

Effects of Black Soldier Fly Carcass Flour on Feed Against Digestibility, Liver and Blood Image of Sangkuriang Catfish (*Clarias gariepinus*)

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Abstract

Muhammad Aidil Huda, Mas Tri Djoko Sunarno, and Moch Nurhudah. 2020. Effects of Black Soldier Fly Carcass Flour on Feed Against Digestibility, Liver and Blood Image of Sangkuriang Catfish (*Clarias gariepinus*). *Aquacultura Indonesiana*, 21 (1): 42 – 48. The purpose of this study was to determine the effect of black soldier fly carcass flour on feed on digestibility, liver and blood features in Sangkuriang catfish (*Clarias gariepinus*). Sangkuriang catfish (*Clarias gariepinus*) used measuring 9-12 cm with a weight of ± 5.27 g. The aquariums are used as many as 5 pieces measuring 100 cm x 50 cm x 51 cm. The amount of sangkuriang catfish (*Clarias gariepinus*) stocked in the aquarium is 10 per aquarium and fed 6% of the total weight of all test fish. The treatments used are black soldier fly carcass flour and fish flour with a percentage of 0%, 25%, 50%, 75% and 100%. The parameters tested were digestibility, liver picture and blood count of sangkuriang catfish (*Clarias gariepinus*). The results showed that the digestibility value of 50% black soldier fly carcass flour (CF) treatment gave the best results. In addition, the liver picture in the 50% CF treatment did not show any abnormalities in the liver of the Sangkuriang catfish (*Clarias gariepinus*). Amount of blood cells in 50% CF treatment is in optimal condition. Based on these results indicate that the administration of Black Soldier fly carcass flour at CF 50% treatment gives the best results on digestibility, liver picture and blood of Sangkuriang catfish (*Clarias gariepinus*), so that Black Soldier fly carcass flour can be used in feed formula.

Keywords: black soldier fly carcass flour, Digestion, liver picture, blood picture, sangkuriang catfish

Introduction

The quality of the black soldier fly carcass depends on the administration of the black soldier fly carcass to the biota especially in fish. For example, research Hariadi et al. (2014) on jambal catfish (*Pangasius djambal*) which stated that the balance between protein, fat and carbohydrate in the combination of feed 75% pellets and 25% black soldier fly carcass flour would encourage fish to utilize fat and carbohydrates as non-protein energy, while feed protein is used for growth. If the feed provided is experiencing a lack of fat and carbohydrates, then the protein in the feed will be used to meet the energy needs of fish for maintenance of living processes, so that the

role of protein for growth is disrupted (Suhenda et al., 2005). Optimum feed for the cultivation of catfish jambal (*Pangasius djambal*) using Black Soldier fly carcass that is 79.00% - 82.50% pellets and 17.50% - 21%. This is due to the ratio of energy and protein feed in a balanced amount between protein, fat and carbohydrates.

The use of other black soldier fly carcass flour can be seen in the research of Irfan and Abdul Manan (2013) on rainbow kuromoi fish, namely that the addition of the average weight of individuals to the rainbow kuromoi fish each treatment that was fed black soldier fly carcass flour showed a value that was not much different from individual weight is 10.42 g in treatment A and 10.53 g in

treatment B. It can be concluded that the research did not experience any changes and

for optimum value the black soldier fly carcass flour was relatively non-existent because each treatment had the same relative amount.

This study aims to determine the effect of adding black soldier fly carcass flour to feed on digestibility, liver features and blood cell counts of sangkuriang catfish (*Clarias gariepinus*).n

Materials and Methods

Test Fish

The fish used in the study were Sangkuriang catfish (*Clarias gariepinus*) weighing $\pm$ 5.27 gr and 9-12 cm long. The aquariums are used as many as 5 pieces with sizes P = 100 cm, L = 50 cm, T = 51 cm, T water = 30 cm and V = 150 L. Amount of fish in each aquarium is 10. The feed used is a mixture of black soldier fly carcass flour with fish flour with a percentage of 0% (Control / 100% fish flour), 25% (75% fish flour and 25% black soldier fly carcass flour), 50% (50 % fish flour and 50% black soldier fly carcass flour), 75% (25% fish flour and 75% black soldier fly carcass flour) and 100% (100% black soldier fly carcass flour). The feed used is 6% of the body weight of sangkuriang catfish (*Clarias gariepinus*). Feed given to Sangkuriang catfish (*Clarias gariepinus*) is given 3 times a day at 7.am, 12 pm and 4 pm.

Digestibility Test

The digestibility test is done by taking sangkuriang catfish (*Clarias gariepinus*) feces. Feces in sangkuriang catfish (*Clarias gariepinus*) are collected 3-4 hours after feeding. The process of collecting feces is done by first removing the remaining feed and feces, then given the treatment feed again. The process of feeding the Sangkuriang catfish (*Clarias gariepinus*) is carried out for 10-30 minutes after that if there is food left then discard it again. After that, leave it for 3-4 hours so that the Sangkuriang catfish (*Clarias gariepinus*) emits feces. Intake of feces using tools such as hoses and small filters. Feces collection must be careful, because there is a mixture of feces with treatment feed. Feces

taken and used should not exceed 4 hours due to the occurrence of decomposition of organic material in the faces of sangkuriang catfish (*Clarias gariepinus*) if it is taken too long. To calculate the total digestibility and protein digestibility, we can use a formula (Watanabe, 1988) :

$$\text{Total Digestibility (\%)} = 100 - [100 \times (a/a')],$$
$$\text{Protein Digestibility (\%)} = 100 - [100 \times (a/a') \times (b'/b)]$$

where: a = % Cr₂O₃ in feed; a' = % Cr₂O₃ in feces

b = % Protein in feed; b' = % Protein in Faces

Histology Test

Histological examination is done by fixation by first inserting sangkuriang catfish (*Clarias gariepinus*) into 10% formalin solution. After that dissect the body of the sangkuriang catfish (*Clarias gariepinus*) and take the internal organs in the form of the liver of the sangkuriang catfish (*Clarias gariepinus*) each treatment. After that the liver is cut again and refixed by cutting the liver with a size of 10 x10 x 5 mm³ using a knife. After that, dehydration and paraffin filling by inserting a cassette in hisommodules fixation basket, then making the paraffin block. Furthermore, making preparations by cutting from the paraffin block using a knife which is then taken using wet cardboard and transferred to a container filled with warm water. After that the coloring process (Blaxhall and Daisley, 1973).

Hematology Test

Samples of sangkuriang catfish (*Clarias gariepinus*) were used to count the amount of blood cells as much as 5 from each treatment aquarium. The calculation of the amount of blood cells is done by taking blood of sangkuriang catfish (*Clarias gariepinus*) as much as 3 using a syringe. The blood sample is then put into a labeled testube. The calculation of red blood cells is done by sucking blood samples each treatment on the testube by using a pipette up to 0.5 mm, then sipping the hayem solution up to a scale of 10 mm and homogenized. After that, throw the first drop

in the solution and then put it into the haemocytometer and cover using a glass cover. The calculation is done by looking at 5 small boxes on the haemocytometer. The calculation of white blood cells is done by sucking blood samples at each treatment on the testube by using a pipette up to 0.5 mm, then suction of the tuk's solution up to a scale of 10 mm and homogenized. After that, throw the first drop in the solution and then put it into the haemocytometer and cover using a glass cover. The calculation is done by looking at the top 5 on the haemocytometer (Blaxhall and Daisley, 1973).

Calculation of blood cells is carried out with the following formula (Hartika et al., 2014) :

$$\Sigma \text{ Erythrocytes / Leukocytes (cell/mm}^3\text{)} = \frac{\text{The erythrocyte / leukocyte cell count}}{\text{Volume (ml)}} = \frac{\text{thinner (ml)}}{\text{Volume (ml)}}$$

Data Analysis

Analysis of the data used is by using descriptive analysis in the form of an explanation of the parameters and the results obtained.

Results

The digestibility of nutrient ingredients for black soldier fly carcass flour is in table 1.

Table 1. Digestibility of Black Soldier fly carcass nutrient ingredients

Test Parameters	Black Soldier Fly Carcass Flour				
	0% (CF 0)	25% (CF 25)	50% (CF 50)	75% (CF 75)	100% (CF 100)
Total Digestibility (%)	82.48	85.18	83.71	81.53	81.87
Protein Digestibility (%)	90.63	92.56	91.42	90.21	90.25

From the test results showed that the total digestibility of black soldier fly carcass flour from the lowest to the highest was 81.87% - 85.18% and the protein digestibility from the lowest to the highest was 90.21% - 92.56%. These results indicate that the total digestibility and digestibility of black soldier fly (CF) 25% protein and 50% CF give the best

results compared with 0% CF (Control), 75% CF and 100% CF.

Histology research results of Sangkuriang catfish (*Clarias gariepinus*) treated with black soldier fly carcass flour treatment showed the presence of each treatment such as fat degeneration, inflammation infiltration, congestion and necrosis (Figure 1).

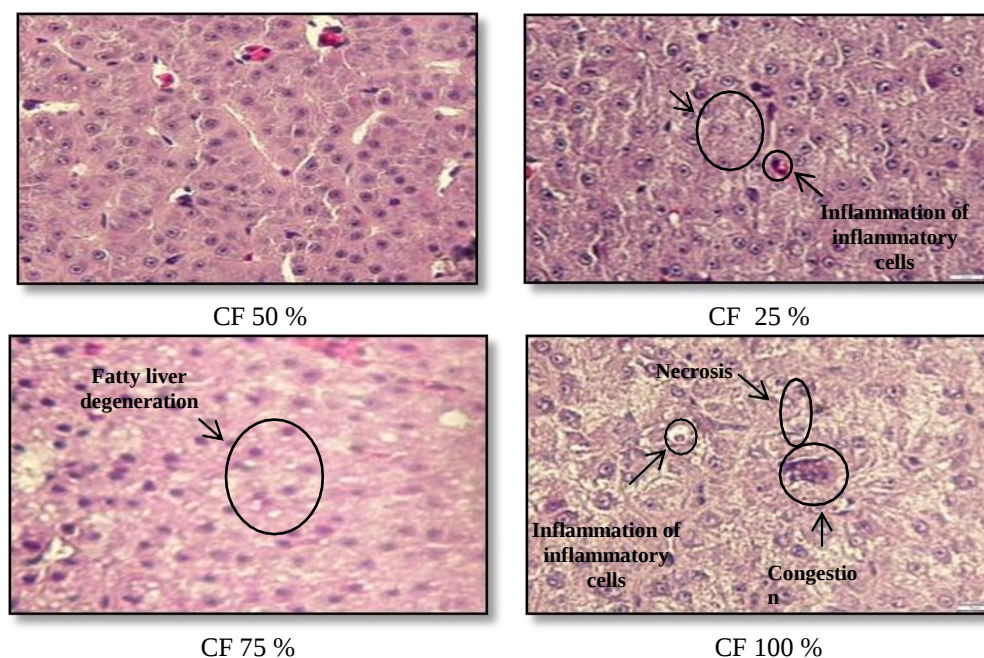


Figure 1. A picture of the liver of a sangkuriang catfish (*Clarias gariepinus*)

Histology test results showed that CF 50% gave the best results compared to CF 0% (Control), CF 25%, CF 75%, and CF 100%. The giving of CF 50% shows no symptoms in the liver of sangkuriang catfish (*Clarias gariepinus*), so that the 50% CF treatment

gives the best picture of the liver compared to the liver picture in other treatments.

The amount of red blood cells and white blood cells can be seen in table 2.

Table 2. Amount of erythrocytes and leukocytes.

Test Parameters	Erythrocyte and Leukocyte Cells Analysis Results				
	0% (CF 0)	25% (CF 25)	50% (CF 50)	75% (CF 75)	100% (CF 100)
Erythrocytes (Cell / mm ³)	8.1 x 10 ⁵	1.6 x 10 ⁵	2.4 x 10 ⁵	2.3 x 10 ⁵	1.2 x 10 ⁵
Leukocytes (Cell / mm ³)	14700	4350	11450	16550	6650

Based on these results indicate that the amount of erythrocytes and leukocytes in each treatment has a different amount depending on the treatment given to the sangkuriang catfish (*Clarias gariepinus*) examined. The amount of erythrocyte cells from the lowest to the highest is 1.2 x 10⁵ cells / mm³ to 8.1 x 10⁵ cells / mm³, while the number of leukocyte cells from the lowest to the highest is 6650 cells / mm³ to 14700 cells / mm³. The highest amount of erythrocyte cells was found in CF as much as 50% and CF 75% compared to CF 25% and CF 100%, while for CF 0% was control. The highest amount of leukocytes was found in CF

50% and CF 75% compared to CF 25%, CF 100%, and CF 0% as Control.

Discussion

Nutrient digestibility is one of the first steps to find out the potential of raw materials used in feed. The digestibility value of feed ingredients and their contents is very necessary to be able to increase fish growth by calculating nutritional needs and metabolic yields that are removed (Zhou et al., 2004). Digestibility can show the amount of nutrient composition that is absorbed and used for the

growth of fish metabolism (NRC, 2011). Black soldier fly carcass flour has a total digestibility value ranging from 81.53% to 85.15% and protein digestibility ranges from 90.21% to 92.56%. According to Mulyantini (2010) digestion must have a structure and function of crude fiber that is low in all nutrients so that it can be digested easily in sufficient quantities. Crude fiber has the property of absorbing water so that it triggers the rate of movement of digestibility to become smooth (Amarullah, 2004).

In the treatment of 25% CF and 50% CF have a balanced crude fiber according to the percentage ratio in the feed formulation. Mawaddah et al. (2018) that black soldier carcass flies contain 6.98% crude fiber, while crude fiber content in fish flour according to Lestari et al. (2013) which is 3.54%, with the content of crude fiber advancing the high total digestibility and nutrient digestibility in the CF treatment of 25% and CF 50%, this is because the percentage of CF treatment is 25% and CF 50%, this shows that there is fiber balance rough on the treatment. For the 0% CF treatment (Control), 75% CF and 100% CF showed the lowest value, this is because the crude fiber in the treatment showed no balance in the feed formulation so as to produce total digestibility and lowest nutrient digestibility. Protein digestibility value in the research conducted is good and optimal, where this is supported by the statement of NRC (2011) that the good protein digestibility value of raw materials ranges from 75% to 95%.

In the CF 50% treatment, there was no abnormality in the liver in Sangkuriang catfish (*Clarias gariepinus*). This indicates that the CF 50% treatment gives the best results in the liver of the sangkuriang catfish (*Clarias gariepinus*) in the absence of symptoms or abnormalities in the sangkuriang catfish (*Clarias gariepinus*). In this case the use of CF 50% can be used as a reference for treatment in the liver of the sangkuriang catfish (*Clarias gariepinus*).

In the 25% CF treatment, 75% CF and 100% CF showed abnormalities in each liver treatment of sangkuriang catfish (*Clarias gariepinus*) ranging from inflammatory infiltration, fatty degeneration, congestion and necrosis. Damage to the liver of the

Sangkuriang catfish (*Clarias gariepinus*) is caused by the addition of black soldier fly carcass flour to the Sangkuriang catfish feed (*Clarias gariepinus*). The addition of black soldier fly carcass flour has a different amount in each treatment. The difference in the composition of the treatment in the feed causes symptoms that trigger abnormalities and damage to the liver of the sangkuriang catfish (*Clarias gariepinus*). Changes in histological structure occur because most of the poisons in the liver of the Sangkuriang catfish that affect the liver in the Sangkuriang catfish (*Clarias gariepinus*) (Malik et al., 2016). The statement is supported by Hastuti and Subandiyono, (2011) which states that the occurrence of abnormalities in the liver is due to the fact that the liver is one of the organs that accumulates the most toxins in the body of the fish, so it experiences disruption of work on liver function and abnormalities in the liver. From the above symptoms it can be explained that the addition of black soldier fly carcass flour in inappropriate Sangkuriang catfish feed (*Clarias gariepinus*) will cause damage and abnormalities in the liver of the Sangkuriang catfish (*Clarias gariepinus*) catfish. The solution to prevent abnormalities in the liver of the sangkuriang catfish (*Clarias gariepinus*) is by knowing a balanced composition in the feed formulation such as CF 50% treatment that has a balanced composition so that the composition does not cause symptoms and abnormalities in the liver of the sangkuriang catfish (*Clarias gariepinus*).

The lowest amount of erythrocytes was found in the CF treatment of 25% and CF 100%. The decrease in the number of erythrocytes in sangkuriang catfish (*Clarias gariepinus*) is suspected because they experience symptoms of anemia. According to Wedemeyer and Yasutake (1997) that low total erythrocytes indicate that fish experience symptoms of anemia. In addition, the decrease in the amount of erythrocytes is due to the presence of exotoxins and endotoxins which cause inflammation or bleeding so that the number of erythrocytes decreases (Syamsir, 2008). The highest erythrocyte values were found in the treatment of CF 50% and CF 75%. The increase in the amount of erythrocytes is thought to be due to a balanced

composition in the addition of black soldier fly carcass flour to the feed, thereby increasing the number of erythrocytes in sangkuriang catfish (*Clarias gariepinus*). The highest amount of leukocytes is found in the treatment of CF 50% and CF 75%. The high amount of leukocytes in the treatment shows that because there is resistance to foreign bodies in the body of the fish resulting in an immune response that is characterized by an increase in total leukocytes (Arindita, 2014). The increase in total leukocytes in fish is the body's defense response to antigens (Nurjannah et al., 2013). In addition, the increase in the number of leukocyte cells is thought to be due to the addition of black soldier fly carcass flour to feed where the addition makes the composition of feed on sangkuriang catfish (*Clarias gariepinus*) become balanced, so that the composition affects the number of leukocyte cells in sangkuriang catfish (*Clarias gariepinus*). The lowest number of leukocytes is in the treatment of CF 25% and CF 100%. The decrease in the amount of leukocytes in sangkuriang catfish (*Clarias gariepinus*) is caused by leukocytes in the blood vessels going down to damaged tissues. In accordance with the opinion of Nuryati et al (2010) which states that the decrease in total leukocytes after infection is caused because these cells are active and out of the blood vessels into damaged tissue. In addition, the decrease in the number of leukocyte cells is thought to be due to the absence of composition of the addition of carcass black soldier fly flour to sangkuriang catfish feed (*Clarias gariepinus*), resulting in damaged tissue and decreased leukocyte cells in sangkuriang catfish (*Clarias gariepinus*). According to Irianto (2005) which states that the value of erythrocytes in teleost fish has a range of $1.05-3.00 \times 10^6$ cells / mm^3 , while according to Dapongtonung (2008) the amount of leukocytes in fish per mm^3 of blood ranges from 20,000 - 150,000.

Conclusion

Based on total digestibility, protein digestibility, liver picture, and blood count, Black Soldier fly carcass flour in feed formulation can be used as raw material for

Sangkuriang catfish feed (*Clarias gariepinus*) at a dose of 50% in feed

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