecostomus, Suckermouth fish, Supplementation, Fish Meal, Growth Performanc

Introduction

Feed is one of the components that determine the success of fish farming. The contribution of feed costs can reach up to 60-80% of the total production costs in intensive cultivation activities. So far, the tendency of fish farmers is to use commercial feed sold in the market because it is more practical and efficient. However, in line with changes in the global economy, several conditions occurred which resulted in the price of commercial feed becoming very expensive and unaffordable for small-scale fish farmers.

The source of animal protein that is commonly used as one of the ingredients for feed is fish meal. Fish meal is not only used in the field of fisheries, but also in animal husbandry, so that the use of fish meal is increasingly faced with supply and price constraints. In an effort to meet protein in feed, it is necessary to seek alternative feed ingredients with relatively the same nutritional value to reduce the use of fish meal in feed. One of the ingredients that can be used as a source of animal protein in feed is suckermouth fishfish meal.

Suckermouth fishfish is one of the non-economical fish that is abundant in the waters of West Java, so it can be processed and used into suckermouth fishfish meal. Fish meal is a potential source of animal protein to be developed as a substitute for fish meal. Based on the results of the proximate analysis, it is known that the protein value of broomfish meal ranges from 56.51-65.45%. The results of this analysis indicate that the fish meal of brooms can be used as a source of animal protein for feed because the crude

protein content is close to that of fish meal (47.85-55.57%).

Research on the use of suckermouth fish meal as a supplement in feed has never been done. It is necessary to do a study first, so that it can be seen to what extent the effect of adding meal as a protein source on fish growth, one of which is tilapia (*Oreochromis niloticus*) which is one of the important commodities in Indonesia.

Material and Method

This research lasted for 4 months, at the Aquaculture Laboratory Hatchery, Faculty of Fisheries and Marine Sciences, Padjadjaran University, while t`he proximate analysis of feed and test feed ingredients, the manufacture of suckermouth fish meal was carried out by the Animal Feed Chemistry Laboratory, Faculty of Animal Husbandry, Padjadjaran University.

Materials and tools used in this study include:

1. Tilapia (*Oreochromis niloticus*) size 10 ± 0.5 grams per fish obtained from the Jangari Cianjur area as many as 250 fish.

2. Fish meal. Procurement of suckermouth fish meal is carried out by collecting broom fish from public waters and then processing it into flour.

3. The feed used in this study was in the form of pellets, with a protein content of 35% for different percentages of flour addition (Table 1), while the average energy content was 2840 kcal EB/kg. Proximate analysis was carried out on feed ingredients and on experimental feed given to fish (Table 2).

The experiment was conducted using a completely randomized design (CRD), consisting of 5 (five) treatments and each repeated 3 (three) times, namely:

Treatment No: Feed with the addition of 0% protein suckermouth fish meal

Treatment N1: Feed with the addition of 5% protein suckermouth fish meal

Treatment N2: Feed with the addition of 10% protein suckermouth fish meal

Treatment N3: Feed with the addition of 15% protein suckermouth fish meal

Treatment N4: Feed with the addition of 20% suckermouth fish meal

Placement of treatment in this experiment was carried out randomly, while the design model used was as follows:

$$Yij = \mu + Ti + \Sigma ij$$

Note:

Yij = the value of the observations in the treatment I-th replication

μ = average response of all treatments and replications

Ti = effect of treatment I

Σ ij = experimental deviation of treatment I and replication to-j

The effect of each treatment was tested by statistical analysis of the F test, and continued with Duncan's test to determine the difference between each treatment. Feed is given with a frequency of three times a day, namely at 08.00, 12.00 and 16.00. Fish weighing was done once a week. Water quality measurements (pH, temperature, dissolved oxygen and ammonia) were carried out 3 times during the study period, namely at the beginning, middle and end of the study. Observational parameters to be collected and analyzed include:

1. Feed Consumption

Consumption of dry matter feed (g/day) = Output dry matter of feces (g/day) x 100% Indigestion

(Sources: Ranjhan, 1980; Schneider, 1973)

2. Absolute Growth

PM = [Wt - Wo]

Note:

PM = absolute growth (g)

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

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

3. Survival Rate

S = Nt x 100%No

Note:

S = survival rate

Nt = number of live fish fry at the end of the study (tails)

No = number of live fish fry at the beginning of the study (tails)

(Source: Effendi, 1979)

Results

Proximate Analysis

Table 1. Feed Ingredients (% dry matter)

Ingredients	Treatments				
	No	N1	N2	N3	N4
	(%)				
Fish Meal	30	25	20	15	10
Suckermouth fish Meal	0	5	10	15	20
Soybean Meal	31	31	31	31	31
Coconut Meal	9	9	9	9	9
Corn Meal	10	10	10	10	10
Fine Bran Meal	14	14	14	14	14
Fish Oil	2	2	2	2	2
Wheat Meal	2	2	2	2	2
DCP	0	0	0	0	0
Premix	2	2	2	2	2
% dry matter	100	100	100	100	100

Sumber: *) Animal Feed Laboratory, Faculty of Animal Husbandry UNPAD (2020)
**) National Research Council (1983)

Table 2. Proximate Analysis from Each Treatment (%)

No	Components	No	N1	N2	N3	N4

1	Crude Protein	35,51	35,44	35,36	35,29	35,21
2	Fat	7,35	7,49	7,64	7,78	7,93
3	Crude Fiber	5,39	6,07	6,75	7,44	8,12
4	Calcium	2,45	2,49	2,53	2,56	2,60
5	Phospor	1,32	1,37	1,43	1,49	1,54
6	Lisine	3,03	2,90	2,77	2,64	2,51
7	Methionine	0,83	0,79	0,76	0,72	0,69
8	Methionine + Cystine	1,40	1,35	1,30	1,24	1,19
9	DE (kkal/kg)	2840	2839	2839	2939	2838

Feed Consumption

The highest average feed consumption for tilapia was found in the control treatment, which was 1.166 grams/day, and the lowest was in the addition of 20%, which was 0.095 grams/day. The results of the analysis of variance showed that there was an effect of treatment on the daily consumption of tilapia and the average daily consumption of tilapia in each treatment during the study is presented in Figure 1.

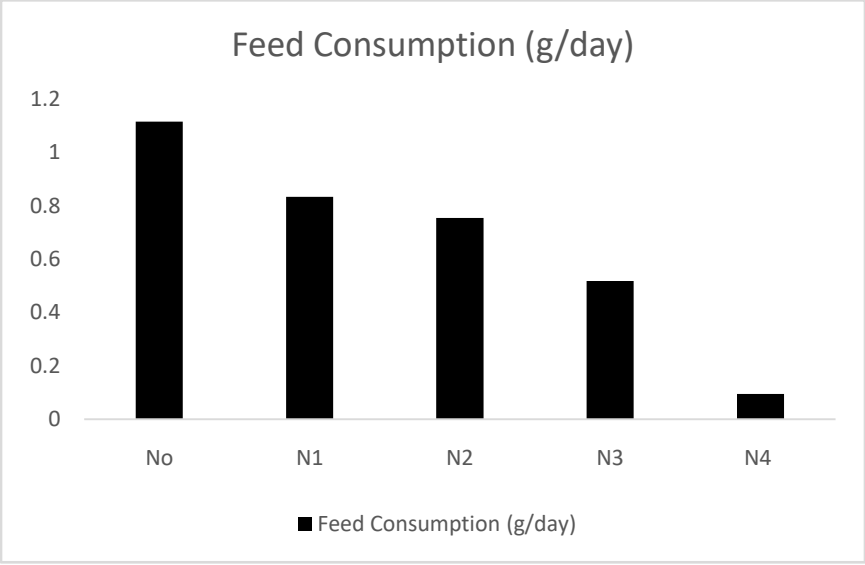

Figure 1. Average Feed Consumption (g/day) during the experimental period

The low feed consumption in the addition of suckermouth fish meal is increasingly related to the palatability of the feed. Hoar (1979) stated that the factors that influence the amount of feed consumption in fish are: feeding habit, physiological status, fish weight, temperature, oxygen concentration, feed composition and palatability. The results of observations during the study showed that the response of fish to feed decreased with the addition of higher suckermouth fish meal. The low level of liking is thought to be related to two things. First, the lower amino acid content was in line with the increase in the percentage of suckermouth fish meal in the feed. In general, the amino acid content in suckermouth fish meal is lower than fish meal, so an increase in the percentage of broom meal in the feed results in a lack of essential amino acids in the feed. Furthermore, Jauncey and Ross (1982) stated that feeds that are deficient in essential amino acids will result in decreased feed palatability, which in turn reduces appetite.

The second factor that affects the low consumption of feed is due to the unpleasant smell or aroma of feed for fish, thus affecting palatability. Palatability is an important factor that determines the level of feed consumption, and is influenced by the aroma, taste and texture of the feed (Church 1979 in Supriadi 1999). Fish meal has a distinctive aroma in the feed so as to increase the response of fish to consume the given feed. There is a tendency that the higher the content of suckermouth fish meal in the feed, the lower the palatability of the feed, so that the level of fish consumption decreases. Although the results of testing the physical characteristics of the pellets showed that the pellets of suckermouth fish meal did not have an odor, the addition of the suckermouth fish meal in the feed actually affected the aroma of the feed, which in turn affected the palatability and consumption of the feed.

Fish consumption in the 20% addition treatment was significantly different from the other treatments and the control. The feed that was given the addition of 20% suckermouth fish meal had a lower amino acid content than the other four treatments, re-

sulting in a distinctive aroma that did not suit the taste of the fish. The aroma of the feed in this case is determined by the quality of the protein in the feed, one of which is the amino acids that make up the protein in the feed (Atema 1980 in Supriadi 1999). According to (Buwono 2000), amino acids with a balanced composition in feed with the composition of amino acids contained in the fish's body will cause fish to grow normally.

Differences in feed consumption may be influenced by feed digestibility. Increased digestibility of feed plays a role in increasing feed consumption. This condition is in accordance with the opinion of Tillman et al. (1987) that feeds that have high digestibility will leave the digestive tract more quickly, so that more space is available for additional feed consumption. While feeds with low digestibility allow the absorption of nutrients to be slower so that feed consumption will be reduced.

Absolute Growth Rate

The highest average absolute growth of tilapia was found in the addition of 10% suckermouth fish meal, which was 6.537 grams, while the lowest was in the control treatment, which was 1.188 gram. From the analysis of variance, it was found that the addition of suckermouth fish meal with different percentages in artificial feed did not significantly affect the absolute growth rate of tilapia. The data in the picture above shows that the absolute growth of tilapia increased with the addition of suckermouth fish meal to a certain extent then the growth decreased at a higher level of addition. (Table 3).

Table 3. Analysis Statistic of Absolute Growth Rate from Nile tilapia

Treatment	Absolute Growth Rate (%)
N0	1,811[a]
N1	2,284[a]
N2	6,537[b]
N3	3,756[c]

The use of 20% suckermouth fish meal in feed significantly reduced fish growth compared to 0%, 5%, 10% and 15%. The decrease in the growth rate of fish is in line with the increase in the content of suckermouth fish meal in the feed. This is related to the dry matter digestibility of feed which decreases with the use of suckermouth fish meal with a higher percentage. Data on dry matter digestibility of feed for all treatments can be seen in the Appendix. From these data, it can be seen that the dry matter digestibility of feed that was given the addition of suckermouth fish meal at 0%, 5%, 10%, 15% and 20% value decreased. The lower the digestibility value of the feed will result in the lower availability of energy, amino acids and fats, and will further reduce the growth rate. Feeds that have low digestibility will cause food substances that should be utilized by the body to come out with feces. Enzymes, digestive juices and intestinal epithelial cells help proteins, polysaccharides, fats and nucleic acids to be degraded into simpler molecules so that they can be absorbed and assimilated by the fish body. But there are some types of proteins and polysaccharides that cannot be degraded.

In the digestive system of fish, each food has a different level of digestibility. Changing the type of food from natural to artificial feed will change the gastric emptying time to be longer. For this reason, it is recommended that the manufacture of artificial feed must be adjusted to the natural feed so that it does not change the time of gastric emptying.

One of the factors that affect feed digestibility is the crude fiber content in the feed. The crude fiber content in the five treatment feeds was relatively the same (2,210-2.219%), but the lignin content in the addition of suckermouth fish meal was 20% the highest (5.92%), while the addition of suckermouth fish meal was 0%, 5%, 10% and 15% respectively 3.65%, 3.68%, 3.70%, 3.82% An increase in the lignin content in the feed is thought to increase the compound ADIN (Acid Detergent Insoluble Nitrogen) which is a bond between lignin and protein, so that the absorption of N decreases and the number of components of undigested crude fiber (Acid Detergent Fiber) increases.

The composition of amino acids, especially essential amino acids from feed will also affect the growth of fish. According to Shigueno (1975), a good feed for growth is feed that has an amino acid pattern that is almost the same as the amino acid pattern of the fish body. When viewed from the comparison of the amino acid composition of fish meal and broomstick fish meal (Table 1), broomstick flour has complete amino acids but the value and amount is lower than fish meal.

The difference in essential amino acid content in each treatment affected the growth of carp. The addition of suckermouth fish meal by 10% resulted in the highest growth (6,537 g), while an increase in the percentage of suckermouth fish meal by 15% and 20% resulted in a decreased growth rate. It is suspected that the addition of 10% suckermouth fish meal has the best feed composition, where a balanced complementary process occurs from the two sources of animal protein. This is in line with the statement of Crampton (1969) when two or more than two proteins containing different amino acids are given to animals, the amino acids complement each other to form a perfect diet. The diversity between the constituent materials causes a complementary effect between nutritional components and affects the metabolism of feed protein in the fish body.

The amino acid with the lowest percentage in suckermouth fish meal was methionine (0.08%), relatively lower than fish meal (1.57%). This resulted in the availability of methionine decreasing in line with the increase in the content of suckermouth fish meal in the feed. Methionine is an essential amino acid containing sulfur which has an important role in fish growth. The process of absorption of amino acids into the cell wall is activated by methionine as a precursor, thereby accelerating the absorption of other amino acids (Scott et al., 1982). Methionine deficiency in the diet also affects the amino acid balance of the feed.

The results of this study are in line with research by Rachmawati (1996) on carp fish aged 40 days which concluded that the best addition of worm flour that can be mixed in the feed is 25%. Meanwhile, more additions will reduce growth, protein and fat retention, feed digestibility, and fish survival rate.

Survival Rate

The survival rate of tilapia ranged from 86.66 to 93.33%. Based on the analysis of variance, it was found that the addition of suckermouth fish meal with different percentages in the feed did not show a significant difference ($P < 0.05$) on the survival rate of tilapia (Table 4).

Table 4. Survival rate of Nile Tilapia during the experimental period (%)

Treatment	Survival Rate (%)*
N0	86,6
N1	86,6
N2	93,3
N3	86,6
N4	86,6

*No significant difference among treatments

There was no significant difference in this treatment because in general the addition of suckermouth fish meal in the feed did not cause lethal effects on fish. Fish growth will be disrupted if the protein content in the feed is low (Makmur 2004). Another factor that affects the survival rate is the condition of the fish rearing media. In this study, temperature, density and water quality were sought to support the maximum survival rate. The experimental fish were kept in a room that had a controlled and relatively stable temperature, low density, aeration, siphoning and periodic water changes. Thus the survival rate obtained in this study truly describes the effect of treatment on experimental fish. The results of the measurement of several water quality parameters during the study can be seen in (Table 5).

Water Quality	Treatments				
	No	**N1**	**N2**	**N3**	**N4**
Temperature (^{o}C)	26,5 - 29	26,0-28.5	26,0-28.5	26,0-28.5	26,0-28.5
Dissolved Oxigen (mg/L)	6,00 – 7,0	6,20 – 7,0	6,30 – 7,20	5,5 – 7,0	5,25 – 6,9
pH	6,5-6,9	6,5-6,8	6,7-6,9	6,6-6,9	6,7-6,9
Alkalinity (mg/l) $CaCO_3$(eq)	12,5-19,5	12,9-19,5	12,7-16,0	13,4-19,0	14,0-20
Ammonia (mg/l)	0,05-0,17	0,05-0,16	0,06-0,17	0,07-0,18	0,05-0,10

The table shows that the range of water quality values for fish rearing media during the study was still within the appropriate range to support fish growth. The survival rate obtained in this study was higher when compared to the survival rate in Rachmawati's (1996) study. This may be due to differences in the source and amount of protein, as well as the size of the fish used.

Conclusion

The addition of 10% suckermouth fish meal in the feed resulted in the best performance in tilapia, including absolute growth of 6.537 grams, consumption of 0.755 grams/day, and survival of 93.3%. The use of suckermouth fish meal up to 20% in feed did not have a negative effect on the survival of tilapia.

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