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Total Digestibility and Protein Digestibility of Litopenaeus Vannamei Feed Made from Moringa Oleifera Flour

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ABSTRACT

This study aims to evaluate the overall digestibility and protein digestibility of feed containing Moringa oleifera meal in white shrimp (Litopenaeus vannamei). The research method involved using standard techniques to feed the shrimp with various concentrations of Moringa oleifera meal and measure total digestibility and protein digestibility. The results showed that the highest total digestibility was obtained in treatment C at 58,68%, while the lowest was in treatment B at 19,35%. Protein digestibility values ranged from 71,94% to 84,94%, with the highest protein digestibility found in treatment C(10% Moringa oleifera leaf meal and 10% soybean meal). These findings indicate that the Moringa oleifera meal has the potential to be an effective and sustainable alternative feed ingredient for the cultivation of Litopenaeus vannamei, provided that its processing can minimize antinutrients. Further research is needed to optimize feed formulation and processing techniques to enhance the digestibility quality of the Moringa oleifera meal.

Keywords : Total Digestibility, Protein Digestibility, Litopenaeus vannamei, Moringa oleifera

I. INTRODUCTION

Feed digestibility is crucial in shrimp aquaculture, especially for Litopenaeus vannamei, a widely farmed white shrimp species globally[1]. Total digestibility and protein digestibility determine the efficiency of nutrient utilization from the given feed. Total digestibility measures the percentage of total nutrients that can be digested and absorbed by the organism, while protein digestibility measures the efficiency of protein utilization in the feed. High digestibility rates indicate that the feed effectively provides the necessary nutrients for the growth and health of shrimp[2].

Moringa oleifera meal, or moringa leaf meal, is known for its high nutritional content, including proteins, vitamins, and minerals[3]. Additionally, moringa

leaves contain various bioactive compounds with potential antimicrobial and antioxidant properties[4]. Using Moringa oleifera meal in shrimp feed can provide additional benefits besides being a nutrient source, such as enhancing shrimp resistance to diseases and environmental stress. However, using plant-based ingredients in shrimp feed requires further research to ensure that the shrimp nutrients are well-digested and absorbed.

Research on the total digestibility and protein digestibility of Litopenaeus vannamei fed with Moringa oleifera meal-based feed is essential to understand how well moringa leaves can replace or complement conventional feed ingredients. Given the abundant availability and ease of cultivation of moringa leaves, this could offer a more cost-effective and sustainable alternative feed ingredient. Furthermore, understanding the nutrient digestibility of Moringa oleifera meal-based feed can aid in formulating more efficient and environmentally friendly feeds.

One challenge in using plant-based ingredients in shrimp feed is the presence of antinutrients that can interfere with the digestion and absorption of nutrients[5]. Therefore, this research also needs to evaluate how the processing of Moringa oleifera meal can reduce these antinutrients to enhance total digestibility and protein digestibility. Processing techniques such as fermentation, heating, or partial removal of antinutrients might be necessary to improve the quality of Moringa oleifera meal as a feed ingredient.

The results of this research are expected to provide valuable information for the aquaculture industry regarding the potential use of Moringa oleifera meal in shrimp feed. By improving feed efficiency through better digestibility, production costs can be reduced, and the sustainability of shrimp farming can be increased. This research could also open opportunities for further exploration of other local plant-based ingredients in shrimp feed, supporting local food security and economy.

II. METHODS AND MATERIAL

2.1 Measurement of Total Digestibility

The digestibility to be measured is the total digestibility value, which can be calculated using the formula:

Total digestibility = 100-(100xa/a´)[6].

Information:

a = % Cr2O3 in feed

a´ = % Cr2O3 in feces

b = % Nutrients (protein) in feed

b´ = % Nutrients (protein) in feces

2.2 Protein Digestibility Measurement

The level of digestibility was measured after the vaname shrimp rearing process for 30 days. Feces are collected after feeding for 2 hours, and then the feces will be stored in the freezer.

The digestibility to be measured is the protein digestibility value, which can be calculated using the formula:

Nutrient (protein) digestibility = 100-(100xa´xb/b´)[6].

2.3 Data Analysis

Data on total digestibility and protein digestibility will be analyzed descriptively.

III. RESULTS AND DISCUSSION

3.1 Total Digestibility

The results of the average total digestibility level of white vaname shrimp (Litopenaeus vannamei) during the study are presented in Figure 1. The average total digestibility level of white vaname shrimp during the study shows that the highest total digestibility level was obtained in the C(10%MLF+10%SM) treatment. Namely, 58,68%, followed by treatment D(5%

MLF+15%SM), namely 47,37%, followed by treatment A(20%MLF+0%SM), namely 21.88%, and the lowest was obtained in treatment B(15%MLF+5%SM) which is 19,35%. The results of calculating the total digestibility level of vaname shrimp (Litopenaeus vannamei) during the study are presented in Figure 1.

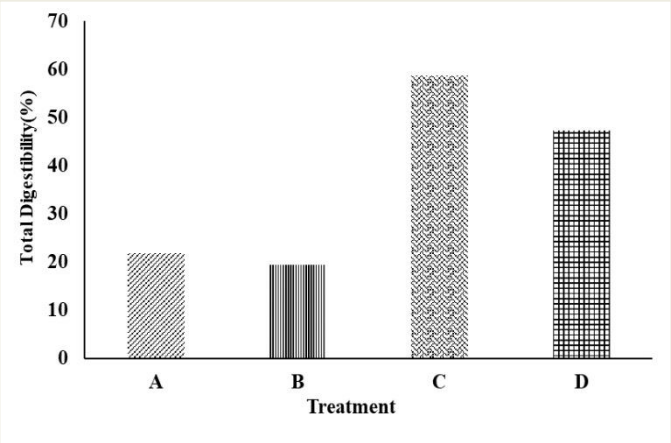

Figure 1. Total digestibility of vaname shrimp (Litopenaeus vannamei) during the study. A(20%MLF+0%SM), B(15%MLF+5%SM), C(10%MLF+10% SM) and D(5% MLF+15% SM).

Digestibility refers to the portion of feed that is not excreted in the feces[7]. The digestibility value indicates the amount of nutrient composition or energy in a feed ingredient that can be absorbed and utilized by the fish. The digestibility of a feed reflects the percentage of nutrients absorbed by the fish's digestive tract; the higher the digestibility value, the more nutrients from the feed are utilized by the organism[8]. Total digestibility identifies the total nutrient digestibility that can be absorbed and used for the growth of the test animal, as well as the metabolic waste produced[9].

Based on the research results, the highest total digestibility was obtained in treatment C at 58,68%, while the lowest was in treatment B at 19,35%. The total digestibility value in this study is relatively low, at 85,21%[10]. The highest digestibility rate in milkfish fed with moringa leaf meal was found in treatment C(50% Moringa Leaf Meal+50% Soybean Meal) compared to treatments B and D.

The high total digestibility in treatment C is likely due to the high and optimal utilization of shrimp feed during maintenance and the influential role of enzymes aiding the digestion process, resulting in a significant amount of nutrients being absorbed and effectively used by the test animal. In contrast, the low total digestibility in treatment B is presumably due to suboptimal feed utilization during maintenance. The digestibility value of an organism, whether high or low, is influenced by the amount of material or energy that can be absorbed by the fish[8], and it is also affected by the efficiency of digestive enzyme activity, which helps optimize feed digestibility in an organism.

3.2 Protein Digestibility

Feed digestibility level is one of the critical indicators in feed testing. The results of calculating the protein digestibility level of vaname shrimp (Litopenaeus vannamei) during the research are presented in Figure 2.

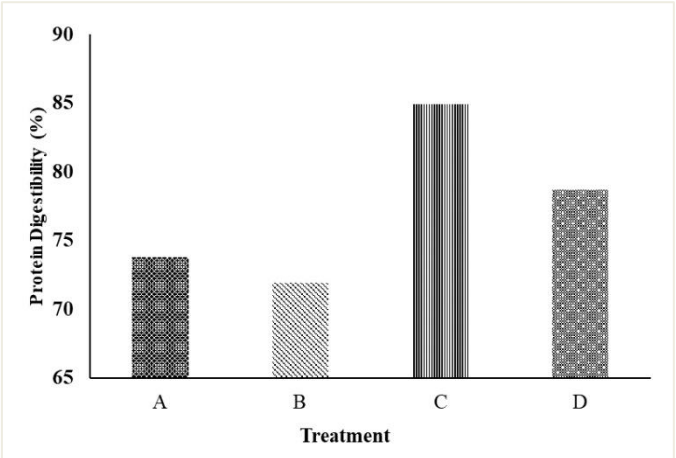

Figure 2. Protein digestibility of white shrimp (Litopenaeus vannamei) during the study. A(20%MLF+0%SM), B(15%MLF+5% SM), C(10%MLF+10%SM) and D(5% MLF+15% SM)

The average protein digestibility levels of white shrimp (Litopenaeus vannamei) during the study are presented in Figure 2. The highest protein digestibility was

obtained in treatment C (10% Moringa Leaf Flour (MLF)+10% Soybean Meal (Sm) at 84,94%, followed by treatment D (5% MLF+15%SM) at 78,67%, treatment A (20%MLF+0%SM) at 73,78%, and the lowest in treatment B (15%MLF+5%SM) at 72,94%.

The study results showed that the protein digestibility values ranged from 71,94% to 84,94%. The highest protein digestibility was found in treatment C(10% Moringa oleifera leaf meal and 10% soybean meal). The highest protein digestibility value reported in another study was for treatment C (50% Moringa leaf meal + 50% soybean meal) at 62,19%[10]. However, this value is lower than the protein digestibility obtained in this study, 84,94%. The optimal protein digestibility in vannamei shrimp is achieved when the feed's protein content meets their dietary requirements, leading to efficient protein utilization[11]. Although treatment D(78,67%) did not reach the high protein digestibility of treatment C(84,94%), it still falls within the range of optimal protein digestibility. However, treatments A (73,78%) and B (72,94%) are categorized as suboptimal or poor. Generally, optimal protein digestibility for fish ranges between 75-95%[12].

Despite having a higher protein content compared to other treatments, the low protein digestibility in treatment A suggests that the test animals did not efficiently absorb the protein in the feed. The optimality of protein digestibility can be determined by the amount of protein absorbed by the test animals; the higher the absorbed protein, the higher the digestibility value[13]. The low digestibility value in treatment B is attributed to the high crude fibre content in the feed, which was 19,05%, compared to treatments A, C, and D. Protein digestibility is significantly influenced by crude fibre content[12]. High oil fibre results in larger faecal output, reducing the digestible protein available to the test animals, thereby affecting their growth[14]. The low protein digestibility is also suspected to be due to the suboptimal Moringa leaf meal in the feed[15] and its higher crude fibre content.

IV. CONCLUSION

This research concludes that the study shows that treatment C (10% Moringa leaf flour and 10% soybean flour) produces the highest total digestibility of 58,68%, and protein digestibility ranges from 71,94-84,94%, with digestibility. The highest protein was also in treatment C.

V. REFERENCES

[1]. C. Y. Tsai, C.-C. Chi, and C.-H. Liu, “The growth and apparent digestibility of white shrimp, Litopenaeus vannamei, are increased with the probiotic, Bacillus subtilis,” Aquaculture Research, vol. 50, no. 5, pp. 1475–1481, 2019, doi: 10.1111/are.14022.

[2]. Y. Jasmanindar, S. Sukenda, A. Alimuddin, M. Z. Junior, and N. B. P. Utomo, “The Chemical Composition of Gracilaria verrucosa Extract and its Utilization on Survival and Growth Litopenaeus vannamei,” Omni-Akuatika, vol. 14, no. 3, Art. no. 3, Nov. 2018, doi: 10.20884/1.oa.2018.14.3.508.

[3]. W. Afuang, P. Siddhuraju, and K. Becker, “Comparative nutritional evaluation of raw, methanol extracted residues and methanol extracts of moringa (Moringa oleifera Lam.) leaves on growth performance and feed utilization in Nile tilapia (Oreochromis niloticus L.),” Aquaculture Research, vol. 34, no. 13, pp. 1147–1159, 2003, doi: 10.1046/j.1365-2109.2003.00920.x.

[4]. E. Dongmeza, P. Siddhuraju, G. Francis, and K. Becker, “Effects of dehydrated methanol extracts of moringa (Moringa oleifera Lam.) leaves and three of its fractions on growth performance and feed nutrient assimilation in Nile tilapia (Oreochromis niloticus (L.)),” Aquaculture, vol.

261, no. 1, pp. 407–422, Nov. 2006, doi: 10.1016/j.aquaculture.2006.08.006.

[5]. B. Moyo, P. J. Masika, A. Hugo, and V. Muchenje, "Nutritional characterization of Moringa (Moringa oleifera Lam.) leaves," AJB, vol. 10, no. 60, pp. 12925–12933, Oct. 2011, doi: 10.5897/AJB10.1599.

[6]. T. Takeuchi, "Laboratory work-chemical evaluation of dietary nutrients," Fish Nutrition and Mariculture, pp. 179–226, 1988.

[7]. D. Fahmiyanto, A. Agustono, and T. Nurhajati, "Subtitusi Tepung Ikan Dengan Tepung Keong Mas Pada Pakan Buatan Terhadap Kecernaan Bahan Kering Dan Lemak Kasar Udang Vanname (Litopenaeus vannamei)," Journal of Aquaculture and Fish Health, vol. 2, no. 1, pp. 30-36, 2013, doi: 10.20473/jafh.v2i1.18250.

[8]. A. Agustono, "Pengukuran Kecernaan Protein Kasar, serat Kasar, Lemak Kasar, dan Energi Pada Pakan Komersial Ikan Gurami (Osphronemus gouramy) dengan Menggunakan Teknik Pembedahan
<I>[Digestibility Value Of Crude Fiber and Nitrogen Free Extract (Nfe) for Different Commercial Feed In Gouramy (Osphronemus goramy Lac.) Using Surgical Technique]<I>," Jurnal Ilmiah Perikanan dan Kelautan, vol. 6, no. 1, pp. 71-80, Apr. 2014, doi: 10.20473/jipk.v6i1.11384.

[9]. D. M. Jannah, R. Rosmawati, and R. Samsudin, "Perbaikan Daya Cerna Tepung Darah Menggunakan Teknik Silase Dan Teknik Spray Dried Pada Ikan Nila (Oreochromis niloticus)," Jurnal Mina Sains, vol. 2, no. 1, pp. 15-23, Apr. 2016, doi: 10.30997/jms.v2i1.415.

[10]. M. Hamzah, W. H. Muskita, and A. Kurnia, "Digestibility of moringa leaf meal (Moringa oleifera) feed in milkfish (Chanos chanos)," AACL Bioflux, vol. 14, no. 1, pp. 291–297, 2021.

[11]. A. Y. D. Kusumabhakti, M. Muhajir, and I. Wirawan, "Respon Konsentrasi Protein Yang Berbeda Pada Pakan Terhadap Pertumbuhan Berat Mutlak Udang Vaname (Litopenaeus vannamei) Umur PL8-PL21 di Bak-bak Percobaan," Juvenil: Jurnal Ilmiah Kelautan dan Perikanan, vol. 4, no. 3, pp. 223-226, Aug. 2023, doi: 10.21107/juvenil.v4i3.20596.

[12]. S. Selpiana, L. Santoso, and B. Putri, "Kajian Tingkat Kecernaan Pakan Buatan Yang Berbasis Tepung Ikan Rucah Pada Ikan Nila Merah (Oreochromis niloticus)," e-Jurnal Rekayasa dan Teknologi Budidaya Perairan, vol. 1, no. 2, pp. 101-108, Feb. 2013.

[13]. T. Hertanti, S. Subandiyono, and S. Hastuti, "Pengaruh Kadar Protein Pakan yang Berbeda Berbasis Rasio E/P 8,5 Kkal/G Protein Terhadap Tingkat Konsumsi Pakan dan Pertumbuhan Udang Jerbung (Fenneropenaeus merguiensis)," Sains Akuakultur Tropis : Indonesian Journal of Tropical Aquaculture, vol. 4, no. 1, pp. 1–12, Apr. 2020, doi: 10.14710/sat.v4i1.5649.

[14]. C. Y. Cho, C. B. Cowey, and T. Watanabe, Finfish Nutrition in Asia: Methodological Approaches to Research and Development. International Development Research Centre, 1985.

[15]. N. Aida, I. Suharman, and Adelina, "Pemanfaatan Tepung Daun Kelor (Moringa oleifera) yang Difermentasi Menggunakan Rhyzopus sp. Dalam Pakan Buatan untuk Pertumbuhan Benih Ikan Bawal Air Tawar (Colossoma macropomum)," Jurnal Akuakultur Sebatin, vol. 1, no. 1, pp. 51-62, Oct. 2020.