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The Differences Effect between Pond Types and Maggot Allotments on The Protein and Fat of Tilapia Meat

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ABSTRACT

Tilapia was one of the freshwater fish commodities that were widely consumed, so the demand for tilapia increased and impacted the high price of tilapia feed. Therefore, maggots can be used as additional fish feed, and recently there have been many variations of pond types in tilapia farming. This study aimed to determine the interaction between pond types and maggot allotments for protein and fat in tilapia meat. This study used two types of pools: tarpaulin and drum. The subjects used in this study were tilapia, with as many as 30 fish per pond. The dependent variables in this study were the protein and fat of tilapia meat. This study used the factorial method with a completely randomized design (RAL) with four treatments; each of the four tests consisted of A1B1 (Tarpaulin pool and maggots), A1B2 (Tarpaulin pool without maggots), A2B1 (Drum pool and maggots), and A2B2 (Drum pool without maggots). Data analysis was done using ANOVA with a significance level of 5% if there is an effect continued Duncan test. The results of this study showed no noticeable effect on meat protein (0.253>0.05) and meat fat (0.067>0.05) tilapia.

KEYWORD

fat, maggot, pond, protein, tilapia

INFORMATION

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1. INTRODUCTION

The popularity of fish consumption has increased since the public has become aware of the importance of maintaining a healthy body and nutritional intake through the consumption of animal protein, one of which is sourced from fish. As a maritime country, Indonesia has various kinds of aquatic ecosystems, including fishery resources (Djunaidah, 2017). Tilapia (*Oreochromis niloticus*) is one of the fish that dominates the production of freshwater fish. Based on data from FAO (2018), tilapia production reached 1.12 million tons in 2018, or around 31.94% of Indonesia's total freshwater aquaculture production. In addition, tilapia has advantages such as easy breeding and a high survival rate, relatively fast growth with a relatively large body size, and resistance to changes in environmental conditions (Taftajani, 2010 in Monalisa, 2010).

The technology used in fish cultivation is growing, so it is undeniable that the pattern or system of fish farming also varies, especially for tilapia. The cultivation system used by most fish entrepreneurs is an intensive aquaculture system, namely a fish culture system with a high stocking density to obtain high production. Intensive cultivation generally uses a limited and not a large maintenance pond (Sepang, 2021).

The increase in tilapia production in line with the fulfillment of community food needs affects the need and availability of feed for tilapia. According to Yunaidi et al. (2020), feed is the highest cost in a freshwater fish farming business because it can reach 75% of the total cost required. The requirement for high-quality feed is that it contains complete nutrients, is easily digested by fish, and does not contain substances harmful to fish. Maggots contain sufficient nutrients to be used as a support for tilapia feed. Maggots come from the eggs of black soldier flies that land on livestock manure. A maggot is a decaying organism because it consumes organic materials to grow. The advantage of the black soldier fly maggot is that it has a chewy texture and can produce natural enzymes that can increase the digestibility of fish feed. The type of quality feed will significantly affect the fish meat's protein and fat content. This study intends to examine the effect of pond type and maggot on the protein and fat of tilapia meat.

2. METHODOLOGY

This research was conducted for two months between September and October 2021 and is located in Plamongan Indah, Pedurungan District, Semarang City. Meanwhile, Tembalang District is the location for laboratory tests. This study used the main ingredients, namely 120 tilapia with a body length of 18 cm and a body weight of 122 grams, maggot and commercial feed. At the same time, the main tools used in this research are aquaculture ponds (tarpaulin ponds and drum ponds), parents, digital scale, rulers, water quality test kits, stationery, aerators, water hoses, and aeration stones. The method used is a factorial, completely randomized design (CRD), where the first factor is the type of pond.

In contrast, the second factor is the provision of maggot which consists of 4 treatments with four replications each, namely A1B1 (Pool tarpaulin and maggot), A1B2 (Pool tarpaulin without maggot), A2B1 (Drum pool and maggot), A2B2 (Drum pool without maggot). Maggot is used for as much as 10% of the total feed and given before commercial feeding. The data obtained was analyzed using 5% ANOVA; if there is an effect, then Duncan's test is continued.

3. RESULTS AND DISCUSSION

3.1. Meat protein

Based on the average data obtained from the laboratory test results for tilapia meat protein, the average data on the protein content of tilapia meat is as follows:

Table 1. Average data of laboratory test results for tilapia meat protein

Maggot Giving	Pool Type		Average
	A1	A2	
B1	20.02 %	21.25 %	20.63 %
B2	21.49 %	21.24 %	21.37 %
General Average	20.76 %	21.25 %	21.00 %

Note : A1B1 (Pool Tarpaulin and added maggot); A1B2 (Pool Tarpaulin and without maggot); A2B1 (Drum Pool and maggot); and A2B2 (Drum Pool and without maggot).

The table above shows that the highest meat protein was found in treatment A1B2, tarpaulin ponds without maggot, with a total meat protein of 21.49%. In comparison, the lowest meat protein was found in the A1B1 treatment with a total meat protein of 20.02%, namely tarpaulin ponds, coupled with the provision of maggot.

Table 2. The results of the ANOVA test for the interaction of pond types and the provision of Maggot on Tilapia fish meat protein

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Mode	5.331[a]	3	1.777	1.164	0.364
Intercept	7055.580	1	7055.580	4620.468	0.000
Pool_Type	.965	1	.965	.632	0.442
Maggot_Giving	2.168	1	2.168	1.420	0.256
Pool_Type*Maggot_Giving	2.198	1	2.198	1.439	0.253
Error	18.324	12	1.527		
Total	7079.236	16			
Corrected Total	23.656	15			

R Squarred = .225 (Adjusted R Squarred = .032)

The comparison of the significance value between factors A (different types of ponds, namely tarpaulin ponds and drum ponds) and B (given and not given maggot) is 0.253 > 0.05. From the comparison results, it can be concluded that there is no interaction between factors A and B in determining the protein content of tilapia meat.

Meat protein is one component with a high content in the body of fish other than water. The research of Ramlah et al. (2016) mentions that protein plays an essential role in the structure and function of the body because it is related to growth and reproduction. Fish cannot synthesize protein and amino acids from inorganic nitrogen compounds; therefore, it is necessary to have protein obtained from fish feed. The composition of fish meat, in general, is 15%–24% protein. The composition of fish meat varies greatly depending on biological and natural factors. Fish protein is easily damaged during handling and processing, such as degradation, denaturation, and coagulation. The interaction between oxidized protein and fat can also cause a decrease in the nutritional value of the protein (Ningrum et al., 2019).

Based on the data in table 1, the data obtained from tilapia meat protein shows that the treatment of the types of ponds, namely tarpaulin ponds and drum ponds, produces meat protein whose average amount is almost balanced with a difference of only 0.49%. In terms of material, tarpaulin ponds and drum ponds are made of plastic material that is quickly overgrown with green algae or moss, which can become additional food for tilapia raised in tarpaulin ponds. According to Madyowati (2017), *Pediastrum sp.* is found in permanent or semi-permanent ponds. Pediastrum is phytoplankton that serves as fish food. Plankton-rich areas are areas of fish-rich waters. Based on the factorial ANOVA statistical test in table 2, namely 0.442>0.05, it is known that factor A has no effect on the protein of tilapia meat. The results of this study mean that the type of pond does not directly affect the protein content of the meat. This indirect effect is in line with previous research conducted by Sulistiyoningsih et al. (2017), and the results state that the type of pond has no significant effect because it has almost the same conditions, which are influenced by water temperature and water acidity (pH).

The results of the study of factor B, namely the provision of maggot based on the factorial ANOVA statistical test in table 2, namely 0.256>0.05, show there is no effect of factor B on the protein of tilapia meat. Maggot itself is known as one of the addictive feeds (additional feed), which has a high protein content, so it is expected to be able to support the protein content of tilapia meat. The absence of a significant effect of maggot on tilapia meat protein was thought to be due to a lack of satisfaction at the time of feeding tilapia (*Oreochromis niloticus*). During the study, the fasting technique was only carried out occasionally, namely at the time of acclimatization of the first fish and fasting overnight after each pond water drain. Based on several results of research conducted by experts such as (Sari et al., 2017; Mulyani and Fitriani, 2014), fasting can increase the level of fish appetite so that fish can fulfill nutrients and metabolism in the fish's body can run well. Fasted fish can increase protease activity compared to fish fed daily. The increase in enzyme activity is thought to be related to the increased effort of fish to digest nutritional content, especially protein. In order to maximize the use of feed protein for growth, fasting causes a decrease in protease activity. However, feeding again triggers an increase in protease activity.

The amount of maggot given as a feed additive also affects the protein content of meat in fish. This study gives maggots to fish as much as 10% of the total amount of tilapia feed. Based on research (Sepang, 2021), the optimal combination of feed, pellets and maggot for growth in tilapia is 50%. The amount of maggot given in this study was 10%, which is only a tiny amount compared to the number of fish that must be fed, so the chances of fish not getting maggot are greater. This amount of feed is related to the aggressive behavior of fish, which establishes fish hierarchy through competition, such as scramble competition, which is characterized by the fastest eating behavior such that fish with this behavior dominate other fish in the same pool or group categories (Zainuri, 2019).

3.2. Tilapia fish meat fat

Based on the average data obtained from the laboratory test results for tilapia meat protein, the average data on the protein content of tilapia meat is as follows:

Table 3. Average data of laboratory test results on tilapia meat fat

Maggot Giving	Pool Type		Average
	A1	A2	
B1	2.08 %	1.44 %	1.76 %
B2	1.35 %	1.91 %	1.63 %
General Average	1.72 %	1.68 %	1.70 %

Note : A1B1 (Pool Tarpaulin and added maggot); A1B2 (Pool Tarpaulin and without maggot); A2B1 (Drum Pool and maggot); and A2B2 (Drum Pool and without maggot).

From the data in table 3 above, it can be seen that the highest meat fat was found in the A1B1 treatment, namely the tarpaulin pool plus the addition of maggot, with a total meat fat of 2.08%. In comparison, the lowest meat fat was found in the A1B2 treatment, with a total meat fat of 1.35%—namely, the tarpaulin pool without the provision of maggot.

Table 4. The results of the ANOVA test for the interaction of pond types and the provision of Maggot on Tilapia fish meat fat

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Mode	1.530[a]	3	.510	1.418	0.286
Intercept	45.867	1	45.867	127.575	0.000
Pool_Type	.005	1	.005	.015	0.906
Maggot_Giving	.066	1	.066	.184	0.675
Pool_Type*Maggot_Giving	1.458	1	1.458	4.055	0.067
Error	4.314	12	.360		
Total	51.711	16			
Corrected Total	5.844	15			

R Squarred = .262 (Adjusted R Squarred = .077)

The comparison of the significance value between factors A (different types of ponds, namely tarpaulin ponds, and drum ponds) and B (given and not given maggot) is 0.067 > 0.05. From the comparison results, it can be concluded that there is no interaction between factors A and B in determining the fat content of tilapia meat.

Fat is a rich source of energy for fish in general. Apart from being an energy source, fat stores essential fatty acids, such as linoleic acid. Fatty acids are used to form fats or oils (triglycerides), which are stored for use as an energy source. Fat as a reserve in the body will be used. Fish can survive for long periods without eating because they first use glycogen and fat before body protein, based on research by Rahardjo (1987) in Ramlah et al. (2016). According to Justie et al. (2003) in Isa et al. (2015), a tilapia is a group of fish with a low-fat content of 2.54%. Based on Wassef and Shenata's (1991) research in Isa et al. (2015), fish use fat as their primary energy source, so they will expend more energy. Fat-rich tissue is usually known to contain triglycerides as the primary fat, while phospholipids can dominate low-fat tissue in tilapia. Fat in tilapia can be divided into two main classes: neutral fat (NL) and polar fat (PL). Polar fats are essential constituents of membranes that function as precursors in the metabolism of eicosanoids (structural fats).

In contrast, neutral fats are lipid depots used as energy sources based on research by Henderson and Tocher (1987) and Isa et al.(2015). Compared to marine fish, freshwater fish contain high C18 polyunsaturated fatty acids and low levels of EPA and DHA. Freshwater fish usually contain high n-6 *polyunsaturated fatty acids*, especially linoleic and arachidonic acids. The fatty acid composition of each fish can vary depending on the feed, location, sex, and environmental conditions (Pratama et al., 2018).

Based on the factorial ANOVA statistical test, which showed that 0.906 > 0.05, there was no effect of factor A on the fat content of tilapia meat. This means that the type of pond does not directly affect the fat content of tilapia meat. Factors that affect the fat content of meat in fish are physiological factors in the fish's body and environmental factors such as feed availability. Food that enters the intestines of fish will stimulate the release of the hormone cholecystokinin to spur the release of bile to dissolve fat granules into an emulsion so that they dissolve in water and are easily absorbed by the intestinal wall and pancreatic juice, which contains lipase enzymes. Lipase enzymes can break down fats into fatty acids and glycerol. In the digestive system of fish, the activity of the lipase enzyme is strongly influenced by the levels of protein contained in fish food. In the lining of the intestinal wall, fatty acids and glycerol bind and are circulated throughout the body via lymph vessels and blood vessels (Ramlah et al., 2016).

The study of factor B, namely the provision of maggots, based on the factorial ANOVA statistical test, 0.675 > 0.05, shows no effect of factor B on tilapia meat fat. This study's low-fat content may be due to protease for protein in fish and is in line with research conducted by Vieira et al. (2012) that showed changes in protein content during growth are proportional to changes in fat content in tilapia meat. The increased protein in the fish's body will decrease the fat content. Fat content decreases at low temperatures and increases at high temperatures. Water temperature is very influential on the activity of the digestive tract of tilapia. Madyowati (2017) states that water temperature dramatically affects the metabolic system of fish. This result is in line with Asnawi's (1983) research in Isa et al. (2015) that the digestion of food carried out by fish runs very slowly at low temperatures; on the contrary, it is faster in warmer waters. The A1B1 treatment, a tarpaulin pool plus maggot, has a more extensive meat fat content than other treatments; the water temperature in this treatment is 28°C, allowing fat metabolism to occur optimally.

4. CONCLUSION

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With the effect of different types of ponds and the provision of maggots on tilapia meat (*Oreohormis niloticus*), it can be concluded that the treatment of different types of ponds and the provision of maggots did not affect the tilapia meat protein and fat. (*Oreohormis niloticus*). It is necessary to conduct further research by determining the ideal combination of feed and maggot. The type of pond can significantly affect the protein and fat of tilapia meat (*Oreohormis niloticus*).

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