

THE EFFECT OF ADDITION MELINJO FRUIT PEEL FLOUR ON FEED TO ENHANCE THE COLOR QUALITY OF GUPPY FISH (*Poecilia reticulata*)

Pengaruh Penambahan Tepung Kulit Melinjo dalam Pakan Terhadap Peningkatan Kualitas Warna Ikan Guppy (*Poecilia reticulata*)

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(Received May 2th 2024; Accepted June 10th 2024)

ABSTRACT

Carotenoids that are added to feed can improve the color quality of fish because they cannot synthesize the color in their bodies. This research aimed to determine the effect of adding Melinjo Fruit Peel Flour on feed to enhance the color quality of Guppies. The experiment used a completely randomized design with five treatments (Melinjo Fruit Peel Flour 0%, 2,5%, 5%, 7,5%, and 10%) and three replications. Data were analyzed using analysis of variance (ANOVA) and significantly different between treatments were analyzed using Duncan's test. The results showed that the addition of 10% Melinjo Fruit Peel Flour on feed had a significant effect to enhance the color quality of Guppies 2,26% in orange and 3,05% in blue. The results showed that the addition of 10% Melinjo Fruit Peel Flour on feed gives the best growth with a weight of 0,32 g/head, length of 0,60 cm/head, and survival rate of 95,8%.

Keywords: Carotenoid, Guppy, Melinjo Fruit Peel

ABSTRAK

Sumber karotenoid yang ditambahkan dalam pakan dapat meningkatkan kualitas warna karena ikan tidak dapat mensintesis warna dalam tubuhnya. Penelitian ini bertujuan untuk mengetahui pengaruh penambahan tepung kulit melinjo dalam pakan terhadap peningkatan kualitas warna ikan guppy. Rancangan percobaan yang digunakan adalah Rancangan Acak Lengkap (RAL) dengan lima perlakuan (Tepung Kulit Melinjo 0%, 2,5%, 5%, 7,5%, dan 10%) dan tiga kali ulangan. Data dianalisis menggunakan analisis ragam (ANOVA) dan berbeda nyata antar perlakuan yang dianalisa menggunakan Uji Jarak Berganda Duncan atau DMRT (Duncan's Multiple Range Test). Hasil penelitian menunjukkan bahwa penambahan tepung kulit melinjo 10% pada pakan memberikan pengaruh nyata terhadap peningkatan kualitas warna ikan guppy yaitu pada warna oranye (jingga) sebesar 2,26% dan pada warna biru sebesar 3,05%. Hasil penelitian menunjukkan bahwa penambahan tepung kulit melinjo 10% pada pakan memberikan pertumbuhan terbaik dengan nilai pertumbuhan bobot 0,32 g/ekor, panjang 0,60 cm/ekor, dan kelangsungan hidup 95,8%.

Kata Kunci: Guppy, Karotenoid, Kulit Melinjo

INTRODUCTION

Freshwater ornamental fish is one of the fishery commodities that has the opportunity to improve the community's economy due to its development. According to the Badan Pusat Statistika (2019), the production of ornamental fish cultivation in Indonesia is 1,297,021. The quality and selling price of ornamental fish is determined based on the brightness of their body color, where the more attractive the color of the fish, the higher the value or price of the ornamental fish. One type of freshwater ornamental fish that is popular with people is the guppy fish. This fish is widely cultivated because it is easy to maintain and the beauty of its color. Guppy fish have a variety of colors such as red, blue, yellow and other colors so they are often collected as aquarium ornamental fish (Pratama *et al.*, 2018).

The problem usually experienced by ornamental fish farmers is the decline in the color quality of the fish over time. A decrease in the quality of fish color can be caused by little or no source of dye (color pigment) in the feed (Pangulu *et al.*, 2021). Fish cannot synthesize color in their bodies, so they need a source of color added to their feed, one of which is the addition of melinjo fruit peel flour. According to Basoruddin *et al.*, (2022) that red melinjo fruit peel extract showed the highest total value for phenolics (0.386 mg GAE/g sample), β -carotene (185.275 ppm), lycopene (12.13 mg/100 g), total carotenoids (241.22 ppm) and vitamin C (9.23 mg/100 mL). Carotenoids are the main source of pigmentation in ornamental fish which can produce color. Information regarding the addition of melinjo skin as a natural pigment for coloring fish is still very limited. The aim of the research was to determine the effect and best dosage of adding melinjo peel flour to feed to improve the color quality of guppy fish. The benefits of the research are as information in carrying out further research regarding the addition of melinjo peel flour in feed to improve the color quality of guppy fish, as well as adding information on the best dose of adding melinjo peel flour to feed to improve the color quality of guppy fish.

METHODS

Research Implementation

The research was carried out for 30 days in December 2022-January 2023 at the Faculty of Agriculture, Tidar University, Magelang. The materials used are guppy fish 2-2.5 cm long, feed (Prima Feed PF-500), melinjo peel flour, and progol. The tools used were 15 aquariums, aerators, thermometers, pH meters, DO meters (HANNA), digital scales (Chrom Tech), blenders (Miyako), ovens (Bionex), scoops, rulers, sieves, laptops and the Adobe Photoshop application. CS.6, stationery, camera (cellphone), mini photo studio, and siphon hose. The research used a Completely Randomized Design (CRD) with 5 treatments and 3 replications. The treatment used the addition of melinjo peel flour at different doses in the feed, namely P1 (0%), P2 (2.5%), P3 (5%), P4 (7.5%), and P5 (10%).

Preparation of Research Containers

The maintenance containers used were 15 aquariums measuring 30 x 20 x 20 cm. Preparation of the container begins with washing, then drying, then the container is ready for use and filled with 10 liters of water equipped with aeration.

Preparation of Test Animals

The test fish used were guppy fish with a length of 2-2.5 cm and a weight of 0.15-0.20 g. Before being given treatment, the fish were acclimatized for one week. During acclimatization, the fish were given test feed that had not been added to melinjo peel flour 2 times a day. Stocking density of 8 fish per aquarium.

Feed Preparation

The feed used is commercial feed with the brand Prima Feed Floating Fish Seed Feed PF-500 with 35% protein. According to Wahyuni *et al.*, (2017), making melinjo skin flour

begins by selecting the red melinjo skin and separating it from the seeds, then washing it. Then, dry the melinjo skin at a temperature of 40 o C until the water content is below 10% for 8 hours, then grind it with a blender and sift it. The feed preparation stage is based on the dosage of melinjo flour according to Marnani *et al.*, (2022), namely:

- P1 (0%) = 100 g commercial feed
- P2 (2.5%) = 2.5 g melinjo peel flour + 97.5 g commercial feed
- P3 (5%) = 5 g melinjo peel flour + 95 g commercial feed
- P4 (7.5%) = 7.5 g melinjo peel flour + 92.5 g commercial feed
- P5 (10%) = 10 g melinjo peel flour + 90 g commercial feed

The stage of mixing flour in feed starts with flour according to the specified dose and progol (5 gr/kg feed) as feed adhesive, mixed in a container and stirred thoroughly, then water is added (150 ml/kg feed) and left for 10 minutes. Then, the feed is poured into a container of flour mixed with progol, then stirred until evenly mixed into the feed and dried in the air.

Fish Maintenance

Fish are reared for 30 days with a feeding frequency of 2 times a day, namely 08.00 and 16.00 WIB. Feeding is 3% of the fish's body weight (Marnani *et al.*, 2022). Water quality measurements, namely temperature, are carried out every day in the morning and evening, pH and DO measurements are carried out once a week.

Research Parameters

Guppy Fish Color Quality

Fish sampling was carried out at the beginning and end of the study. The calculation of the color increase for each treatment focuses on orange and blue. Observations of the color of guppy fish were carried out using the Adobe Photoshop CS.6 application to determine the same color code in the photos of the fish being studied. Color calculations use the following formula:

$$\text{Grid Code} = \frac{\text{number of grids per code}}{\text{total number of grids}} \times 100\%$$

The results of calculating the percentage of color obtained are followed by calculating the average for each treatment. Then, to find out which treatment provides the best improvement, use the formula:

$$Pw = Wak - Waw$$

Information:

- Pw = Color enhancement
- Wak = Final color (%)
- Waw = Initial color (%)

Absolute Growth

Absolute growth consists of two, namely absolute length growth and absolute weight growth. Absolute length growth according to Simamora *et al.*, (2021), namely as follows:

$$Lm = Lt - Lo$$

Information:

- Lm : Absolute length growth (cm)
- Lt : Final average length (cm)
- Lo : Initial average length (cm)

Absolute weight growth is calculated using the formula in Simamora *et al.*, (2021), which is as follows:

$$W = Wt - Wo$$

Information:

- W : Absolute weight growth (g)
- Wt : Final average weight (g)
- Wow : initial average weight (g)

Survival Rate

The calculation of the survival value of the test fish is obtained by following the formula of Mentari *et al.*, (2016), namely as follows:

$$SR = \frac{N_t}{N_o} \times 100\%$$

Information:

SR : Survival of test animals (%)

Nt : Number of test fish at the end of the study (tails)

No : Number of test fish at the start of the study (tails)

Data Analysis

Statistical analysis of the research used one-way ANOVA analysis of variance with an error level of $\alpha = 0.05$ and 0.01 to determine whether or not there was an effect of giving melinjo peel flour in the feed on increasing the color quality of guppy fish. If in the calculations the results are significantly different ($P < 0.05$) or very significantly different ($P < 0.01$), then a DMRT (Duncan's Multiple Range Test) follow-up test is carried out using SPSS version 26 software.

RESULT

Improving the Color Quality of Guppy Fish (*Poecilia reticulata*)

The addition of melinjo peel flour to the feed of guppy fish kept for 30 days was analyzed focusing on increasing the orange and blue color. The percentage increase in the quality of orange color in guppies given additional feed with melinjo peel flour at different doses using *Adobe Photoshop* is presented in Table 1.

Table 1. Average Results of Measurements of Increase in Orange Color in Guppy Fish

Treatment	Measurement Period		Color Enhancement
	Initial Color	Final Color	
P1 (0%)	2.07%	2.45%	0.38%
P2 (2.5%)	2.07%	2.57%	0.50%
P3 (5%)	2.07%	2.83%	0.76%
P4 (7.5%)	2.07%	3.46%	1.39%
P5 (10%)	2.07%	4.33%	2.26%

The increase in the blue color of guppy fish was calculated using *Adobe Photoshop*, then analyzed and presented in Table 2. According to Solihah *et al.*, (2015) that if carotenoids bind to protein they will become carotenoproteins which produce blue and purple colors.

Table 2. Average Results of Measuring The Increase In Blue Color In Guppy Fish

Treatment	Measurement Period		Color Enhancement
	Initial Color	Final Color	
P1 (0%)	0.85%	1.13%	0.28%
P2 (2.5%)	0.85%	1.80%	0.95%
P3 (5%)	0.85%	2.68%	1.83%
P4 (7.5%)	0.85%	3.03%	2.18%
P5 (10%)	0.85%	3.90%	3.05%

Absolute Weight Growth of Guppy Fish (*Poecilia reticulata*)

Data on the absolute weight growth of guppy fish during the study is presented in Figure 1. The data included is the result of calculations from the average final weight minus the average initial weight of the fish during rearing.

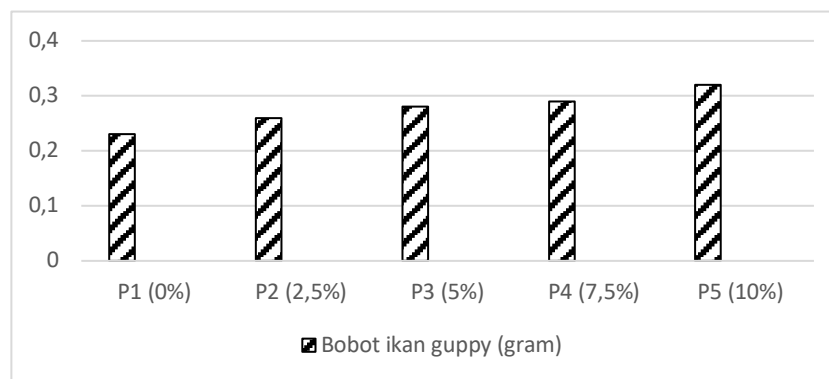


Figure 1. Average Absolute Weight Growth of Guppy Fish (grams)

Absolute Length Growth of Guppy Fish (*Poecilia reticulata*)

The results of measuring the absolute length growth of guppy fish can be seen in Figure 2. Based on the length growth measurements, the data entered in the table is the average final length minus the average initial length of the fish during the study.

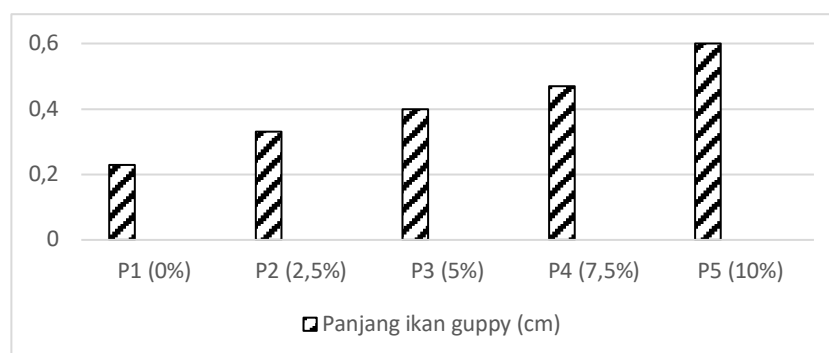


Figure 2. Average Absolute Length Growth of Guppy Fish (cm)

Survival of Guppy Fish (*Poecilia reticulata*)

Survival is the comparison between the number of individuals alive at the end of the study and the number of individuals at the start of the study. The survival rate of guppy fish can be seen in Figure 3.

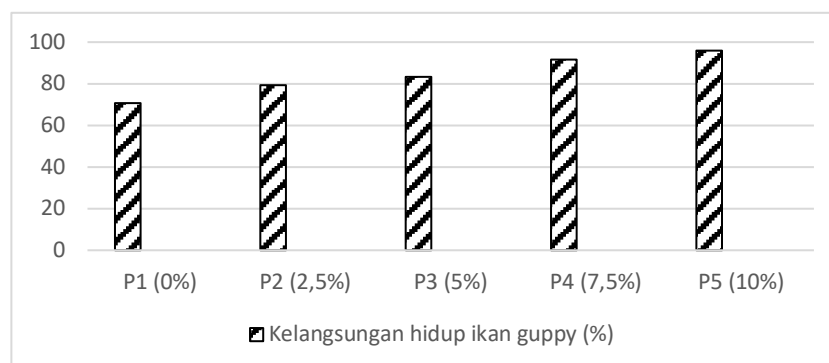


Figure 3. Average Survival of Guppy Fish During Maintenance

Water Quality

The water quality parameters observed during the research were temperature, pH, and DO. Water quality measurement data during the study is presented in Table 3.

Table 3. Results of Water Quality Measurements in Research Media

Parameter	Treatment					Normal Standards Based on References
	1	2	3	4	5	
Temperature (°C)	24.5 – 26.7	24.5 – 26.6	24.5 – 26.5	24.5 – 26.5	24.5 – 26.8	22- 27 (Muttaqin <i>et al.</i> , 2022)
DO (mg/L)	6.02 – 6.46	6.07 – 6.45	6.11 – 6.48	6.07 – 6.45	6.00 – 6.46	3 – 6.8 (Malik <i>et al.</i> , 2019)
pH	6.8 – 7.6	6.9 – 7.6	7.0 – 7.6	7.0 – 7.6	6.8 – 7.6	6.8 – 8 (Malik <i>et al.</i> , 2019)

DISCUSSION

Improving the Color Quality of Guppy Fish (*Poecilia reticulata*)

The results of research on the average measurement results of increasing orange color in Guppy Fish which are presented in Table 1 show that the addition of melinjo peel flour to the feed provides an increase in orange color in guppy fish. The result of an increase in the orange color value in all treatments is thought to be the higher the carotenoid (β -carotene) content in melinjo peel flour with more doses added. According to Rachmawati *et al.*, (2016) that the increase in fish color depends on the amount of feed, especially the composition of the feed, the greater the dose of carotenoids, the brighter the color on the fish's body. Treatment P1 (control) showed the lowest increase, thought to be due to increasing fish age. According to Simbolon *et al.*, (2021) that the color of fish will increase normally with age so that this will indirectly influence color changes. SPSS 26 analysis concluded that the addition of melinjo peel flour to feed had a real effect. This is in accordance with Basoruddin *et al.*, (2022) that adding melinjo fruit skin to feed has a real influence on the brightness of color in goldfish, namely yellow-orange.

The research results in Table 2 show that all treatments experienced an increase in the blue color of the guppy fish's body. The difference in the increase in blue color for each treatment is thought to be due to differences in the dose of melinjo peel flour added to the feed. According to Solihah *et al.*, (2015), the increase in color in each treatment was caused by different levels of fish absorption of the type and amount of carotenoids given. Treatment P1 (control) showed the lowest results, thought to be due to the absence of adding melinjo peel flour to the feed, however, the increase in blue color in the fish was thought to be due to genetic factors. According to Afini *et al.*, (2016) genetically, fish body color patterns are also a phenotype that is inherited. SPSS 26 data analysis concluded that the addition of melinjo peel flour to feed had a real effect on increasing the blue color of guppy fish. This is in accordance with research by Apriasih *et al.*, (2021) that changes the color of guppy fish with the addition of red peppers and red spinach which contain carotenoids (β -carotene) to the feed resulting in blue and purple colors.

Absolute Weight Growth of Guppy Fish (*Poecilia reticulata*)

Based on data on the absolute weight growth of guppy fish during the research presented in Figure 1, it shows the highest to lowest weight growth, namely treatments P5, P4, P3, P2, and P1 with values respectively 0.32 grams, 0.29 grams, 0.28 grams, 0.26 grams, and 0.23 grams. Treatment 5 (10%) resulted in the highest growth, presumably because melinjo peel flour contains nutrients such as carotenoids, vitamin C and protein needed for growth. According to Hidayah *et al.*, (2022) that carotenoids play a positive role in increasing nutrient utilization which leads to increased growth. Khairiman *et al.*, (2022) adding vitamin C physiologically causes fish to be more active and have a higher appetite so that growth increases. Purba *et al.*, (2020) also added that protein content influences fish growth by forming new tissue for growth and replacing damaged tissue. These components, if utilized properly,

will encourage growth in fish. SPSS 26 analysis concluded that the addition of melinjo peel flour had a real influence on the absolute weight growth of guppy fish.

Absolute Length Growth of Guppy Fish (*Poecilia reticulata*)

Based on the results of measuring the absolute length growth of guppy fish which are presented in Figure 2, the absolute length of guppy fish in treatment 5 shows a higher average length value compared to other treatments. Treatment P5 (10%) produced the highest value, namely 0.6 cm. This is thought to be because the nutritional content such as protein, carotenoids and vitamin C from melinjo skin flour can be utilized by guppy fish. According to Septiyan *et al.*, (2017) that the increase in fish length occurs due to the nutritional feed given to the fish. Based on the ANOVA test, it shows a real influence on the length growth of guppy fish.

Survival Rate of Guppy Fish (*Poecilia reticulata*)

The average survival of guppy fish during rearing presented in Figure 3 shows that the highest average survival of guppy fish was in the P5 treatment at 95.8% and the lowest was P1 (control) at 70.8%. The average survival results of guppy fish in the study were classified as good. This is in accordance with Afdola's (2018) statement that a survival rate of >50% is considered good, survival of 30 – 50% is moderate, and survival <30% is classified as poor. Based on the research results, increasing the dose of melinjo peel flour in the feed showed increased survival. This is thought to be because melinjo peel flour contains vitamin C which helps reduce mortality rates. According to Khairiman *et al.*, (2022) that giving vitamin C can support the survival of fish by increasing immunity, so that fish are healthier and more active. The carotenoid content of melinjo peel flour is thought to also play a role in improving the fish's immune system. This is in accordance with Mustaqim *et al.*, (2021) that fish that consume carotenoids can not only help with color formation but also improve the body's immune system.

Water Quality

Based on the results of water quality measurements in the research media, it shows that the water temperature in the container is classified as normal. According to Muttaqin *et al.*, (2022) that guppy fish can live at a water temperature of 22-27 °C. The DO content during the study was 6.00–6.48 mg/L. Based on these results, the dissolved oxygen content is said to be good for guppy fish. According to Malik *et al.*, (2019) that the DO that fish can tolerate is between 3–6.8 mg/L. The pH at the time of the study was around 6.8–7.6, this range is still the optimal limit for guppy fish. According to Malik *et al.*, (2019) the optimal pH range for the survival of guppy fish is 6.8 – 8. The water quality parameter values produced in the research show that guppy fish are in a suitable environment.

CONCLUSION

Based on the results of the discussion, it can be concluded that adding melinjo shell flour to the feed has an effect on improving the color quality of guppy fish. The best treatment for improving the color quality of guppy fish is the addition of melinjo peel flour at a dose of 10% to the feed, namely 2.26% orange and 3.05% blue. The best growth, namely a weight of 0.32 grams, a length of 0.6 cm, and the best *survival rate* of 95.8% were also obtained in the treatment with the addition of melinjo peel flour at a dose of 10%.

ACKNOWLEDGEMENT

The author would like to thank Mrs. Andri Nofreeana and Mr. Eric Armando as supervisors in providing assistance during the research through to the writing process, as well as all parties who directly or indirectly helped in carrying out the research.

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