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THE EFFECT OF SOYBEAN FLOUR SUBSTITUTION WITH PALM KERNEL MEAL IN FEED ON GROWTH AND SURVIVAL OF SANGKURIANG CATFISH (*Clarias* sp.)

Pengaruh Substitusi Tepung Kedelai dengan Bungkil Sawit Pada Pakan Terhadap Pertumbuhan, Kecernaan, dan Kelangsungan Hidup Ikan Lele Sangkuriang (*Clarias* sp.)

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ABSTRACT

Palm kernel meal is considered very potential to be used as fish feed because it contains 15.43% crude protein. The problem by aquaculture is the imbalance in income obtained compared to production costs that have been incurred. This is because farmers depend on manufactured feed so that the price of commercial feed issued is high. The purpose of this study was to analyze the effect of different soybean meal and palm kernel meal feed substitutions on the growth and survival of catfish (Clarias sp). The study used a Completely Randomized Design with 3 treatments and 4 repetitions, consisted of three main treatments, namely: the first treatment (P1) feed based on a ratio of 80% soybean meal with 20% palm kernel meal and the second treatment (P2) feed based on 70% soybean meal and 30% palm kernel meal and (P3) feed based on 60% soybean meal and 40% palm kernel meal...The highest Weight gain value was found in P1 at 71.3 gr, followed by P2 at 51.5 gr, and P3 at 47.6 gr. The results showed that the highest RGR value was found in treatment P1 at 0.3% followed by treatments P2 and P3 at 0.2%. The best Feed Covertion Ratio (FCR) was found in treatment P1 at 4.31, followed by treatment P2 at 5.85 and treatment P3 at 6.22. The highest SR in treatment was found in treatment P1 at 91.7% followed by P2 and P3 at 90%.

Keywords: Clarias sp., Feed Conversion, Growth, Palm Kernel Meal, Survival Rate

ABSTRAK

Bungkil sawit dinilai sangat potensiall dimanfaatkan sebagai bahan baku pakan ikan dikarenakan terdapat kandungan protein kasar sebesar 15.43%. Permasalahan yang dihadapi pembudidaya ikan adalah tidak seimbangnya pendapatan yangg diperoleh daripada biaya produksi yang sudah dikeluarkan. Hal ini dikarenakan pembudidaya ketergantungan akan pakan pabrikan sehingga harga pakan komersial yang dikeluarkan tinggi. Tujuan dilakukan penelitian ini yakni menganalisis pengaruh subsitusi pakan tepung kedelai dan bungkil sawit

yang berbeda pada pertumbuhan serta kelangsungan hidup ikan Lele sSangkuriangg (*Clarias* sp). Metode penelitian menggunakan Rancangann Acakn Lengkapn (RAL) dengan 3 perlakuan dan 4 kali pengulangan yang terdiri dari tiga perlakuan utama yaitu: perlakuan pertama (P1) pakan berbahan dasar perbandingan tepung kedelai sebesar 80 % dengan bungkil sawit 20% dan perlakuan kedua (P2) pakan berbahan dasar tepung kedelei 70% dan bungkil sawit 30% serta (P3) pakan berbahan dasar tepung kedelei 60% dan bungkil sawit 40%.Hasil tertinggi nilai Bobot Total (WG) terdapat pada P1 sebesar 71,3 gr, diikuti oleh P2 sebesar 51,5 gr, dan P3 47,6 gr. Hasil penelitian menunjukkan bahwa nilai Laju Pertumbuhan Relatif tertinggi terdapat pada perlakuan P1 sebesar 0,3% diikuti oleh perlakuan P2 dan P3 sebesar 0,2%. Konversi Pakan terbaik terdapat pada perlakuan P1 yaitu sebesar 4,31 diikuti oleh perlakuan P2 sebesar 5,85 dan perlakuan P3 sebesar 6,22. Kelulusanhidup pada perlakuan tertinggi terdapat pada perlakuan P1 yaitu sebesar 91,7% diikuti oleh P2 dan P3 sebesar 90%.

Kata Kunci: Bungkil Sawit, Ikan lele, Kelulusan Hidup, Konversi Pakan, Pertumbuhan

INTRODUCTION

Sukamara District is one of the districts in Sukamara Regency located in Central Kalimantan Province as an area with extensive oil palm land. Oil palm plantations in Sukamara Regency are owned by companies and individuals, namely the local community, which makes the potential for oil palm there large (Ismail, 2021). The form of palm oil processing in the Sukamara Regency area is in the form of the Crude Palm Oil (CPO) industry, which will produce waste in the form of palm kernel cake. The existence of palm kernel cake is very easy to find if the area is a center for oil palm plantations. Sukamara Regency has the potential to be a center for oil palm plantations on the island of Kalimantan. Arief et al. (2012) stated that palm kernel cake can be used as a source of protein for fish feed. In addition, palm kernel cake is considered very potential to be used as a fish feed ingredient because it contains a crude protein content of 15.43%.

Feed is the main component of fish cultivation and supports the growth and survival of fish being cultivated. Muntafiah (2020) when feeding farmed fish must pay attention to the quality and quantity in it based on the nutritional needs required by the fish. Fish feed can be assessed as good and of good quality seen from the complete nutritional composition, easily digested by fish, and does not contain hazardous materials. One factor in increasing the production of fish farming results is the availability of quality feed at a low price, currently farmers generally still use imported raw materials such as corn, fish meal, and Meat Bone Meal (MBM) which are considered relatively expensive for raw materials for farmed fish feed in Indonesia. Efforts to reduce dependence on imported feed raw materials include finding alternative raw materials that are of good quality, cheap, easy to obtain, and can reduce feed costs so as to increase the efficiency of fish farming businesses (Amri, 2007).

The problem faced by fish farmers is the imbalance in income obtained from the production costs that have been incurred. This is because farmers depend on manufactured feed so that the price of commercial feed issued is high. The cost of feed in fish farming production mostly comes from operational production funds of 60-80% (Nikhlani et al., 2022). As is the case based on research by Rahman et al. (2023) the largest cost is spent on capital in raising catfish at the time of procuring fish feed, which is 70-80% of the total required. From this condition, the profits obtained by fish farmers will be very small and even have an impact on losses in freshwater fish farming production.

Sangkuriang Catfish (*Clarias* sp.) as one of the freshwater fish that is in great demand because it has a high nutritional content, as a source of animal protein and low in fat compared to chicken and beef. Catfish are also quick to adapt when given artificial feed and easily digest any type of feed given. The solution to reducing feed costs by utilizing natural ingredients

includes replacing fish pellets (commercial feed) with homemade feed that is rich in protein content. The increasing price of fish feed means that fish farmers need alternatives to reduce feed costs, one of which is replacing pellets with homemade feed that is high in protein (Amandanisa & Suryadarma, 2020). FAO (2013) stated that the cost of protein sources for fish feed as well as the threat of food security, environmental pressures, increasing human population, and increasing demand for fish feed have an impact on the price of protein on the market which is relatively expensive.

Fish farmers often use waste as an alternative feed that has a high nutritional content and can be easily obtained. Palm kernel meal and soybean flour waste are alternative feeds that still have a fairly high nutritional content. Soybean flour acts as a vegetable protein that has a protein content of 39.6% (Abadi, 2010). Therefore, it is necessary to conduct research on the use of soybean flour with palm kernel meal in the manufacture of artificial feed raw materials for the growth and survival of Sangkuriang Catfish (*Clarias* sp.) in Sukamara Regency. The purpose of this study was to analyze the effect of alternative feed substitution with soybean flour and palm kernel meal on the growth and survival of Sangkuriang Catfish (*Clarias* sp.). The results of this study are expected to be useful and beneficial for Catfish farmers in Sukamara Regency, especially in terms of providing studies related to alternative feed from waste that can reduce operational costs in freshwater fish farming production.

METHODS

Time and Place

The research time was carried out for approximately 4 months starting from preparation to the end of the activity. The making of pellet feed and fish maintenance were carried out at the PSDKU fish farming workshop in Sukamara Regency. The proximate analysis test was carried out at the Fisheries Lab of the Pontianak State Polytechnic.

Research Methods

This research consisted of three main treatments, namely: the first treatment (P1) feed made from a ratio of 80% soybean flour with 20% palm kernel cake and the second treatment (P2) feed made from 70% soybean flour and 30% palm kernel cake and (P3) feed made from 60% soybean flour and 40% palm kernel cake. The study used a Completely Randomized Design (CRD) with three treatments and four repetitions. The data obtained were tested for normality, homogeneity and one-factor analysis of variance (one way), then a further BNT test was carried out to determine the effect between each treatment.

This study refers to the results of previous studies (Rusmiati et al., 2017) stating that the use of 10% BKS produces an optimal dose of TKP of 7.25%; RGR of 7.18%; PER of 7.12% and EPP of 7.59% with each value being 98.06 g; 2.09%/day; 1.65% and 49.11%. The research treatments include:

- Treatment P1 : 80% soybean meal feed : 20% palm kernel meal
- Treatment P2 : 70% soybean meal feed : 30% palm kernel meal
- Treatment P3 : 60% soybean meal feed : 40% palm kernel meal

The fish feed formulation made takes into account the ratio between palm kernel meal and soybean meal. The materials used include fish meal and shrimp head meal as a source of animal protein, soybean meal, palm oil meal, wheat flour as a source of vegetable protein. The composition ratio consists of (palm oil meal : soybean meal) 20:80, 30:70, 40:60. The fish feed formulation can be seen in Table 1.

Table 1. Feed Formulation

Raw Material	Comparison of Palm Kernel Meal : Soybean Meal		
	20:80	30:70	40:60
	%	%	%
Fish Meal	39.4	39.4	39.4
Shrimp Head Meal	5.1	5.1	5.1
Palm Kernel Meal	13.3	20.0	26.7
Soybean Meal	19.1	16.7	14.3
Wheat Flour	4.0	4.0	4.0
Tapioca Flour	2.0	2.0	2.0
Fish Oil	3.5	3.5	3.5
Vitamin C	1.0	1.0	1.0
Vitamin Premix	2.0	2.0	2.0
Min Mix	2.0	2.0	2.0
CMC	8.6	4.3	0.0
Total	100	100	100
Protein %	35.4	35.4	35.4
Fat %	12.4	12.4	12.4

Observation Data

Weight Growth

The total weight growth of fish is calculated using the formula according to Zonneveld et al (1991), namely:

$$WG = Wt - Wo$$

Where:
WG = Weight Growth (g)
Wt = Final weight of the study (g)
Wo = Initial weight of the study (g)

Relative Growth Rate

Relative growth is the difference between the average weight of fish at the end of the study and the average initial weight of the study divided by the length of time during which the study took place. The daily growth rate is calculated using the formula according to Zonneveld et al. (1991), namely:

$$RGR = \frac{(W_t - W_0)}{t}$$

Where:
RGR = Relative Growth Rate (%/day)
Wt = Average weight of fish at the end of the study (g)
Wo = Average weight of fish at the end of the study (g)
t = Length of study (days)

Feed Conversion

Feed conversion or Feed Conversion Ratio (FCR) uses the Effendie (2002) formula as follows:

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

Where:
FCR = Feed Conversion Ratio / Feed Conversion
F = Amount of feed given during maintenance (g)
Wt = Total final weight (g)
Wo = Total initial weight (g)
D = Weight of fish that died during maintenance (g)

Survival Rate

The survival rate or Survival Rate (SR) is calculated based on the formula (Effendie, 2002):

$$SR = \frac{Nt}{N_0} \times 100\%$$

Where:
SR = Survival rate
Nt = Final number (fish)
No = Initial number (fish)

RESULTS

Total Weight Growth

Growth occurs due to tissue changes due to muscle and bone cell division. Fish weight growth can be seen through the difference between the final weight and the initial weight. Based on the results of the treatment carried out, it showed that the highest value was in P1 at 71.3 grams, followed by P2 at 51.5 grams, and P3 at 47.6 grams. The results of the ANOVA test did not show a significant difference between the substitution treatments of palm kernel meal and soybean meal. The graph can be seen in the Figure 1.

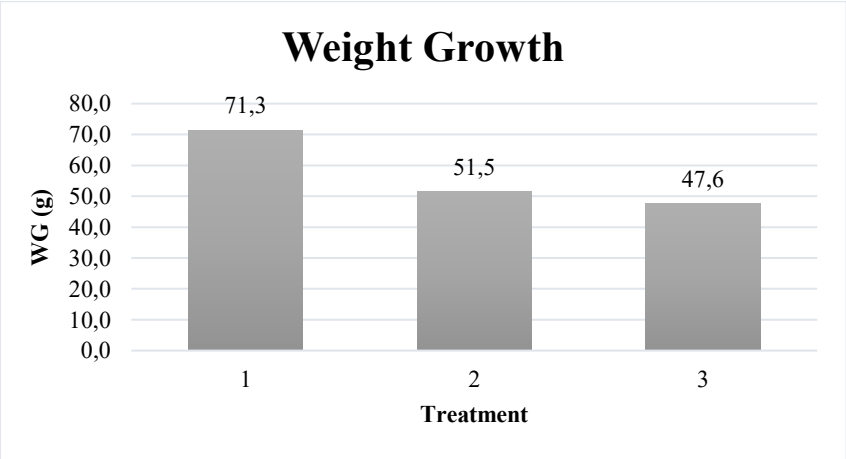

Figure 1. Total Growth Graph of Test Fish

Relative Growth Rate

Relative Growth Rate is a parameter used to analyze the growth rate of fish in a certain period of time during maintenance which is compared to the weight of fish at the end and beginning of maintenance. The results showed that the highest Relative Growth Rate (RGR) value was in the P1 treatment at 0.3%/day followed by the P2 and P3 treatments at 0.2%/day. Based on. The RGR result graph can be seen in Figure 2.

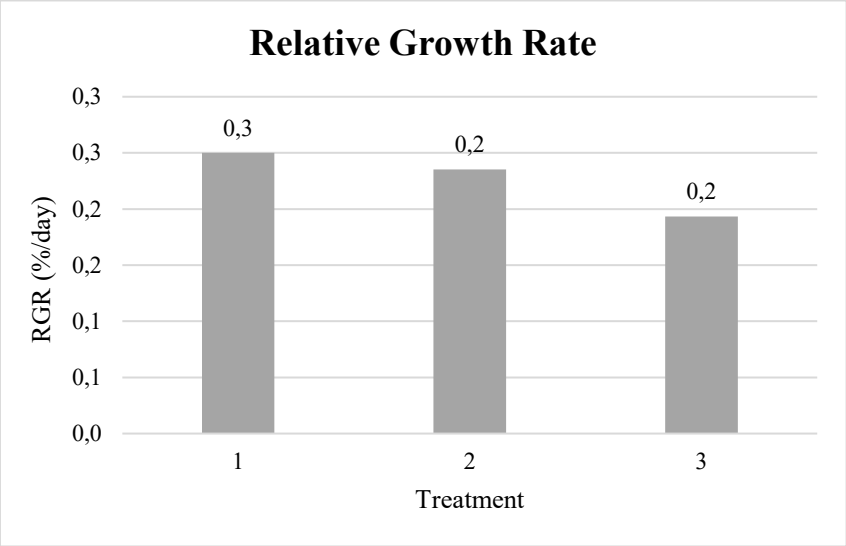

Figure 2. Relative Growth Rate Graph (RGR)

Feed Conversion

Feed conversion is the ratio or comparison between the amount of feed consumed by fish and the weight gain produced in a certain period of time. Feed conversion can be said to be good if the lower the feed conversion value, the more efficient the use of feed and the lower the production costs. Based on the results of the study, it was shown that the best FCR was in the P1 treatment, which was 4.31, followed by the P2 treatment of 5.85 and the P3 treatment of 6.22. The graph between test treatments can be seen in the Figure 3.

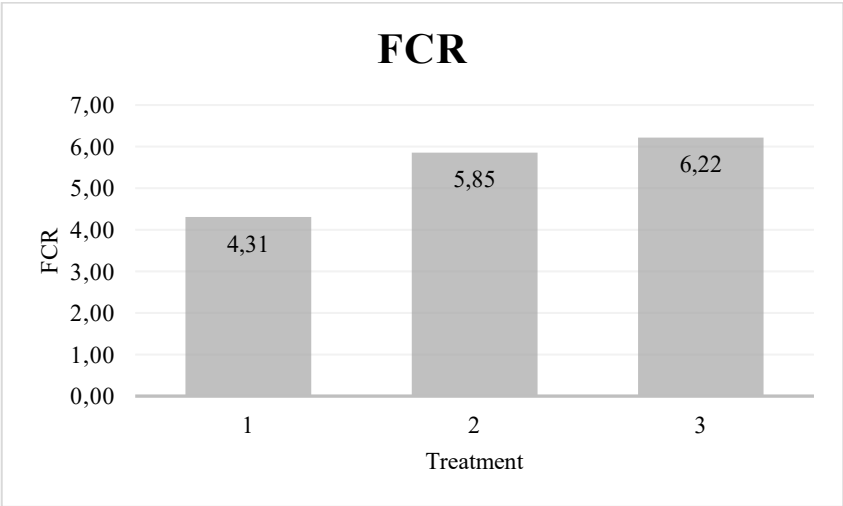

Figure 3. Test Fish Feed Conversion Ratio Graph

Survival Rate

Fish survival is a comparison between fish that live at the end of maintenance with fish at the beginning of maintenance. Based on the results of the study, it was shown that the highest SR value in the treatment was in the P1 treatment, which was 91.7%, followed by P2 and P3 of 90%. The test fish survival graph can be seen in the following Figure 4.

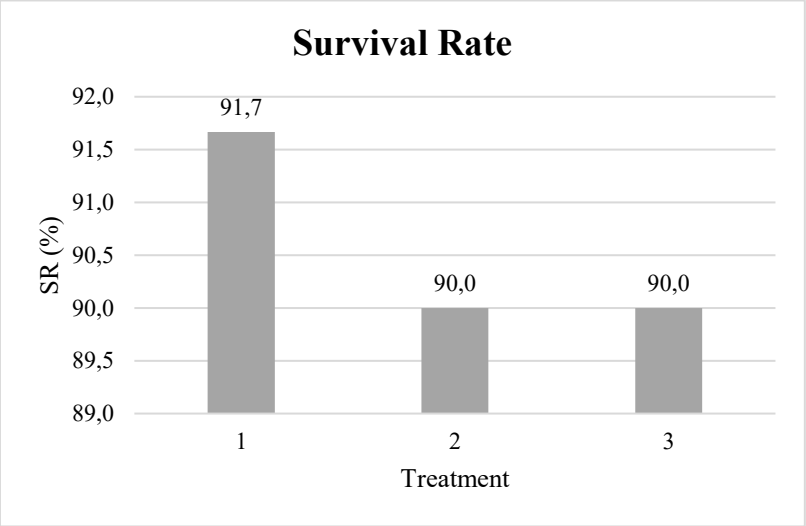

Figure 4. Test Fish Survival During Maintenance

DISCUSSION

Growth Performance and Feed Utilization

Based on the results of the treatment carried out, it was shown that the highest weight growth value was found in P1 at 71.3%, followed by P2 at 51.5%, and P3 at 47.6%. The results of the ANOVA test did not show a significant difference between the substitution treatments of palm kernel meal and soybean meal. This result is different from Hadihah et al., 2019, which stated that the provision of palm kernel meal had a significant effect on growth in palm kernel meal supplemented with fish meal. Meanwhile, according to Dikhlan et al., 2022, the results of the study showed that pellet feed made from palm kernel meal provided higher weight and length growth results for sangkuriang catfish (*Clarias gariepinus*) when compared to the growth of sangkuriang catfish (*Clarias gariepinus*) given bran-based feed. Meanwhile, the feed conversion of the addition of bran was higher when compared to the addition of palm kernel meal.

Meanwhile, for the observation parameters of the relative growth rate, the results of the study showed that the highest RGR value was in the P1 treatment of 0.3%, followed by the P2 and P3 treatments of 0.2%. Based on this value, it looks lower when compared to research (Rusmiyati et al., 2017) showing that Treatment C with the use of 10% BKS produced an optimal RGR dose of 7.18%. Based on the results of the study, it showed that the best FCR was in the P1 treatment, which was 4.31, followed by the P2 treatment of 5.85 and the P3 treatment of 6.22. The FCR value shows that the effect of the feed consumed on the comparison of the growth of the weight of the test fish. The results of this test show that the FCR in the test treatment is lower when compared to the results of the study (Nikhlani et al., 2022), which is 2.03. The low digestibility value of the test feed is caused by the antinutrient content in palm kernel meal, which affects the digestibility of the test fish. The higher the substitution of the use of palm kernel meal, the lower the digestibility of the feed conversion into fish meat.

Strengthened by the opinion that the use of palm kernel cake as feed without prior processing can have a negative effect on nutrient digestibility (Alshelmani *et al.,* 2016). The negative effect is mainly due to the anti-nutrient content in palm kernel cake, namely non-starch polysaccharide content of 47-78%, crude fiber 13-20%, cellulose 12%, and lignin 8-15% (Rakhmani *et al.,* 2015).

Survival

Fish survival is a comparison between fish that live at the end of maintenance with fish at the beginning of maintenance. Based on the results of the study, the highest SR value in treatment was in treatment P1, which was 91.7%, followed by P2 and P3 at 90%. Fish survival is influenced by several factors including water quality, availability of feed that is in accordance with fish needs, ability to adapt, and stocking density. Good water quality will reduce the risk of fish getting sick and increase survival rate (Yuniarti, 2006).

CONCLUSION

Based on the description above, it can be concluded that there is no significant effect between each treatment. The highest growth performance results of fish weight value were in P1 of 71.3 gr followed by P2 of 51.5 gr and P3 47.6 gr. The highest Relative Growth Rate was in treatment P1 of 0.3% followed by treatments P2 and P3 of 0.2%. The best feed conversion (FCR) results were in treatment P1 of 4.31, followed by treatment P2 of 5.85 and treatment P3 of 6.22. While the highest survival rate in treatment was in treatment P1 of 91.7% followed by P2 and P3 of 90%.

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