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PENGARUH PEMBERIAN MAGGOT (Chrysomya megacephala) YANG DIPELIHARA PADA MEDIA BERBEDA TERHADAP PERFORMA PRODUKSI IKAN NILA (Orechromis niloticus)

The Effect Of Giving Maggot (*Chrysomya megacephala*) Maintained In Different Media On The Production Performance Of Nile Fish (*Orechromis niloticus*)

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ABSTRAK

Ikan nila merupakan komoditas perikanan bernilai ekonomis tinggi. Produksi ikan nila mengalami peningkatan dari 24,98% pada tahun 2018 menjadi 26,76% di tahun 2019, naik sebesar 7,11%. Dalam budidaya ikan nila, pakan menjadi faktor utama, namun harganya yang mahal mendorong pencarian pakan alternatif. Maggot menjadi solusi potensial karena harganya murah dan kandungan protein tinggi (40–50%) serta mengandung asam amino esensial. Penelitian ini menggunakan metode eksperimen dengan rancangan acak lengkap (RAL) yang terdiri dari 4 perlakuan dan 3 ulangan, yaitu: P1 (limbah rumah tangga), P2 (limbah buah-buahan), P3 (limbah ampas tahu), dan P4 (limbah kotoran ayam). Penetasan telur dilakukan di baskom dengan media pellet dan air lembap. Setelah larva berumur satu minggu, dipindahkan ke wadah kayu berisi limbah masing-masing sebanyak 2 kg. Proses pembesaran maggot berlangsung selama dua minggu. Maggot dipanen di usia tiga minggu, dikeringkan dengan cara disangrai, lalu digunakan sebagai pakan ikan. Pemeliharaan ikan nila dilakukan selama 45 hari dalam 12 container yang diaerasi, dengan pemberian pakan maggot tiga kali sehari. Kualitas air dicek setiap minggu. Hasil penelitian menunjukkan bahwa pertumbuhan bobot mutlak, laju pertumbuhan bobot spesifik (SGR), panjang mutlak, laju pertumbuhan panjang spesifik (LPPS), dan kadar glukosa darah memberikan hasil signifikan. Namun, nilai FCR dan kelangsungan hidup (SR) tidak menunjukkan perbedaan signifikan. Perlakuan terbaik diperoleh pada P1 (limbah rumah tangga) dengan bobot mutlak 11,42 g, SGR 1,67 %/hari, panjang mutlak 4,92 cm, LPPS 1,02 %/hari, FCR 1,9, kelangsungan hidup 84,44 %, dan glukosa darah 73,3 mg/dL.

ABSTRACT

Nile tilapia is a high-value aquaculture commodity. Its production increased from 24.98% in 2018 to 26.76% in 2019, showing a 7.11% rise. In tilapia farming, feed is a major factor, but its high cost has encouraged the search for alternative feeds.

Maggot offers a promising solution due to its low cost and high protein content (40–50%) along with essential amino acids. This research used an experimental method with a completely randomized design (CRD), consisting of 4 treatments and 3 replications: P1 (household waste), P2 (fruit waste), P3 (tofu dregs), and P4 (chicken manure). Egg hatching was carried out in plastic containers with a moist mixture of pellet and water. After one week, larvae were transferred to wooden rearing containers filled with 2 kg of each type of waste. The maggot rearing process lasted for two weeks. Maggots were harvested at three weeks old, then dried by roasting and used as fish feed. Tilapia were reared for 45 days in 12 aerated containers and fed maggots three times a day. Water quality was monitored weekly. The results showed that weight gain, specific growth rate (SGR), absolute length, specific length growth rate (SLGR), and blood glucose levels were significantly affected by the treatments. However, feed conversion ratio (FCR) and survival rate (SR) were not significantly different. The best results were obtained from P1 (household waste), with absolute weight gain of 11.42 g, SGR of 1.67%/day, absolute length of 4.92 cm, SLGR of 1.02%/day, FCR of 1.9, survival rate of 84.44%, and blood glucose level of 73.3 mg/dL.

Kata Kunci	*Ikan Nila, Maggot, Limbah*
Keywords	*Tilapia, Maggot, Waste*
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INTRODUCTION

Tilapia is one of the fish that has high economic value. Tilapia also has several advantages compared to other freshwater fish, namely it is very easy to cultivate and grows quickly (Prajayati, Hasan, and Mulyono 2020). Data obtained in 2018, the amount of tilapia production was 24.98%, and in 2019 it was 26.76%. Data obtained in 2018 and 2019 showed an increase in production of 7.11% (Indriati and Hafiludin 2022).

Feed is the main factor in tilapia cultivation. According to Berampu et al., 2022, the high price of feed causes high production costs and affects maintenance costs. Maggots can be an alternative feed for tilapia, apart from being cheaper, maggots also have a high protein content so that they are very potential for additional feed in raising tilapia (Alorang et al. 2023).

Maggots or larvae of black soldier flies are feed containing 40-50% protein and essential amino acids. Protein content and metamorphosis processes can be disrupted if the growth media used are not appropriate (Alorang et al. 2023). The results of the analysis of H. illucens larvae fed tofu dregs contained 43.14% protein (Indriyanti, Widiyaningrum, and Setiati 2023). The protein content in chicken feces waste is 18.64% and fat 1.97%, the high and low fat content is influenced by the nutritional content in the maggot media (Aditama, Imanudin, and Widianingrum 2023). The growth media using fruit waste contains 9.57% protein and 5.99% fat (Khuluqiyyah

2023). In household waste media, the protein value is 40.60%, 3.48% fiber and 17.93% fat (Susilo et al., 2023).

Therefore, research related to the growth media for maggots needs to be carried out, which aims to determine the most influential media for good growth values for tilapia maintenance feed.

METHODS

Place and Time

This research was conducted for 45 days starting from July 10 - August 28, 2024, located in the Production and Reproduction Laboratory of the Aquaculture Study Program, Faculty of Agriculture, University of Mataram. The tools used consisted of stationery, aerators, DO meters, 45 L plastic buckets, cameras, containers, small basins, pH meters, thermometers, scales, and shelves. The materials used were fresh water, tofu dregs waste, fruit waste, chicken manure waste, household waste, maggots, beach sand, tilapia fish and maggot eggs.

Research Design

This study used an experimental method conducted using a completely randomized design (CRD). This treatment was carried out with 4 treatments and 3 repetitions, namely:

P1: Feeding maggots using household waste
P2: Feeding maggots using fruit waste
P3: Feeding maggots using tofu dregs
P4: Feeding maggots using chicken manure

Procedure

Research preparation

The initial process begins with preparing the egg hatching media in the form of a mixture of pellets and water with high humidity, then placed in a plastic basin. Maggot eggs are placed in a higher part of the media. This media functions as the initial feed for larvae and is made from nutritious organic materials such as bran and pellets. After the larvae hatch and are one week old, they are transferred to the rearing media.

Preparation of the maintenance container is carried out using a basin for hatching and 4 wooden containers (size 100 × 50 cm) for rearing. The wooden container is cleaned first, then filled with dried waste, namely household waste, fruit, tofu dregs, and chicken manure, according to each media.

Maggot rearing lasts for 2 weeks using 4 media: household waste, tofu dregs, fruit waste, and chicken manure, each as much as 2 kg/day. Household waste is chopped and dried until half wet, tofu dregs are cooled, fruit waste (banana, papaya, mango) is cut into small pieces, and chicken manure from Kebon Roek Market is dried before being given to the maggots.

The feed material used is maggots harvested at the age of 3 weeks. The maggots are then dried by roasting them using hot beach sand until dry and fluffy. From each medium, 1 kg of dried maggots are obtained as feed for tilapia maintenance.

Maintenance uses 12 container units, each equipped with 2 aerations. Before use, the container is washed clean, dried in the sun, then filled with 20 liters of water and fitted with aeration connected to a blower for oxygen supply.

This study used tilapia measuring 8–9 cm from the Lingsar Fish Seed Center with a stocking density of 15 fish/20 liters of water (Arifaldianzah et al. 2022). The fish were acclimatized for 3 days before maintenance. The second biota, namely maggots, came from eggs weighing 10 grams obtained from the Mataram Maggot Center, Kebon Talo, Ampenan.

The maintenance of the test animals was carried out for 45 days by providing natural feed in the form of maggots cultivated in different media (household waste, fruit waste, tofu dregs, and chicken manure). Feed was given 3 times a day (08.00, 12.00, and 17.00 WITA). Water quality was checked once a week, and siphoning was carried out when the water looked dirty, with the addition of water according to the volume wasted. Sampling of 5 tilapia per container was carried out every week.

Data obtained from the results of this study such as Absolute weight growth, Specific growth rate (SGR), Survival, and Absolute length growth will be analyzed using one-factor analysis of variance (one way analysis of variance) at a significance level of 0.05. If the results obtained are significantly different (p <0.05), then a Duncan test is carried out to obtain the location of the significance of the data obtained.

RESULT AND DISCUSSION

Result

The provision of maggots maintained in different media, for 45 days of maintenance, gave a growth value of 7.57-11.42 grams to tilapia. The results of the ANOVA test showed significant results (P<0.05) on the absolute weight of tilapia.

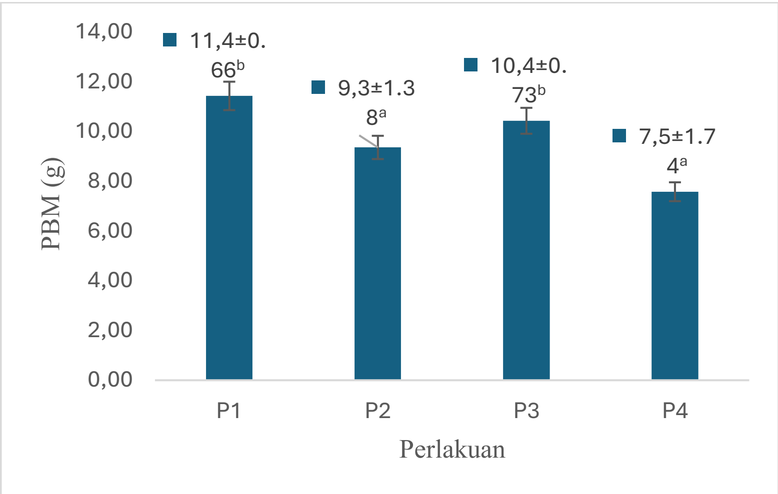

Figure 1. Absolute weight gain

This study shows that the growth rate of specific weight of tilapia during 45 days of maintenance with the provision of maggots given different feeds. The results of the ANOVA test showed that the provision of maggots given different feeds had a significant effect (P <0.05) on the growth rate of specific weight of tilapia

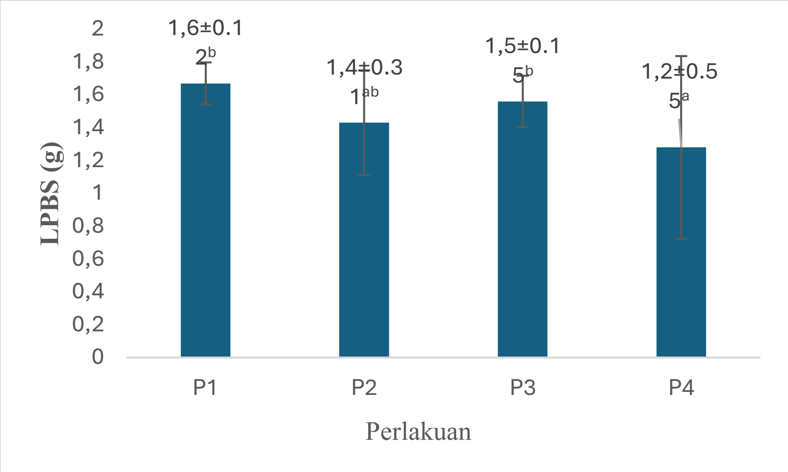

Figure 2. Specific weight growth rate

The results of the study showed that the absolute length growth of tilapia fish during 45 days of maintenance ranged from 2.52-4.92 cm. The ANOVA results showed that the effect of giving maggots maintained in different media showed a significant effect (P<0.05) on the absolute length of tilapia fish seeds.

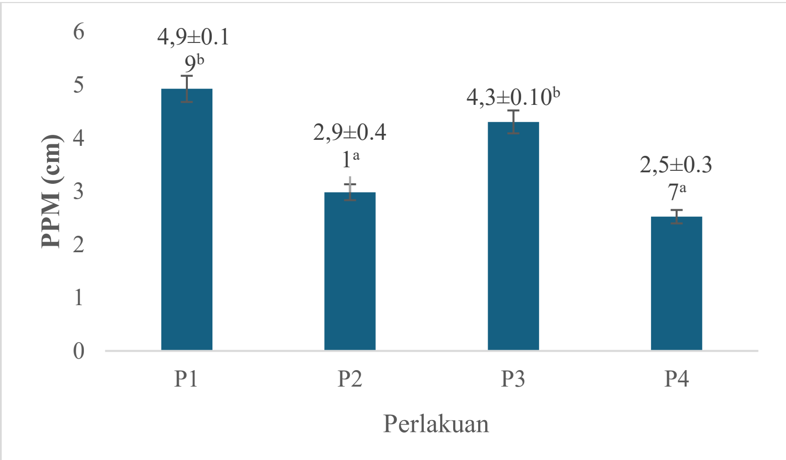

Figure 3. Absolute length growth

This study shows that the specific length growth rate of tilapia during 45 days of maintenance is in the range of 0.58-1.02 cm. Based on the results of ANOVA, the provision of maggots maintained in different media has a significant effect (P<0.05) on the specific length growth rate of tilapia.

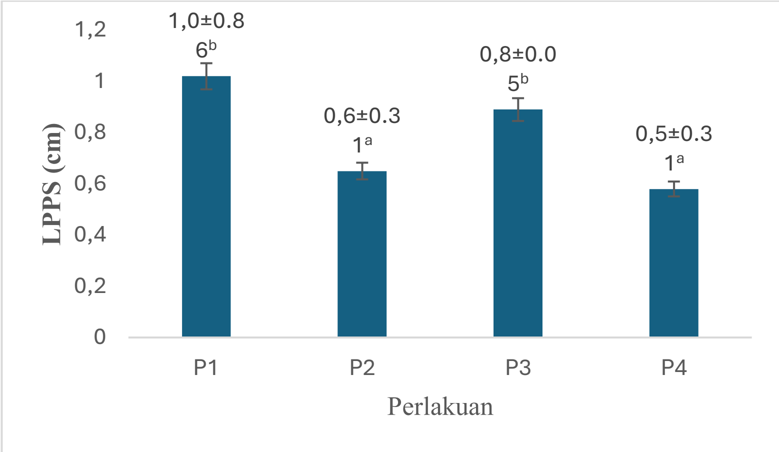

Figure 4. Specific length growth rate

Based on the test results (ANOVA) showed that the provision of maggots maintained in different media showed insignificant results (P>0.05) on FCR.

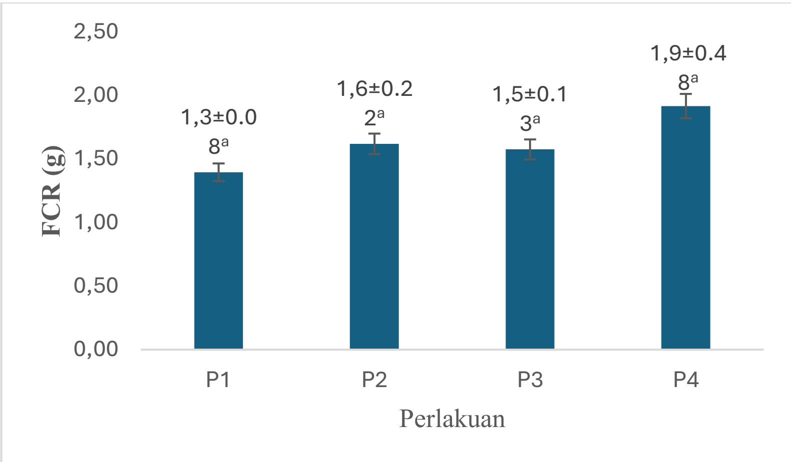

Figure 5. Feed conversion ratio (FCR)

The results of the ANOVA analysis showed no significant effect on the survival rate of tilapia.

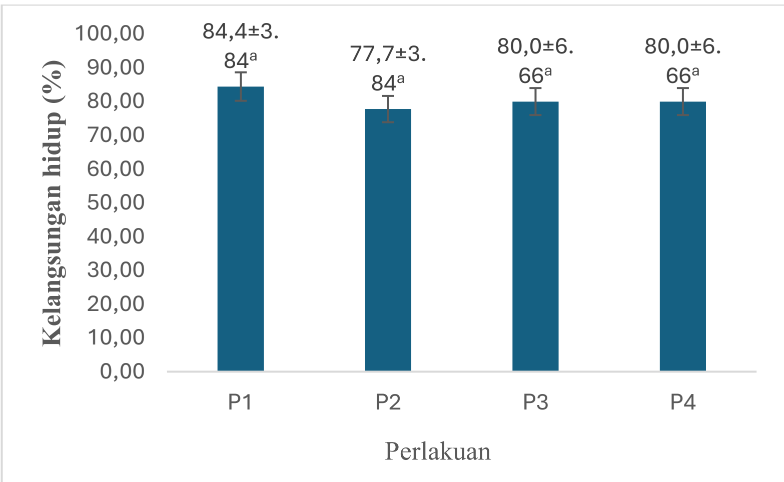

Figure 6. Survival

Blood glucose of tilapia at the beginning of the study ranged from 65-72.6, while blood glucose at the end of the study ranged from 73.3-96.6, which shows that there was an increase during the study.

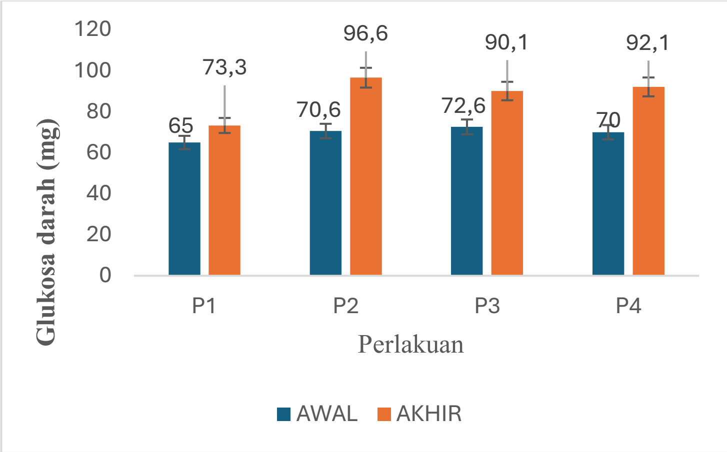

Figure 7. Blood glucose

The results of measuring the water quality of tilapia fish for 45 days can be seen in Table 1. Based on the table below, it can be seen that the results of checking the water quality in all treatments are still within the optimal range.

Table 1. Water Quality of Tilapia

Treatment	Temperature	DO	pH
P1	28,3	7,4	7,7
P2	28,3	7,4	7,6
P3	28,3	7,4	7,5
P4	28,3	7,3	7,4

Discussion

Absolute weight gain is the increase in fish weight during maintenance (Zuhdi, Prasetiyo, and Sasongko 2024). In this study, the highest weight value was obtained in P1 of 11.42 g and the lowest in P4 of 7.57 g. The use of minerals in maintenance media and from feed can increase growth (Scabra et al., 2024). This is thought to be because maggots have nutritional content so that they can provide absolute weight gain in tilapia. The protein requirement required by tilapia to achieve optimal growth ranges from 25-35%, the high protein content in maggots can increase fish growth (Putri et al., 2022). Based on the statement of Susilo et al. (2023) states that the nutritional value of maggots from household waste has a protein value of 40.60%, 3.48% fiber and 17.93% fat. (Purba et al., 2023) maggots given tofu dregs contain 18.67% crude protein, 8.69 dry matter, 24.43% crude fiber, 9.43% crude fat, 3.42% ash and BETN 41.97%.

The absolute weight growth rate in P4 got the lowest value and showed no significant difference with P2, this is thought to be because the nutritional content in

P4 and P2 is less than optimal compared to P1 and P3. According to Purnamasari et al., (2023) chicken manure contains 17.15% protein, 7.45% crude fiber, 2.56% fat, and 4.01% ash. Purnamasari et al., (2023) stated that the nutritional content of fruit waste is 14.18% crude protein, 93.59% water content, 6.40% ash, 3.64% crude fat, and 14.16% crude fiber. Based on this statement, maggots fed with household waste and tofu dregs can provide the best value for the weight of tilapia.

The specific weight growth rate in this study ranged from 1.28-1.67%/day. The best value in this study was found in P1 with a value of 1.67%, P2 1.43%, and P3 1.56%, which shows that the specific weight growth rate between P1, P2, and P3 has the same effect while the lowest value is in P4 with a value of 1.28%. This is thought to be due to the low nutritional value so that it is unable to affect the growth of tilapia. According to the statement of Purnamasari et al., (2023) that the nutritional content of fat in chicken manure waste is 2.56% and in maggots from household waste contains 17.93% fat Susilo et al. (2023).

Based on the statement of Supardan et al., (2023) stated that maggots have one advantage, namely they contain high nutrients so that the nutritional needs of fish are met. According to Scabra et al., (2024) growth will increase if the nutritional needs in feed and media such as the availability of protein, fat, carbohydrates, vitamins and minerals are met. In line with absolute weight growth, the highest nutritional content is found in maggots fed household waste, namely protein of 40.60%, fat 17.93%, and the lowest is found in maggots given chicken manure containing protein of 17.15% and fat 2.56%.

Absolute length growth in this study ranged from 2.52-4.92 cm. The highest absolute length value in P1 was 4.92 cm and the lowest in P4 was 2.52 cm. When compared to previous research conducted by Supardan et al., (2023), the highest absolute length of tilapia seeds weighing 4-7 grams was obtained in the MK55 treatment with 50% maggot feeding and 50% commercial, namely with a length of 3.5 cm. It can be concluded that the treatment of maggot feeding fed with household waste had a higher absolute length growth of 4.92 cm. This is in line with the absolute weight growth where the maggot content with household waste feed contains 40.60% protein, 17.93% fat and the lowest content is in P4 containing 17.15% protein, 2.56% fat. However, P1 showed no significant difference with P3 with a length value of 4.3 cm, a protein content of 18.67%, a fat content of 9.43% and P4 showed no significant difference with P2 with a length value of 2.98 cm, a protein content of 14.18%, a fat content of 3.64%. Based on the statement of Rachmawati et al., (2013) that fish can grow well if their nutritional intake is sufficient, especially their protein needs. According to Yolanda et al., (2013) sufficient amounts of nutrients in feed are not only able to provide energy for the metabolic activities of the tilapia body, but also able to meet the needs of tilapia to grow. Fish growth can occur if the amount of feed nutrients digested and absorbed by the fish is greater than the amount needed to maintain its body.

The specific length growth rate in this study ranged from 0.58-1.02 cm/day. The highest value was obtained at P1 1.02% and the lowest at P4 0.58%. However, P1 showed no significant difference with P3 0.89% and P2 0.65% showed no significant difference with P4. This is suspected that the low fat content of P4 in maggots affects the low energy of fish feed, so that fish cannot utilize energy from fat for activities and maximize the function of protein for growth Purnamasari et al., (2023). Based on the statement of Munisa et al., (2015) the use of fat as a "Protein sparing effect" is a substitute for protein as an energy source, so that the use of energy from protein can be used to support growth. This is in line with the treatment of specific weight growth where the fat content in P1 according to Susilo et al. (2023) is 17.93 and P3 according to (Purba et al., 2023) is 9.43%, while the lowest fat content is in P4 based on the statement of Purnamasari et al., (2023) which is 2.56%.

Feed conversion means how many kg of feed can be converted into one kg of meat (Sepang et al., 2021). The treatment of giving maggots with different feeds obtained FCR ranges of 1.39-1.92, this value is still optimal for tilapia. Where each treatment has the same effect on FCR. In accordance with the results of the study (Fathul et al. 2023) which showed the optimal FCR for tilapia is 0.8-1.6. When tilapia growth is high, feed conversion will be low. This is in accordance with the statement (Abidin et al. 2015) that the feed conversion value is correlated with the growth rate. The higher the growth value, the lower the feed conversion ratio can be. According to (Budiyati et al. 2023) the lower the FCR value, the more effective the use of feed by fish for growth. The feed conversion value is still considered good if it is less than 3. The lower the value, the higher the quality of the feed and the better the efficiency of the fish in utilizing the feed it consumes for fish growth.

The survival rate obtained in this study was optimal with a range of 77.78% - 84.44%. This is in line with previous studies, namely that tilapia weighing 4-7 grams had the highest survival rate of 83.3% and the lowest of 69% Supardan et al., (2023). Based on the statement (Ririhena and Palinussa 2021) it states that the survival rate (SR) ≥50% is classified as good, survival of 30 - 50% is moderate and less than 31% is not good. This shows that giving maggots as feed has no effect on fish survival. It is suspected that the feed used is not soluble in water so that the environmental conditions of the fish are suitable for the survival of tilapia, so that the tilapia that are kept can adapt to their environment. According to Vardian et al., (2013) survival is influenced by internal and external factors, where internal factors are factors from the individual tilapia itself, while external factors are factors influenced by the quality of the feed and the quality of the water itself.

Blood glucose of tilapia fish at the beginning of the study ranged from 65-72.6, while blood glucose at the end of the study ranged from 73.3-96.6, indicating that there was an increase during the study. In this study, the highest blood glucose was at P2 at 96.6 and the lowest at P1 at 73.3. The blood glucose levels of tilapia fish are in the optimal range. Based on the statement of Hartanti et al., (2013) glucose levels in tilapia fish under normal conditions range from 41-150 mg/dl. High glucose levels in fish indicate stress experienced by the fish due to increased maintenance temperatures. Stress experienced by fish causes hyperglycemia, which is the process of increasing blood glucose levels rapidly over a certain period of time, this condition will gradually affect fish growth and even further result in death in farmed animals (Yunus 2023). Therefore, efforts are needed to handle it so that fish blood glucose levels can immediately return to normal levels after the fish experience stress so as not to affect fish growth. In this stressful state, fish will experience homeostasis disorders with the characteristics of the body continuing to release glucose as an energy supplier during the duration of stress (Istikomah 2024). In line with the increase in blood glucose, it will also directly impact the increase in cortisol levels in the blood due to stress. This increase in cortisol levels will affect the performance of insulin in the blood. Meanwhile, the role of insulin is very much needed to mobilize glucose in the blood so that it can enter cells. By continuing to increase and accumulate glucose in the blood, it will give a signal to the nerve center as a sign that the fish feels full so that its appetite decreases (Yunus 2023).

The water quality obtained during the study still showed a normal range. The temperature obtained was around 28.30C, still in the optimal range for tilapia growth, this is in accordance with Supardan et al., (2023). The optimal temperature for tilapia growth is 28 - 32 ^{0}C. Low temperatures cause low metabolism which results in decreased fish appetite, causing slow growth. The dissolved oxygen (DO) value in this study ranged from 7.3-7.4 mg/l, where this DO value shows a range of values that are still optimal. According to Mardiana et al., (2023) namely 4.1 - 7.8 mg/l. The level of dissolved oxygen in water is influenced by temperature, salinity, water turbulence, and atmospheric pressure, while the decrease in dissolved oxygen levels is influenced by increasing temperature, altitude, and decreasing atmospheric pressure (Supardan et al., 2023). Based on the pH value obtained from the research results ranging from 7.4-7.7, in this case the pH value obtained is still tolerable for Tilapia. According to Supardan et al., (2023) In general, the ideal pH number is between 4 - 9, but for optimal growth for tilapia, the ideal pH is between 6 – 8.

CONCLUSION

The provision of maggots maintained in different media provided the best growth of tilapia (Oreochromis niloticus) in P1 (household waste) with an absolute weight of 11.42 g, SGR of 1.67%/day, absolute length of 4.92 cm and LPPS of 1.02%/day, FCR 1.9, survival rate of 84.44%, and blood glucose of 73.3 mg.

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