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PROXIMATE ANALYSIS ON NILE TILAPIA ARTIFICIAL FEED FROM SHRIMP WASTE

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ABSTRACT

Nile Tilapia (Oreochromis niloticus) is the most widely cultivated freshwater fish because it can grow well in tropical countries and temperate regions. This research aims to create artificial feed that matches the nutritional parameters needed by nile tilapia. This artificial feed will use the basic ingredients of shrimp waste, with addition of oilcake, bran, starch flour, vitamins, squid oil, and water. There are four variables used to make artificial feed with different basic and additional ingredients, as well as varied processing techniques. After artificial feed is completed, proximate analysis will be carried out to test composition of crude fiber, carbohydrates, water, fat, ash, and protein using various methods. The test method for the composition of crude fiber, carbohydrates, fat, ash, and protein follows the method set by the Association of Official Analytical Chemists (AOAC). Based on the results of proximate analysis, variable 1 (V1) has fulfilled the nutritional content of protein and moisture content needed by nile tilapia. This shows that artificial feed formulations from shrimp waste can be used because protein is an important element for nile tilapia growth, but the content of crude fiber, carbohydrates, fat, and ash exceeds ideal value for nile tilapia nutrition. This also occurs in variables 2, 3, and 4 that have not met nutritional needs, especially protein. However, the composition of artificial feed with shrimp waste and addition of meal, bran, starch flour, vitamins, and water in V1 can be further investigated to reduce the content of crude fiber, carbohydrates, fat, and ash.

KEYWORDS *Nile Tilapia, Proximate Analysis, Artificial Feed, Shrimp Waste.*

INTRODUCTION

Nile Tilapia (*Oreochromis niloticus*) is one of the leading commodities and its cultivation is in great demand by people in Indonesia. This fish is very adaptable to an unfavorable environment, so it is most in demand by the public. Nile tilapia is a source of low-cholesterol animal protein with a nutritional content of 17.7%

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and fat of 1.3% (Niode et al., 2017). Nile tilapia farming has the largest feed production costs because it requires nutrients of good quality and quantity to accelerate the growth of nile tilapia. In general, nile tilapia can be given natural food such as plankton, phytoplankton, hydrila and plants that can live in ponds. As the growth of nile tilapia increases, natural food alone is not enough because the longer the condition of the plants in the pond can invite pests and fish diseases and inhibit the growth of nile tilapia. Therefore, to meet the nutritional needs of nile tilapia, artificial feed is added so that it can increase productivity (Xu & Ming, 2018).

Artificial feed is feed made with certain formulations based on the nutrients needed by nile tilapia. As for the types of artificial feed that can be used, one of them is commercial feed. Commercial feed is usually available on the market, but the price tends to be more expensive, so it is less profitable for farmers. This causes cultivators to make alternative artificial feed independently to reduce feed production costs. The raw materials that are usually used to make artificial feed consist of agricultural by-products as well as from fresh shrimp waste. Making artificial feed requires the right formulation according to the nutritional content of nile tilapia, namely crude fiber, carbohydrates, moisture content, fat, ash, and protein. The formulation used is based on shrimp waste, bran, oil palm meal, starch flour, and vitamins (Dada, 2019). A good artificial feed has the content of proteins, carbohydrates, fats, vitamins, and minerals necessary for optimal growth and health of fish.

Nile tilapia needs nutrition from feed containing crude fiber (4% - 8%), protein (18% - 50%), fat (10% - 25%), carbohydrates (15% - 20%), ash (< 8.5%), water (< 10%), vitamins and minerals. Most feed manufacturing in Indonesia still has quality below commercial feed (Sunarno et al., 2017). So, the problem in this study is to make nile tilapia artificial feed with feed content according to the nutrients needed for fish. The basic ingredients used are shrimp waste with the addition of oilcake, bran, starch flour, squid oil, vitamins, and water. Nile tilapia feed that has been processed independently, then proximate analysis. Proximate analysis is a method to analyze the nutritional content of fish feed consisting of crude fiber, carbohydrates, moisture content, fat, ash, and protein.

RESEARCH METHOD

The study was conducted at the chemical engineering laboratory of the Kalimantan Institute of Technology. The analysis employed in this study was proximate analysis using shrimp waste as the main material, supplemented with oilcake, bran, starch flour, squid oil, vitamins, and water. The shrimp waste originates from one of the shrimp processing factories in Balikpapan. The waste utilized comprises the heads and shells of various shrimp species. Proximate analysis involved assessing moisture content, ash, fat, protein, carbohydrates, and crude fiber. Determination of moisture content in feed ingredients using drying or oven methods (thermogravimetry) from SNI 01-4270-1996 ([BSN] Badan Standardisasi Nasional, 1996). The principle of the method is by drying the sample in an oven 100°C - 105°C until the weight is constant and the difference in initial and final weight is calculated as moisture content (Alaba et al., 2019).

Crude fiber, carbohydrates, fat, ash, and protein were analyzed using the methods outlined by the Association of Official Analytical Chemists (AC, 2016). The principle of analysis of crude fibers is all organic matter insoluble in dilute strong acids and dilute strong bases heated successively for 30 minutes. Crude fibers will burn in a furnace or muffle furnace so that coarse fibers are obtained from the difference in weight before and after burning. Furthermore, carbohydrate analysis is carried out by difference, which is the result of a reduction of 100% with water content, ash content, protein content, and fat content so that carbohydrate levels depend on the reduction factor. Next, determination of fat content by extraction of feed ingredients in organic and nonpolar solvents, namely n-hexane (Anggorodi, 2015). Then, the principle of ash testing is to burn the sample into a furnace or muffle furnace which will cause all organic substances to burn out, so that only mineral residues (inorganic substances). At high temperatures, the organic matter in the feed will burn and the rest is ash which is considered to represent the inorganic part of the food. Last, determination of protein levels by the kjedahl method consists of the process of destruction, distillation, and titration. The principle of protein testing is that concentrated sulfuric acid (H2SO4) breaks the nitrogen bonds present in organic compounds into ammonium sulfate.

There are 4 variables used with different compositions of shrimp waste, oilcake, bran, starch flour, vitamins, squid oil, and water. The composition of each raw material used in this study can be seen in table 1.

Table 1. Research Variables

Variable	Shrimp Waste	Oilcake	Bran	Starch Flour	Vitamins	Squid Oil	Water	Information
V_1	48 gr (dry)	20 gr	20 gr	10 gr	2 gr	-	75 ml	Foodstuffs dried in the oven
V_2	58 gr (dry)	20 gr	-	2 gr	2 gr	10 ml	75 ml	Foodstuffs dried in the oven
V_3	137,5 gr (wet)	20 gr	20 gr	10 gr	2 gr	-	64 ml	Foodstuffs dried in the oven
V_4	48 gr (dry)	20 gr	20 gr	10 gr	2 gr	-	75 ml	Foodstuffs dried in the sun

RESULT AND DISCUSSION

The production of nile tilapia feed from shrimp waste has been carried out using a composition of shrimp waste, oilcake, bran, starch flour, vitamins, and water. The nile tilapia feed is in the form of elongated pellets with a fragile texture and a dark brown color. Based on the conducted research, the proximate analysis results are as follows.

Table 2. The Proximate Analysis Results for All Variables

No	Parameter	Ideal Levels	V_1 (%)	V_2 (%)	V_3 (%)	V_4 (%)
1	Crude Fiber	4% – 8%	18.00	24.00	16.00	26.00
2	Carbohydrates	15% - 20%	50.61	47.26	53.97	50.31
3	Moisture Content	< 10%	5.39	8.45	10.18	9.90
4	Fat	10% - 25%	3.00	12.20	5.00	3.40
5	Ash	< 8,5%	23.00	17.50	14.00	20.00
6	Protein	18% - 50%	18.00	14.59	11.67	16.39

In Table 2, number 1 represents the parameter for crude fiber content using the digestion method from AOAC in nile tilapia feed. Crude fiber is a carbohydrate component that cannot be digested and is not a crucial nutrient for fish. While crude fiber may cause container fouling in fish tanks, it is still necessary for waste elimination. The required crude fiber content for fish is typically around 4% - 8% (Iskandar & Fitriadi, 2017). However, the results indicate that the crude fiber content in the fish feed for all variables mentioned exceeds 8%. This high crude fiber content suggests decreased digestibility, reduced absorption, increased metabolic waste, and diminished water quality within the tanks. Furthermore, for number 2, it represents the parameter for carbohydrate content using the "by different" method from AOAC in Nile tilapia feed. Determining the optimal carbohydrate level in feed is challenging due to protein and fat typically serving as primary energy sources before carbohydrates. Nevertheless, carbohydrates still play functional and structural roles in the body (Ramlah et al., 2016). The required carbohydrate content for fish ranges from 15% to 20%. However, the results indicate that the carbohydrate content in the fish feed exceeds 50% for all variables. This outcome suggests a significantly high fat content due to the addition of starch, which inherently possesses a high carbohydrate content.

For Table 2, number 3 indicates the parameter for moisture content using the drying method (thermogravimetry) in nile tilapia feed. The moisture content in Nile tilapia feed should ideally be < 10% as higher moisture content makes the feed more prone to fungal growth if left stagnant for too long. Moreover, excessive moisture content facilitates the proliferation of bacteria, mold, and yeast, leading to food spoilage (Gumolung, 2019). The moisture content results in all variables are below 10%, indicating that the moisture content meets the requirement for Nile tilapia. Moving on to number 4, it represents the parameter for fat content using the Soxhlet extraction method from AOAC in nile tilapia feed. Fat serves as an energy source for fish, and it stores essential fatty acids such as linoleic acid. Fat serves as a reserve in fish bodies, enabling them to survive for extended periods without food by utilizing glycogen and stored fat as body protein. The required fat content for fish ranges from 10% to 25%. The fat content results in V_1, V_3, and V_4 are below 10%, indicating insufficient fat reserves for energy, potentially leading to quicker death in nile tilapia if not fed over an extended period. However, the fat content in V_2 meets the required fat content for fish feed.

Number 5 in Table 2 represents the parameter for ash content using the dry method from AOAC in nile tilapia feed. Ash content indicates the mineral content in the feed. Higher mineral content promotes fish growth. Ash is defined as the

residue produced during the combustion of organic matter, consisting of inorganic compounds in the form of oxides, salts, and minerals. The required ash content for fish feed is < 8.5% (Iskandar & Fitriadi, 2017). However, the ash content results for all variables are above 8.5%, indicating an excessively high ash content, which may not meet the fish's mineral requirements. Lastly, number 6 represents the parameter for protein content using the Kjeldahl method from AOAC in nile tilapia feed. Protein content analysis refers to the crude protein content, which measures the nitrogen content in the sample. Protein is crucial for fish growth. If protein is insufficient, there can be a drastic reduction or cessation of growth or loss of body weight, as fish may draw protein from some tissues to maintain the function of more vital tissues. The required protein content for fish ranges from 18% to 50%. The protein content in the V_1 fish feed is 18%, meeting the nile tilapia's protein requirements, although it is still relatively low and not suitable for larger fish. However, the protein content in V_2, V_3, and V_4 is below 18%, resulting in insufficient protein for the fish pellets.

This study focused on the need for protein in artificial feed because it is a major factor in the growth of nile tilapia. If protein is not met, then nile tilapia does not grow and causes death. This can create losses for nile tilapia entrepreneurs. Therefore, artificial feed that has protein content in accordance with the nutritional needs of nile tilapia, namely in variable 1 (V_1). The variable shows a protein of 18% and is supported by the need for water content of 5.39%. This shows that protein has met the nutritional needs of tilapia, which is 18% to 50% and water content is less than 10%. Because protein needs and water content have been met, it can be made and re-tested tilapia artificial feed based on V1 by changing the composition of additional ingredients such as oilcake, bran, starch flour and vitamins for further research.

CONCLUSION

This research overcomes the problem of artificial feed for tilapia that has quality below commercial feed. Artificial feed uses shrimp waste with additional ingredients, namely oilcake, bran, starch flour, vitamins, squid oil, and water. Shrimp waste comes from one of the shrimp-based frozen food processing plants in Balikpapan. Artificial feed that has been made will be proximate analysis to test crude fiber, carbohydrates, moisture content, fat, ash, and protein. There are four variables with different compositions of artificial feed manufacturing. Based on research on these four variables, the results showed that artificial feed in variable 1 (V_1) has parameters that meet the main needs for nile tilapia nutrition than other variables, namely water content of 5.39% and protein by 18%. However, there are four parameters that do not meet the nutritional needs of tilapia, namely crude fiber by 18%, carbohydrates by 50.61%, fat by 3%, and ash by 23%. This study emphasizes the importance of protein nutrition in nile tilapia artificial feed because protein is necessary for fish growth. Protein deficiency can result in impaired growth or weight loss in nile tilapia, which can lead to death and loss for nile tilapia entrepreneurs. The results of this study are expected to provide input for future research to reduce the nutritional content of other parameters. This aims to be a

guideline for the community in making artificial feed for nile tilapia, so that it can reduce costs and not rely on commercial feed.

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