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Comparison of Black Soldier Fly (BSF) Maggot Nutrition with Different Culture Media

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Abstract

Maggot Black Soldier Fly (Hermetia illucens) is one of the natural feeds widely used by fish farmers. Maggot has a high nutritional content so that it is in great demand by the community. This study aims to determine the nutritional value contained in maggot cultured using different culture media. The culture media used in this study include fermentation of tofu waste and fermentation of fish waste. Fermentation of culture media was carried out for 7 days using EM4, sugar and water. The parameters analyzed in this study included protein content, fat content, water content, ash content and carbohydrates. The results showed that maggots cultured using fish waste fermentation culture media had a higher protein content compared to tofu waste fermentation culture media. The nutritional value of the fish waste fermentation treatment was 33.94% protein, 8.13% moisture content, 2.85% ash content, 3.31% fat and 51.16% carbohydrate.

Keywords: *Maggot, nutritional value, protein*

Introduction

Feed costs account for 60-70% of production costs, making it unaffordable for farmers (Dzepe et al., 2019). According to (Pouomogne, 2008) feed cost is a major factor affecting the development of fish farming. Based on a report (Aniebo et al., 2008) the high cost of feed is attributed to protein sources such as fishmeal and soybean meal being expensive. Many farmers and fish farmers are looking for alternative feeds that contain high nutritional value. One of them uses maggot. According to (Nur'aini & Prawanto, 2021) that Black Soldier Fly (BSF) larvae have been widely used as fish and poultry feed to replace conventional protein sources. According to (Rambet et al., 2015) that BSF maggot feed has the potential to replace fishmeal up to 100% for broiler feed mixtures without side effects, although the best results were obtained from replacing fishmeal up to 25% or 11.25% in the feed.

Maggot meal production is cheaper and less attractive when compared to other animal protein sources (Ajani et al., 2004; Anene et al., 2013). Maggots from the fly Musca domestica can be produced in large biomasses using a variety of agricultural by-products such as bran, poultry manure and cow dung (Akpodiete et al., 1997; Aniebo & Owen, 2010; Hussein et al., 2017). Maggot meal contains nutritional value comparable to most high-protein feed ingredients (Hussein et al., 2017; Hwangbo et al., 2009). According to (Akpodiete et al., 1997) that maggot meal contains ten essential amino acids in amounts comparable to many animal proteins. In addition, (K & A., 2000) maggot meal contains higher amounts of some essential amino acids such as cystine, histidine, phenyalanine, tryptophan and tyrosine than fish meal and soybean meal. However, information on the impact of culture media on maggot nutrition is still limited.

Organic wastes such as tofu pulp and fish waste have the potential to be utilized as growth media and bioconversion of maggot larval production in BSF maggot cultivation. This is because tofu waste and fish waste still contain nutrients in the form of protein, fat, water, carbohydrates. According to (M. Anis et al., 2007) that the crude protein content in vegetable waste is 12.64% - 23.50% and the crude fiber content is 20.76% - 29.18%. Fish waste has a protein content of 15% - 24%, fat 2.0% - 22% and carbohydrates of 0.75 -1.32% (Tranggono, 1990). Tofu waste contains 23.55% protein, 5.54% fat, 26.92% carbohydrate, 17.03% ash, 16.53% crude fiber and 10.43% water (Anonymous, 2006). The use of different culture media will certainly affect the nutritional value contained in mangosteen. The purpose of this study is to determine the nutritional value contained in maggot cultivated using different culture media.

Method

Media Preparation

The process of making BSF maggot egg hatching media uses soft-textured media. The media used are tofu pulp and fish waste. Furthermore, the media is fermented. The steps taken in the process of making fermentation media are that all materials used are first dried in the sun for ± 2 days to avoid too high a moisture content. Then fermented using EM4 activator solution, sugar and water. The amount of material used was 0.3% sugar, 0.1% water and 0.001% EM4. The media fermentation process was carried out for 7 days.

Container preparation

The containers used were plastic trays measuring 38x31x13 cm. The containers were neatly arranged into a rectangular wooden rack. The number of containers used amounted to 6 pieces and filled with 200 grams of each treatment media. Furthermore, the container is covered with a net which aims to prevent maggot from leaving the cultivation site and maggot is protected from other animals that can damage maggot cultivation media such as insects and others.

Egg Hatching

Egg hatching is done by putting 3 grams of BSF fly eggs into each research container. Maggot eggs are placed on the net so that they do not directly hit the media. This is done to avoid moist maggot eggs. Furthermore, the eggs are spread evenly over the wire support which is placed above the feed media. This is done so that eggs that have hatched will more easily go down to the media and immediately eat the feed available on the media. Egg observation was carried out for 4 days. After the eggs hatch and grow into adult maggots, the nutrient content is measured.

Harvesting

The maggot harvesting process is carried out once a week during the rearing period. After that, the maggot is separated and cleaned from the rest of the growth medium by mixing water with the growth medium, then the maggot is taken using a sieve and then put into a tray.

Research Design

This study used two treatments and three replications. The treatments used were treatment fermentation tofu waste and treatment fermentation fish waste).

Parameters Observation

The parameters observed in this study were the nutritional content of BSF maggot including moisture content, ash content, fat content, protein, and carbohydrates. The test method used in the analysis of moisture and ash content using the oven method, fat content using the sokhlet test method, protein content test using the micro-Kjedahl method. The method used follows (AOAC, 1995). The carbohydrate content test uses the by different method.

Data Analysis

The data obtained from the research were analyzed descriptively and presented in graphs.

Results

The research data on the nutritional content of maggot is presented in the figure below.

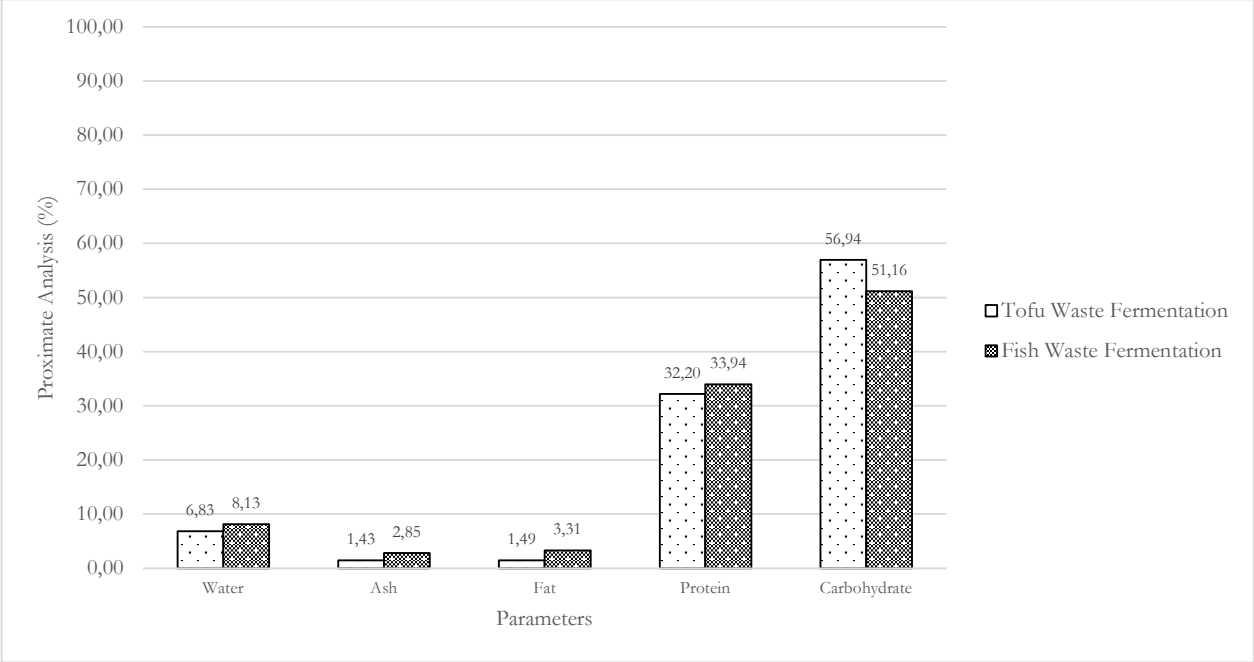

Figure 1. Results of proximate analysis of BSF maggot

Based on the figure above, it shows that the highest nutritional content was found in the fermented fish waste treatment with a protein value of 33.94%, moisture content of 8.13%, ash content of 2.85%, fat of 3.31% and the highest carbohydrate in the fermented tofu pulp treatment, namely 56.94%. The high protein content of BSF maggot in the fish waste fermentation treatment is thought to be that the culture medium provides sufficient nutrients for growth. This culture medium is in accordance with the nutritional needs of maggot, where maggot is a waste material eater and there is a lot of organic material that has decomposed so that it becomes a source of protein that maggot utilizes. (Barroso et al., 2014) explained that maggot, especially the Hermetia illucens (Black Soldier Fly), has a high protein content that is influenced by its food substrate. The protein content of maggot varies depending on the type of organic waste consumed, making it similar to protein sources from its environment. In addition, (Oonincx et al., 2020) found that the protein and nutrient content of maggots is influenced by the organic matter consumed, and this can increase the nutritional value of the larvae when fed protein-rich feed from the culture medium.

(Hwangbo et al., 2009) added that mangosteens are able to eat various types of organic matter. In addition, the maggot digestive system contains enzymes that can convert organic matter into nutrients such as protein, fat, and calories in its body. According to (Azir et al., 2017), the use of fish waste by 50% can increase the protein content of maggot by 41.22%. Fish waste has a high protein content with nutrients so that it can be utilized as feed. A low-quality substrate will result in less maggot production, as the growth medium contains less or limited nutritional components. If the content of nutritional value in the growth medium is reduced, the production of maggot can reach a small amount and take a long time to develop, while a quality substrate will produce sufficient nutrients for the growth and development of maggot, the results of which can be measured through maggot biomass.

Conclusion

The results showed that maggots reared on fish waste fermentation culture media had a higher protein content compared to maggots cultured on tofu waste fermentation culture media. The nutritional value of the fish waste fermentation treatment is 33.94% protein, 8.13% moisture content, 2.85% ash content, 3.31% fat and 51.16% carbohydrate.

References

Ajani, E. K., Nwanna, L. C., & Musa, B. O. (2004). Replacement of Fishmeal with Maggot Meal in The Diets of Nile Tilapia, Oreochromis niloticus. *World Aquaculture*, *35*(1), 52–54.

Akpodiete, O. J., Ologhobo, A. D., & Oluyemi, J. A. (1997). Production and Nutritive Value of Housefly Maggot Meal on Three Substrates of Poultry Faeces. *Journal of Applied Animal Research*, *12*(1), 101–106. https://doi.org/10.1080/09712119.1997.9706192

Anene, A., Afam-Anene, O. C., Ike, K., & Ekekwe, N. H. (2013). Preliminary Investigations on Quantity and Proximate Quality of Maggots Produced From Four Different Sources of Livestock Wastes. *Journal of Research in Biology*, *3*(6), 1060–1065.

Aniebo, A. O., Erondu, E. S., & Owen, O. J. (2008). *Proximate Composition of Housefly Larva (Musca domestica) Meal Generated From Mixture of Cattle Blood and Wheat Bran*. *20*(12).

Aniebo, A. O., & Owen, O. J. (2010). Effects of Age and Method of Drying on the Proximate Composition of Housefly Larvae (Musca domestica Linnaeus) Meal (HFLM). *Pakistan Journal of Nutrition*, *9*(5), 485–487. https://doi.org/10.3923/pjn.2010.485.487

AOAC. (1995). *Official methods of analysis of The Associated of Analytical Chemists*.

Azir, A., Harris, H., & Haris, R. B. K. (2017). Produksi dan Kandungan Nutrisi Maggot (Chrysomya Megacephala) Menggunakan Komposisi Media Kultur Berbeda. *Jurnal Ilmu-IImu Perikanan Dan Budidaya Perairan*, *12*(1), 34–40.

Barroso, F. G., de Haro, C., Sánchez-Muros, M. J., Venegas, E., Martínez-Sánchez, A., & Pérez-Bañón, C. (2014). The potential of various insect species for use as food for fish. *Aquaculture*, *422–423*, 193–201. https://doi.org/10.1016/j.aquaculture.2013.12.024

Dzepe, D., Nana, P., Tchuinkam, T., Meutchieye, F., Lontsi, M. D., Tchoumbou, M., & Kimpara, J. M. (2019). Production and Valorization of Maggot Meal : Sustainable Source of Proteins for Indigenous Chicks. *Asian Journal of Research in Animal and Veterinary Sciences*, *3*(3), 1–9.

Hussein, M., Pillai, V. V., Goddard, J. M., Park, H. G., Kothapalli, K. S., Ross, D. A., Ketterings, Q. M., Brenna, J. T., Milstein, M. B., Marquis, H., Johnson, P. A., Nyrop, J. P., & Selvaraj, V. (2017). Sustainable Production of Housefly (Musca Domestica) Larvae as a Protein-Rich Feed Ingredient by Utilizing Cattle Manure. *PLoS ONE*, *12*(2), 1–19. https://doi.org/10.1371/journal.pone.0171708

Hwangbo, J., Hong, E. C., Jang, A., Kang, H. K., Oh, J. S., Kim, B. W., & Park, B. S. (2009). Utilization of House Fly-Maggots, a Feed Supplement in the Production of Broiler Chickens. *Journal of Environmental Biology*, *30*(4), 609–614.

K, A. E. A., & A., M. (2000). Use of Housefly Maggots as a Fishmeal Replacer in Tilapia Culture: A Recent Vogue in Nigeria. *Proceedings of the Fifth International Symposium on Tilapia Aquaculture, Rio Dejaneiro, Brazil*,

138–143.

Nur'aini, & Prawanto, A. (2021). The Effectiveness of Maggot (Hermetia Illucens) Growth in Various Growing Media. *Indonesian Journal of Agricultural Research*, *4*(3), 219–226. https://doi.org/10.32734/injar.v4i3.7155

Oonincx, D. G. A. B., Laurent, S., Veenenbos, M. E., & van Loon, J. J. A. (2020). Dietary enrichment of edible insects with omega 3 fatty acids. *Insect Science*, *27*(3), 500–509. https://doi.org/10.1111/1744-7917.12669

Pouomogne, V. (2008). Capture-Based Aquaculture of Clarias Catfish: Case Study of the Santchou Fishers in Western Cameroon. *FAO Fisheries Technical Paper*, *508*, 93–108.

Rambet, V., Umboh, J. F., Tulung, Y. L. R., & Kowel, Y. H. S. (2015). Kecernaan Protein dan Energi Ransum Broiler Yang Menggunakan Tepung Maggot (Hermetia Illucens) Sebagai Pengganti Tepung Ikan. *Zootec*, *35*(2), 13. https://doi.org/10.35792/zot.36.1.2016.9314