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THE EFFECT OF SUBSTITUTION OF SUCKERMOUGHT CATFISH FLOUR WITH LOCAL FISH FLOUR IN ARTIFICIAL FEED ON SURVIVAL AND FCR OF NILE TILAPIA

Pengaruh Substitusi Tepung Ikan Sapu-sapu Dengan Tepung Ikan Lokal Dalam Pakan Buatan Terhadap Sintasan Dan FCR Ikan Nila

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ABSTRACT

Feed is a key component in the success of fish farming. However, there is a problem in the cultivation process, namely that raw materials for feed are still imported, resulting in high feed prices for production costs. So that alternatives are needed to overcome these problems, one of which is utilizing available local raw materials that do not compete with human needs, one of which is suckermouth catfish flour. The purpose of this study was to determine the effect of substituting suckermouth catfish flour as a substitute for local fish flour in artificial feed on tilapia production. This study was conducted in January-February 2025, located at the Unhas Education Pond, Bojo District, Barru Regency, South Sulawesi. This study used a completely randomized design (CRD) with 5 treatments and 3 replications, so that there were 15 research containers filled with 15 test animals weighing 3 grams/head. The treatments given were treatment A = 100% local fish meal and 0% suckermouth catfish meal, treatment B = 75% local fish meal and 25% suckermouth catfish meal, treatment C = 50% local fish meal and 50% suckermouth catfish meal, treatment D = 25% local fish meal, 75% suckermouth catfish meal, and treatment E = 0% local fish meal, 100% suckermouth catfish meal. Data were analyzed using a comparison of the mean analysis of variance (ANOVA). Based on the results of the study, the treatment with the best value on the survival parameter was treatment D and the best treatment on the feed efficiency and FCR parameters was E with a survival value (84.33 ± 7.50a), feed efficiency (4.62 ± 0.60) and FCR (2.70 ± 0.17b). The results of the water quality analysis showed temperature results with a value of 27-28℃ and pH with a value of 7.2-77.

Keywords: Suckermouth catfish, feed, survival

ABSTRAK

Pakan merupakan komponen kunci dalam keberhasilan usaha budidaya ikan. Namun terdapat masalah pada proses budidaya yaitu bahan baku pakan yang masih diimpor memgakibatkan tingginya harga pakan biaya produksi. Sehingga diperlukan alternatif untuk mengatasi permasalahan tersebut, salah satunya memanfaatkan bahan baku lokal yang tersedia yang tidak

bersaing dengan kebutuhan manusia, salah satunya tepung suckermouth catfish. Tujuan penelitian ini untuk mengetahui pengaruh substitusi tepung suckermouth catfish sebagai pengganti tepung ikan lokal dalam pakan buatan terhadap produksi ikan nila. Penelitian ini dilaksanakan pada bulan Januari-Februari 2025, bertempat di Tambak Pendidikan Unhas, Kecamatan Bojo, Kabupaten Barru, Sulawesi Selatan. Penelitian ini menggunakan rancangan acak lengkap (RAL) dengan 5 Perlakuan dan 3 ulangan, sehingga terdapat 15 wadah penelitian yang diisi 15 ekor hewan uji dengan berat 3 gram/ekor. Perlakuan yang di berikan adalah perlakuan A = 100% tepung ikan lokal dan 0% tepung suckermouth catfish, perlakuan B = 75% tepung ikan lokal dan 25% tepung suckermouth catfish, perlakuan C = 50% tepung ikan lokal dan 50% tepung suckermouth catfish, perlakuan D = 25% tepung ikan lokal, 75% tepung suckermouth catfish, dan perlakuan E= 0% tepung ikan lokal, 100% tepung suckermouth catfish. Data dianalisis menggunakan perbandingan rerata analisis ragam (ANOVA). Berdasarkan hasil penelitian menunjukkan perlakuan dengan nilai terbaik pada parameter sintasan adalah perlakuan D dan perlakuan terbaik pada parameter efisiensi pakan dan FCR adalah E dengan nilai sintasan (84,33 ± 7,50$^{a)}$, efisiensi pakan (4,62 ± 0,60) dan FCR (2,70 ±0,17^{b}). Hasil analisis kualitas air menunjukkan hasil suhu dengan nilai 27-28℃ dan pH dengan nilai 7,2-77.

Kata Kunci: ikan sapu-sapu, pakan, sintasan

INTRODUCTION

Tilapia (*Oreochromis niloticus*) is a very popular fish among Indonesian people because of its affordable price, high nutritional content, and stable price in the market. Tilapia is one of the most sought-after freshwater fish (Niode *et al.,* 2017). However, the obstacle in tilapia cultivation is the use of commercial feed which is the highest cost component in fish cultivation (Ramli, 2024).

Feed is a key component in the success of fish or shrimp cultivation efforts (Ardiansyah, 2022). In addition to functioning as a source of material and energy to support the life and growth of fish, feed also constitutes the majority of production costs, ranging from 50 to 70% (Yanuar, 2017). Quality feed must have complete and balanced nutritional content according to the needs of the fish. Natural protein sources in feed come from animals with high protein content both in terms of quantity and quality, such as fish meal (Yanuar, 2017). Fishmeal has good protein quality because it contains essential amino acids (methionine and lysine) needed by fish and shrimp (Saputra, 2019).

Fishmeal is the main factor in determining the quality of artificial feed and is a source of animal protein commonly used in making fish feed (Ramli, 2024). However, the high amount of fishmeal imports causes the price to become more expensive, thus becoming a challenge for the development of fisheries businesses. To overcome this problem, alternative sources of animal protein are needed that are more affordable, consistently available, and of good quality. Fish feed formulations that use various fishmeals from different raw materials, such as trash fish, salted fish, and fish heads, can be a substitute for commercial fishmeal and function as a source of protein that supports fish growth (Utomo *et al.,* 2015). However, availability is inadequate so that alternative raw materials for animal protein feed sources are needed that do not compete with humans and are abundantly available, one of which is suckermouth catfish flour.

Lake Sidenreng and Lake Tempe are a single unit called the Lake Tempe system, but both are separate and each has its own name due to continuous sedimentation and shallowing. One thing that is also thought to affect the diversity of fish species in Lake Sidenreng is the suckermouth catfish (*Pterygoplichthys* spp). The existence of the suckermouth catfish species

which is experiencing a population explosion (an increase in the number of species from year to year) has resulted in the fish becoming a threat to the population of local fish species (Hasrianti *et al.,* 2022). Suckermouth catfish, especially in Lake Tempe, have a fairly high nutritional content with 15.20% protein; 6.27% fat; 4.74% ash; and 67.19% air content, but have not been optimally utilized and are even considered pests and predators by the local community (Hasnidar *et al.,* 2022). According to research that has been conducted (Sumaidi *et al.,* 2023) the results of the proximate content test of suckermouth catfish were analyzed descriptively to describe its proximate composition with the suitability of suckermouth catfish as food or raw material for making feed. The nutritional content of suckermouth catfish meat is in the form of water content, crude protein (91.11%), crude fat (0.74%), crude fiber (0.39%), BETN (1.17%), and ash (6.59%). Suckermouth catfish contains a complete nutritional composition such as protein, fat, crude fiber, BETN, water, so it can be recommended as a source of nutritious food and used as a raw material for fish and livestock feed. The protein content of suckermouth catfish flour is almost equivalent to fish flour in general, which is around 47-55%.

The purpose of this study was to determine the effect of substituting suckermouth catfish flour as a substitute for local fish flour in artificial feed on tilapia production.

RESEARCH METHODS

Time and Place

This research was conducted in January - February 2025. Located at Tambak Pendidikan Unhas, Bojo District, Barru Regency, South Sulawesi Province.

Tools and Materials

The tools and materials used in the research were plastic basins, sieves, aerators, measuring cups, digital scales, spoons, cameras, suckermouth catfish flour, local fish flour, fresh water, soybean flour, fish oil, tilapia, wheat flour and shrimp head flour.

Maintenance

Tilapia fish were put into a basin containing 25 liters of water with a density of 15 fish. Before the research was carried out, the fish were acclimatized first for approximately 30 minutes so that the fish could adjust to the new environmental conditions and were fasted for 24 hours.

By weighing the weight of the fish and putting them in each container that had been prepared. Maintenance was carried out for 30 days, feeding 2 times a day at 07.00 and 17.00 WITA with a percentage of feeding of 6% of the total weight of the fish.

Research Design

This research was an experimental study using a completely randomized design (CRD) with 5 treatments, 3 replications were carried out in each container, so that there were 15 containers filled with 15 test animals weighing 3 grams, the treatments given were as follows:
Treatment A = 100% fish meal and 0% suckermouth catfish meal;
Treatment B = 75% fish meal and 25% suckermouth catfish meal;
Treatment C = 50% fish meal and 50% suckermouth catfish meal;
Treatment D = 25% fish meal and 75% suckermouth catfish meal; And
Treatment E = 0% fish meal and 100% suckermouth catfish meal.

Test parameters

The parameters observed in the study were survival, feed efficiency, feed conversion ratio and water quality.

Survival Rate

The percentage of survival rate was calculated using the formula from (Effendie, 1997) as follows:

$$SR = \frac{Nt}{N0} x\ 100\%$$

Description:

SR : Survival (%);
Nt : Number of fish alive at the end of maintenance (tail); and
N0 : Number of fish at the beginning of maintenance (tail).

Feed efficiency

The feed utilization efficiency (EPP) value is calculated using the formula (Kurniawan, 2023) as follows:

$$EPP = \frac{Wt - Wo}{F} x\ 100\%$$

Description:

EPP : Feed utilization efficiency (%);
Wt : Total weight of fish at the end of the study (g);
Wo : Total weight of fish at the beginning of the study (g); and
F : Amount of feed consumed during the study (g).

Feed Conversion Ratio

Feed conversion is the ratio of the amount of feed in dry conditions given during the maintenance process minus the weight of dead fish and the initial weight of fish at the end of maintenance (Tahapari and Suhenda, 2009). With the following equation:

$$FCR = \frac{F}{(Wt + D) - Wo}$$

Description:

FCR : Feed Conversion Ratio;
Wo : Weight of test animals at the beginning of the study (g);
W : Weight of test animals at the end of the study (g);
D : Weight of dead fish (g); and
F : Amount of feed consumed (g).

Water Quality

Water quality measurements are carried out daily using a digital thermometer and a digital pH meter. The water quality measured is temperature and pH.

Data Analysis

Data on survival rate, feed efficiency and feed conversion ratio were analyzed using analysis of variance or Analysis of Variance (ANOVA) test. If the results showed a significant effect, it was continued with the W-Tukey test.

RESULT

Survival Rate

The survival of tilapia after being fed with fish meal and suckermouth catfish meal with different treatments (100% fish meal and 0% suckermouth catfish meal, 75% fish meal and 25% suckermouth catfish meal, 50% fish meal and 50% suckermouth catfish meal, 25% fish meal and 75% suckermouth catfish meal and 0% fish meal and 100% sau-sapu fish meal) is shown in Table 1.

Table 1. Average survival of tilapia during the study

Parameter	Parameter ± Std
	Survival (%)
A	62,33 ± 4,04[b]
B	67,00 ± 0,00[b]
C	71,00 ± 3,46[ab]
D	84,33 ± 7,50[a]
E	80,00 ± 0,00[ab]

Note: Different superscript letters in the same column indicate significant differences between treatments at the 95% confidence level (P<0.05).

Feed efficiency

The feed efficiency of tilapia after being given fish meal and suckermouth catfish meal substitute feed with different treatments (100% fish meal and 0% suckermouth catfish meal, 75% fish meal and 25% suckermouth catfish meal, 50% fish meal and 50% suckermouth catfish meal, 25% fish meal and 75% suckermouth catfish meal and 0% fish meal and 100% sau-sapu fish meal) is shown in table 2.

Table 2. Average feed efficiency of tilapia during the study

Parameter	Parameter ± Std
	Feed efficiency
A	4,58 ± 0,19
B	4,15 ± 0,76
C	4,51 ± 0,48
D	4,34 ± 0,31
E	4,62 ± 0,60

Food Convertion Ratio (FCR)

Food Conversion Ratio (FCR) of tilapia after being given fish meal and suckermouth catfish meal substitution with different treatments (100% fish meal and 0% suckermouth catfish meal, 75% fish meal and 25% suckermouth catfish meal, 50% fish meal and 50% suckermouth catfish meal, 25% fish meal and 75% suckermouth catfish meal and 0% fish meal and 100% sau-sapu fish meal) is shown in table 3.

Table 3. Average FCR of tilapia during the study

Parameter	Parameter ± Std
	FCR
A	3,18 ± 0,10^{ab}
B	3,43 ± 0,17^{a}
C	3,25 ± 0,35^{ab}
D	2,93 ± 0,17^{ab}
E	2,70 ±0,17^{b}

Note: Different superscript letters in the same column indicate significant differences between treatments at the 95% confidence level (P<0.05).

Water Quality Analysis

Measurement of water quality parameters during 30 days of tilapia maintenance by providing substitute feed of suckermouth catfish flour with local fish flour can be seen in Table 4.

Table 4. Average water quality of tilapia during the study

Parameter	**Treatment**				
	A	B	C	D	E
Temperature	28,76℃	28,20℃	27,25℃	27℃	27,70℃
pH	7,7	7,2	7,3	7,5	7,5

DISCUSSION

Survival Rate

The results of the analysis of variance showed that the provision of fish meal and suckermouth catfish meal substitute feed had a significant effect on the survival of tilapia (P <0.05). The W-Tukey test showed that the fish meal and suckermouth catfish meal substitute feed in treatment D was significantly different from treatments A and B but the same as treatments C and E. The results showed that the highest survival was in treatment D (84.33%), followed by treatment E (80.00%), treatment C (71.00%), treatment B (67.00%), and the treatment with the lowest survival was treatment A (62.33%).

Survival is one of the most important factors in cultivation. Although diverse, the survival rate in all treatments showed a high number. A high survival rate indicates a good response by the fish to the management of the treatment and feed given, feed that has good nutrition plays a very important role in maintaining survival and accelerating fish growth (Manam, 2023).

The high survival rate in treatment D indicates that the high rate of consumption and quality of feed consumed by tilapia. According to Dodi et al., 2015 in his research stated that feed that has good nutrition plays a very important role in maintaining the quality of life and accelerating the growth of fish.

Treatments E, C, and B showed decreasing survival values, allegedly caused by feed residues that accumulated at the bottom of the container, this also caused the water quality in the research container to be poor, making it impossible for fish to consume more feed. Decreased water quality will cause fish to become stressed so that growth slows down, because tilapia depend on clean water for their lives, decreased water quality can cause fish to starve to death, grow too slowly, get sick, or die altogether (AP *et al.,* 2022).

The low survival rate in treatment A was caused by a lower feed consumption rate compared to other treatments so that it did not meet metabolic and growth needs so that the little feed consumed by fish will cause nutritional deficiencies which result in a lack of nutrients absorbed by the fish's body and indirectly will cause fish to be easily stressed and susceptible to disease (Yanto *et al.,* 2019).

Feed Efficiency

The results of the analysis of variance showed that the provision of fish meal and suckermouth catfish meal substitute feed did not have a significant effect on the efficiency of tilapia feed (P <0.005). This is thought to be due to the nutritional content of the feed not being met for the needs of the fish so that it was not utilized properly. The results showed that the highest feed efficiency was in treatment E (4.62%), followed by treatment A (4.58%), treatment C (4.51%), treatment D (4.34%), and the treatment with the lowest feed efficiency was treatment B (4.15%).

The feed efficiency value indicates the ability of fish to utilize nutrients in the feed so that they can be utilized. The higher the feed efficiency, the higher the level of feed utilization by the fish, this also means the better the quality of the feed (Adelina *et al.,* 2012).

The best feed efficiency value was found in the provision of fish meal and suckermouth catfish meal substitute feed in treatment E with a value of 4.62 ± 0.60. This is thought to be because the feed in treatment E has a fairly high nutritional value so that it can be utilized well by the fish. The same thing was explained by Vini *et al.* (2018), that the higher the feed utilization efficiency value, the more efficient the fish are in utilizing the feed given for consumption and increasing their growth. The high value of feed utilization efficiency is thought to be because the feed given to the fish is in accordance with the nutritional needs of the fish, especially protein, and in accordance with the eating habits and characteristics of the fish so that it becomes a factor that influences growth and can increase the feed efficiency value (Sulasi *et al.,* 2018).

Treatment B showed the lowest feed efficiency value, which is thought to be caused by inadequate nutrition in the feed consumed by the fish, resulting in poor growth and low feed utilization efficiency (Zaminhan *et al.,* 2018). In addition to protein content, other nutrients such as fat and carbohydrates also play an important role as a source of energy for fish. Marzuqi (2013) explained that a fairly high fat and carbohydrate content plays an important role in the metabolic process, and contributes to supplying energy to the fish's body, apart from protein.

Food Convertion Ratio (FCR)

The results of the analysis of variance showed that the provision of fish meal and suckermouth catfish meal substitute feed had a significant effect on the feed conversion ratio of tilapia (P <0.05). The W-Tukey test showed that the fish meal and suckermouth catfish meal substitute feed in treatment E was different from treatment B. The results showed that the treatments with the highest to lowest FCR were in treatment B with a value of 3.43 ± 0.17, followed by treatment C with a value of 3.25 ± 0.35, treatment A with a value of 3.18 ± 0.10, treatment D with a value of 2.93 ± 0.17 and the lowest in treatment E with a value of 2.70 ± 0.17.

The Feed Conversion Ratio (FCR) of tilapia is a ratio used to measure the efficiency of feed use in fish production. Radona *et al.* (2017), explained that the FCR value shows how much feed nutrition is used by fish.

Treatment E has the lowest feed conversion value. The smaller the feed conversion value indicates the more efficient utilization of feed in the body. The lower the feed conversion rate, the less feed is needed to produce 1 kg of fish meat. This means that the more efficiently the feed is converted into meat. The same thing is explained by (Cardoso *et al.,* 2020) that the lower the feed conversion value, the better the quality of the feed and the more efficiently the fish utilize the feed for growth because the feed can be digested optimally.

In treatments B, C, A and the highest conversion value in treatment D. Each treatment showed a higher feed conversion value. This indicates less efficient feed utilization by fish. The high feed conversion value indicates that more feed is needed to be converted into meat. This has an impact on feed costs which will be higher. The same thing is explained by Setiyano, 2015 that a high feed conversion value indicates that the amount of feed needed to increase body weight is high and increases feed efficiency.

Water Quality Analysis

During the study, the water quality parameters observed included temperature and pH. The measurement results showed that the water temperature ranged from 27 to 28.75°C, while the pH value was in the range of 7.2 to 7.7. Measurements of these two parameters were carried out periodically during the study period to ensure that the environmental conditions of the waters remained within the optimal range for the growth and survival of the fish being cultivated. According to Arifin, 2016 the optimal water temperature for cultivating tilapia (*Oreochromis niloticus*) is 25-30°C while a temperature of 21°C can reduce the fish's appetite and temperatures below can facilitate disease attacks. According to the Indonesian National Standardization issued by the National Standardization Agency (BSN), the optimal temperature for cultivating black tilapia ranges from 25 - 35°C (SNI 7550:2009), this supports the results measured during the study that the temperature is in optimal conditions for the growth and survival of tilapia.

In the world of fisheries, the pH value is used as a description of the ability of waters to produce mineral salts. Tilapia can grow and develop well in aquatic environments with a neutral acidity (pH) or low alkalinity. Arikunto and Suharsimi (2019), stated that the pH of water that can be tolerated by tilapia ranges from 5-11. Optimal growth and reproduction of tilapia requires a pH of 7-8, just like the opinion according to (Setyo 2016) the ideal pH for maintaining saline tilapia ranges from 7.0-,8.0.

CONCLUSION

Based on the results of the study, it can be concluded that the use of suckermouth catfish flour can be used as a source of protein in tilapia fish. Treatment D - a mixture of 25% fish flour and 75% catfish flour had the best results in terms of tilapia survival with, while treatment E - 0% fish flour and 100% catfish flour had the best results in terms of feed efficiency. The percentage of this combination is superior in the use of feed that can reduce commercial feed costs.

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