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EFFECT OF DIFFERENT CONTAINER COLOURS ON THE PRODUCTION PERFORMANCE OF KOI FISH (*Cyprinus carpio*)

Pengaruh Warna Wadah Yang Berbeda Terhadap Kinerja Produksi Ikan Koi (*Cyprinus carpio*)

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ABSTRCT

The selling value of koi fish can be seen from the quality of its color and body shape. According to Putriana et al., (2015), the criteria for selecting a good koi fish are having an ideal body shape, brilliant color and contrast without any color gradations or shadows. The aim of this research was to determine the effect of container color on improving the color quality of koi fish (*Cyprinus carpio*), the growth of koi fish (*Cyprinus carpio*) and the survival of koi fish (*Cyprinus carpio*). The research used an experimental method with a Completely Randomized Design (CRD) which included 5 different container color treatments, namely Control (transparent), red, yellow, white and black. The data obtained was tabulated in Microsoft Excel, then analyzed statistically using SPSS software. The results of the research showed that the treatment applied had a real effect on growth, but did not make a significant difference in the survival rate of koi fish and increased color quality. The highest growth value was found in the black treatment (H), namely absolute weight growth (PBM) of 12.9 ± 0.6b g.

ABSTRAK

Nilai jual ikan koi dilihat dari kualitas warna dan bentuk tubuhnya. Menurut Putriana dkk., (2015), kriteria pemilihan ikan koi yang baik adalah mempunyai bentuk tubuh yang ideal, warna cemerlang dan kontras tanpa ada gradasi warna atau bayangan. Tujuan penelitian ini adalah untuk mengetahui pengaruh warna wadah terhadap peningkatan kualitas warna ikan koi (*Cyprinus carpio*), pertumbuhan ikan koi (*Cyprinus carpio*) dan kelangsungan hidup ikan koi (*Cyprinus carpio*). Penelitian ini menggunakan metode eksperimen dengan Rancangan Acak Lengkap (RAL) yang meliputi 5 perlakuan warna wadah berbeda yaitu Kontrol (transparan), merah, kuning, putih dan hitam. Data yang diperoleh ditabulasikan dalam Microsoft Excel, kemudian dianalisis secara statistik menggunakan software SPSS. Hasil penelitian menunjukkan bahwa perlakuan yang diterapkan memberikan pengaruh nyata terhadap pertumbuhan, namun tidak memberikan perbedaan yang signifikan terhadap tingkat kelangsungan hidup ikan koi dan peningkatan kualitas warna. Nilai pertumbuhan tertinggi terdapat pada perlakuan hitam (H) yaitu pertumbuhan bobot mutlak (PBM) sebesar 12,9 ± 0,6b g.

Kata Kunci	*Warna wadah, performa produksi, ikan koi, cyprinus carpio*
Keywords	*Container color, production performance, koi fish, cyprinus carpio*
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INTRODUCTION

Indonesia is a fairly large exporter of ornamental fish, with around tens of millions of ornamental fish per month, one of which is koi fish. According to Yanuhar et al., (2019), the export value of Indonesian koi fish continues to increase, namely in 2010 the export value was around 12 million dollars, increasing to 20 million dollars in 2011 and the export value of koi fish reached 65 million dollars in 2016.

Koi fish are freshwater ornamental fish that are related to goldfish or carp and have high economic value. Based on the results of interviews with koi fish cultivators in Lenek village, Aikmel District, the selling price of koi fish increases in size and age, the price of koi fish will be higher, starting from Rp. 500-Rp.1,000 for ages 1-2 months with a size of 1-3 cm, Rp.1,500-Rp.4,000 for ages 3-4 months with a size of 3-8 cm... The selling value of koi fish can be seen from the quality of color and shape ideal body. According to Putriana et al., (2015), the criteria for selecting a good koi fish are having an ideal body shape, not widening, not having a bent spine, brilliant and contrasting colors without any color gradations or shadows, the fish's movements are calm but agile, and not be alone and sick. The obstacles in cultivating koi fish are the low survival rate, relatively slow fish growth, and the decreasing brightness level of koi fish (Emaliana & Usman, 2015).

Color is a parameter in determining the selling value of ornamental fish. The brighter the color of a type of ornamental fish, the higher its selling value. This causes farmers to try to maintain the beautiful color of the fish. Color changes that often occur are caused by changes in the amount of pigment. According to Said & Supyawati (2017), the decrease in pigment is caused by environmental stress such as sunlight, water quality and pigment content in feed. The brightness of the color of koi fish is influenced by genetic, environmental and nutritional factors. Apart from that, according to Rahmawati et al., (2016), the sensitivity of koi fish body color to improve the color quality of the fish can be influenced by the color of the container.

Much research has been done on the effect of container color on fish. Zulfikar et al., (2018) used blue, red, yellow and green when rearing clownfish for 45 days and found that the color of the container had an effect on survival and growth with the best color being blue. These results are the same as the results of Subiyanto's (2013) research, using green, blue, yellow and red containers to obtain the best results, namely blue. Another research by Pratama (2018), using transparent, black, yellow and silver colors on guppy fish, showed that there was an influence of the color of the container on increasing color intensity in guppy fish and the best results were with transparent colors. This is also the same as research conducted by Kusuma (2019), on areca nut trophy fish, which used transparent container colors, brown, red and blue and obtained the best results for survival and growth, namely transparent colors.

The aim of this research was to determine the effect of container color on improving the color quality of koi fish (*Cyprinus carpio*), the growth of koi fish (*C. carpio*) and the survival of koi fish (*C. carpio*). The benefit obtained from the research is that it is able to provide information to the public, especially koi fish farmers, regarding the correct container color to improve the color quality of koi fish (*C. carpio*), the growth of koi fish (*C. carpio*) and the survival of koi fish (*C. carpio*), so as to maintain the quality and selling price of koi fish (*C. carpio*).

RESEARCH METHOD

The research used an experimental method with a Completely Randomized Design (CRD) which included 5 treatments and 3 replications, namely Treatment B: Control (using transparent color); Treatment M: Red container; Treatment K: Yellow container; Treatment P: White container; Treatment H: Black container. The container used is an aquarium measuring 30cm x 20cm x 30cm. The aquarium that is ready is then lined with colored plastic on each side and filled with 20 cm of water/aquarium equipped with aeration. The water that will be used comes from the well of the Aquaculture Study Program, Mataram University.

15 containers in the form of aquariums are prepared, with dimensions of 30cm x 30cm x 30cm. The container is filled with water to a height of 20cm/aquarium, and 6 fish are put in/container measuring 5-8cm. Before being put into the container, the fish are first acclimatized for 30 minutes and then kept for 24 hours in a holding tank to help the fish adapt to the new environment. Fish that have been acclimatized are divided into each aquarium with a total of 6 fish/aquarium with predetermined treatment groups. Feeding is carried out three times a day in the morning (07.00), afternoon (13.00) and afternoon (17.00), using the adlibitum or excessive method. Control During the research, the container and aeration were controlled every day and the media/test container water was changed at least once every 2 days, amounting to 20-30% of the total amount of water (Yurayama, 2018).

Observation Variables

Increased Color Brightness (ICB)

The PKW value was measured by taking pictures of the fish using a cellphone camera with a camera resolution of 12 megapixel wide angle + 12 megapixel telephoto with a distance between the fish of 10-20 cm depending on the size of the fish. The resulting photos were then analyzed for brightness (B) values using the Photoshop CS5 application with 5 repetitions (Oktaviani et al., 2020). The body parts taken are those that have the same color, namely red, black, yellow and white found on the top of the koi fish (back). According to (Aprilia et al., 2018) changes in fish color can be measured using the formula:

$$PKW = Ct - Co$$

Note :
PKW = Increased brightness (%) ; Ct = Final color value of research (%) ; Co = Initial color value of research (%)

Wavelength of Light

The wavelength of light is measured using a luxmeter with the unit of wavelength being lux. Light wavelength measurements were carried out on days 0, 15, 30, and 45.

Survival Rate (SR)

As for the way to determine the results of the fish survival rate, one must know the number of fish at the start of stocking in the research and the number of fish that are still alive at the end of the research and then enter it into the percentage formula (SR).

$$TKH = \frac{Nt}{No} \times 100$$

Note :
TKH = Survival Rate ; Nt = Number of live fish at the end of the experiment ; No = Number of fish at the start of the experiment

Absolute Weight Growth (AWG)

According to (Aprilia et al., 2018) the formula for measuring absolute weight growth is as follows:

$$PBM = Wt - Wo$$

Note :
PBM = Absolute Weight Griwth (gr/ekor) ; Wt = Final average weight (gr/ekor) ; Wo = Initial average weight (gr/ekor)

Feed Conversion Ratio (FCR)

Feed Convertion Ratio (FCR) or the feed conversion ratio value is used to determine the feed conversion ratio, namely the weight of the animal at the start of the study, the weight of the animal at the end of the study, the number of fish observed, and the amount of feed given. Scabra et al., (2021a) calculated the RKP value using the following formula:

$$FCR = \frac{F}{(Wt + D) - W0}$$

Note :
FCR = Feed Convertion Ratio(gr) ; Wo = Weight of test animals at the start of the stu (gr); Wt = Weight of test animals at the end of the study (gr); D = Total weight of dead fish (gr); F = Amount of feed given (gr)

Water Quality

The water quality parameters you want to know are water temperature, pH, ammonia and DO. For pH, water temperature, and DO, measurements were carried out on days 0, 15, 30, and 45, while for ammonia it was carried out at the beginning and end of the study.

RESULT AND DISCUSSION

Improved Color Quality (ICQ)

Increasing the color quality of koi fish (*Cyprinus carpio*) based on the brightness value test results listed in the Photoshop CS5 application. The value of increasing the color quality of koi fish during this research is presented in the form of tables and graphs. The brightness of the color of koi fish is important to analyze because color brightness is an indicator that determines the attractiveness and selling price of ornamental fish. Data on the brightness values of koi fish based on ANOVA analysis of variance can be seen in the table and graph of the increase in brightness of white, black, yellow and red colors in koi fish.

The increase in white brightness values in koi fish during the 45 day rearing period with different colored containers can be presented in the form of tables and graphs. Data on increasing the brightness of white color in koi fish can be seen in Figure 1. From the graph above, it can be seen that the increase in fish color quality during the 45 day rearing period has results that are not significantly different between treatments.

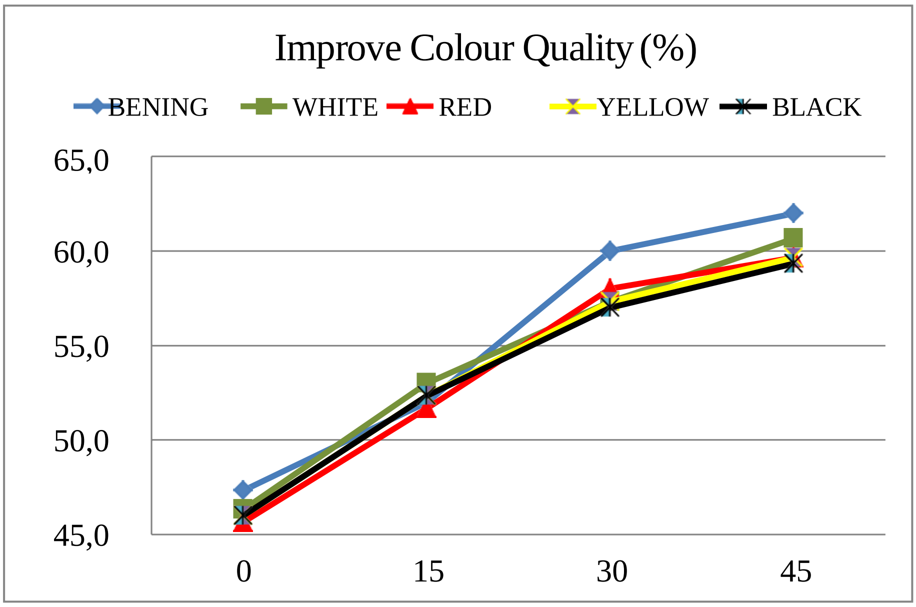

Figure 1. Progress graph of improving color quality

Improve the color quality of koi fish during the research by observing on day 0, day 15, day 30 and day 45. The data displayed is data on increasing the brightness value (brightness) of the color of koi fish in white, black, yellow and red in each treatment during the research. The unit of brightness value is percent (%). The feed used during the research was 1mm takari feed with a protein content of 30%.

Based on the data in Figure 1, the increase in fish color quality during the 45 day rearing period with the highest to lowest increase in color quality occurring in the clear (B), white (P), red (M), yellow (K) and black (H) treatments, with the values respectively are 14.7%, 14.3%, 14.0%, 13.7%, and 13.0%. The results of the one-way ANOVA analysis of variance showed that using different container colors to increase the white color showed results that were not significantly different ($p<0.05$), so no further Duncan test was carried out. This shows that the treatment did not have a real effect on improving the color quality of koi fish.

Based on Figure 1, it is known that treatment B (clear) provides the highest color quality improvement value and treatment H (black) provides the smallest color quality improvement value. This is thought to be caused by the wavelength of light in treatment (B), clear having the largest wavelength of light because the clear color reflects all the light and none of it is absorbed, whereas in treatment (H) black has the smallest wavelength of light because the black color absorbs all the light elements. and none of it was reflected. Therefore, the increase in fish color quality in treatment (B) clear was greater than in treatment (H) black. According to Pratama (2018), containers that reflect light have a better effect than containers that absorb light in increasing the color of fish, this is due to differences in the location of the movement of pigment granules in chromatophore cells to the existing stimuli.

Chromatophore cells are cells that give color to fish. According to Oktaviani et al., (2020), chromatophore cells are located in the epidermis of the skin and between the scales and contain pigment granules as a light source. Chromatophores can move in the cytoplasm or accumulate on the skin surface. Bright light conditions provide a better improvement in fish color quality compared to dark light conditions. This is because in bright light conditions the chromatophore pigment is distributed within the cells, causing the cells to absorb light perfectly, resulting in a higher color quality increase. Meanwhile, in dark light conditions, chromatopher pigments gather around the nucleus, which causes an increase in the color quality of lower light.

According to Pratama (2018), there are two factors that influence the color quality of fish, namely internal and external factors. Internal factors are factors that originate from within the fish's body and are of a permanent nature, namely genetics. Meanwhile, external factors are factors that come from outside the fish's body, namely the fish rearing media.

Environmental factors influence the level of fish stress, where unfavorable environmental conditions cause the fish being kept to become easily stressed which affects the growth and survival of the fish. According to (Hastuti et al., 2004) in stressful conditions there is a reallocation of metabolic energy from investment activities (such as growth and reproduction) into activities to improve homeostasis, such as respiration, movement, hydromineral regulation and repair. Fish stress levels are caused by rearing media factors such as the wavelength of light entering the water, and water quality such as Ph, DO, temperature, ammonia, etc. According to Dergisi (2015), container color is one of the environmental factors that can influence growth performance, survival and stress response of fish.

According to Amin et al., (2012), the increase in color varies in each treatment because fish have different levels of absorption of color pigments. This is in accordance with the opinion of Zulfikar et al., (2018), that fish have the ability to distinguish colors. This ability is due to the presence of pigment in the fish's eyes, so that fish kept in light conditions will be different from fish kept in dark conditions. This is supported by Pratama (2018), fish kept in light conditions will give different color reactions to fish kept in dark conditions. This is due to differences in the reaction of melanosomes containing melanophore pigment to existing light stimuli.

Wavelength of Light

The wavelength of light is measured using a luxmeter with the unit of wavelength being lux. Light wavelength measurements were carried out on days 0, 15, 30, and 45. Light wavelength data can be seen in Table 1.

Table 1. Light Wavelength Values

No.	Treatment	Wavelength of Light (lux)	Intervals
1	(B) BLACK	39,6-62,3	22,7
2	(R) RED	60,9-93,8	32,9
3	(B) BENING	99,6-134,6	35
4	(W) WHITE	73,1-110,3	37,2
5	(Y) YELLOW	59,1-102,9	43,8

According to (Zulfikar et al., 2018) the wavelength of light is closely related to the penetration of light into water. The high and low light intensity will also affect the distance the fish gather from the light source. The shape and color of the cultivation container will influence the light intensity and wavelength that is reflected back, this condition will influence the development and survival of cultivated fish (Pratama, 2018).

In Table 1 data on light wavelengths during the 45 day maintenance period, the results show that light wavelengths in the black treatment (H) were 39.6-62.3 lux with a wavelength interval of 22.7, in the red treatment (M) 62.9-93, 8 lux with a wavelength interval of 30.9, clear treatment (B) 99.6-134.6 lux with a wavelength interval of 35, white treatment (P) 73.1- 110.3 lux with a wavelength interval of 37.2, and in the yellow treatment (K) 59.1-102.9 lux with a wavelength interval of 43.8.

The wavelength of light affects the level of stress of fish, where unfavorable environmental conditions cause the fish being kept to become easily stressed which affects the growth and survival of the fish. According to Hastuti et al., (2004), under stressful conditions there is a reallocation of metabolic energy from investment activities (such as growth and reproduction) into activities to improve homeostasis, such as respiration, movement, hydromineral regulation and repair. Fish stress levels are caused by rearing media factors such as the wavelength of light entering the water, and water quality such as Ph, DO, temperature, ammonia, etc. According to Dergisi (2015), container color is one of the environmental factors that can influence the growth performance, survival and stress response of fish in cultivation conditions.

According to Üstundag & Rad (2015), container color is one of the environmental factors that can influence the growth performance, survival and stress response of fish in cultivation conditions. This is confirmed by Hastuti et al., (2004), in stressful conditions there is a reallocation of metabolic energy from investment activities (such as growth and reproduction) into activities to improve homeostasis, such as respiration, movement, hydromineral regulation and repair.

Survival Rarte (SR)

Data on the survival rate of koi fish during the study is presented in the form of tables and graphs. The data entered is the result of calculations of the average number of live fish at the end of the study divided by the average number of live fish at the start of the study and multiplied by 100%. Data on the survival rate of koi fish can be seen in Table 2.

Table 2. Survival Rate (SR)

No.	Treatment	Survival Rate (%)
1	(B) BENING	94,4±9,6
2	(Y) YELLOW	94,4±9,6
3	(R) RED	94,4±9,6
4	(W) WHITE	94,4±9,6
5	(B) BLACK	100,0±0,0

One of the parameters for the success of a cultivation activity is survival. Survival rate (SR) is the percentage of fish that are still able to survive from the start to the end of rearing. The data used to determine survival rate (SR) is the number of fish at the start of stocking and the number of fish still alive at the end of the study. The results of research conducted during 45 days of maintenance can be seen in Table 2. Units of survival rate are percent (%).

Based on data on the highest to lowest survival rates for koi fish, namely in the black (H), clear (B), yellow (K), red (M), and white (P) treatments with a survival value of 100.0 ± 0, 0%, 94.4±9.6%, 94.4±9.6%, 94.4±9.6%, and 94.4±9.6%. After carrying out analysis of variance using One-Way Annova, it was found that the use of different container colors on the survival of koi fish showed results that were not significantly different ($p>0.05$), so no further Duncan test was carried out. This shows that using different colored containers has no real effect on the survival of koi fish, which means koi fish can be kept in containers that have different colors.

Different container colors affect the wavelength of light that enters the water, which will affect the survival of fish. According to Pratama (2018), the color of the cultivation container will affect the light intensity and wavelength that is reflected back, this condition will affect the development and survival of cultivated fish. This is supported by the statement of Üstundag & Rad (2015), that the color of the container is one of the environmental factors that can influence the performance of growth, survival and stress response of fish during the cultivation process. According to (Ardi et al., 2017) stressed fish cause hyperglycemia (increased blood glucose levels), which can interfere with further growth and can even be fatal.

However, based on Table 2, the black treatment (H) is the treatment with the highest value, namely 100.0%, followed by other treatments with the same survival value of 9.6%. Fish deaths during research were caused by fish jumping out of the research container. It is thought to be due to stress due to taking pictures, measuring the length and weight of the fish every 15 days, which causes the fish to have to readjust to the environment. This is what causes the fish to become stressed and jump from the rearing container.

Absolute Weight Growth (AWG)

Data on the absolute weight of koi fish during the research is presented in the form of tables and graphs. During the research, koi fish experienced growth rates in length and body weight which can be seen in Table 3 and Figure 2.

Table 3. Absolute Weight Growth Values

No.	Treatment	Absolute Weight (gram/ekor)
1	(Y) YELLOW	8,4±2,0 [a]
2	(R) RED	9,6±0,9 [a]
3	(W) WHITE	9,9±0,7 [a]
4	(B) BENING	10,0±0,9 [a]
5	(B) BLACK	12,9±0,6 [b]

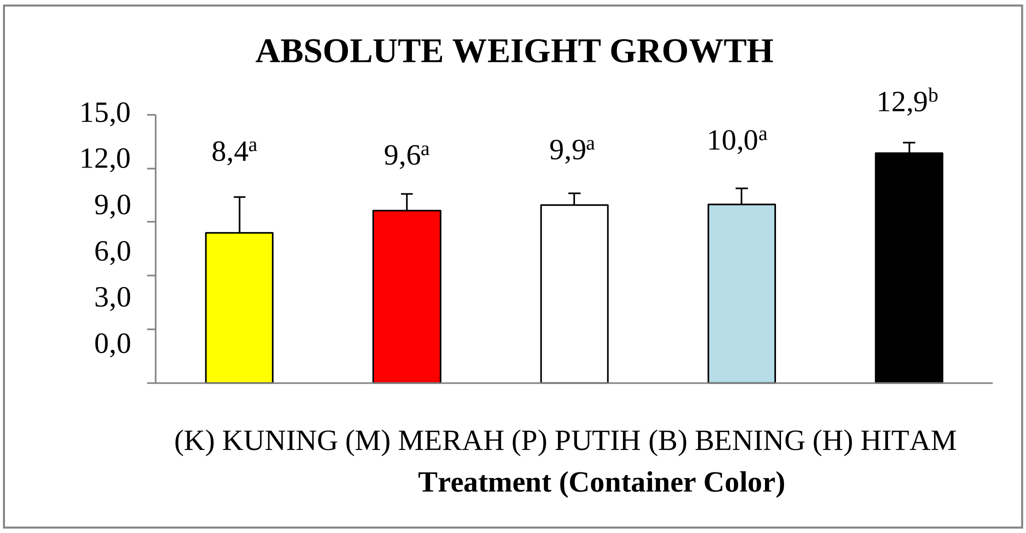

Figure 2. Absolute Weight Growth (PBM) Graph

From the table above, the absolute weight growth values show that the results in the black (H) treatment are significantly different from those in the clear (B), yellow (K), red (M), and white (P) treatments. The clear treatment (B) was significantly different from the black treatment (H), but not significantly different from the yellow (K), red (M), and white (P) treatments.

Absolute weight growth data shows the effect of using different colored containers on koi fish kept for 45 days. Figure 2 and Table 3 show the absolute weight growth in the black (H), white (P), red (M), clear (B), and yellow (K) treatments, with respective values of 12.9 ± 0.6b grams. , 10.0±0.9a gram, 9.9±0.7a gram, 9.6±0.9a gram, and 8.4±2.0a gram.

The results of the one-way ANOVA analysis of variance showed that using different container colors to increase the white color showed significantly different results ($p<0.05$), so a further Duncan test was carried out.

The results of the analysis show that the use of different container colors has a real influence on the absolute weight growth of koi fish. Based on growth data, the highest absolute weight was in the black treatment (H) at 12.9 ± 0.6 grams, the lowest was in the yellow treatment (K) at 8.4 ± 2.0 grams. This is thought to be caused by the color of the container influencing the level of fish food consumption which is related to the fish's ability to see and eat food. According to Zulfikar et al., (2018), the color of the container can influence fish eating behavior. The color of the container also affects the reflection of light which will later affect the fish's vision of the contrast between the food and the background.

Absolute weight growth is also influenced by the wavelength that enters the aquatic environment which will affect the stress level of the fish, where unfavorable environmental conditions cause the fish being kept to be easily stressed which affects the growth and survival of the fish. According to Hastuti et al., (2004), under stressful conditions there is a reallocation of metabolic energy from investment activities (such as growth and reproduction) into activities to improve homeostasis, such as respiration, movement, hydromineral regulation and repair. Fish stress levels are caused by rearing media factors such as the wavelength of light entering the water, and water quality such as Ph, DO, temperature, ammonia, etc. According to Dergisi (2015), container color is one of the environmental factors that can influence the growth performance, survival and stress response of fish in cultivation conditions.

Apart from environmental factors, the internal condition of the fish in relation to the fish's ability to digest and utilize feed is thought to be one of the causes of differences in absolute weight growth. According to Zulfikar et al., (2018), apart from the color of the container, internal factors of the fish such as the ability to digest and utilize feed are thought to be factors limiting fish growth. Fish at the beginning of rearing find it difficult to adapt to the new container in which they are reared. This is what causes the absolute growth of fish to be lower in the first 15 days than in the next 15 days.

Feed Convertion Ratio (FCR)

Feed conversion ratio (FCR) or feed conversion ratio during the research is presented in the form of tables and graphs. The data entered is the result of calculations of the amount of feed consumed during the research then divided by the final fish weight plus the weight of the dead fish and then subtracted by the initial weight. Feed conversion ratio data can be seen in Table 4 and Figure 3.

Table 4. Feed Conversion Ratio Value

No.	**Treatment**	Rasio Konversi Pakan
1	(Y) YELLOW	1,8±0,2 [a]
2	(R) RED	1,6±0,1 [a]
3	(B) BENING	1,5±0,2 [a]

4	(W) WHITE	1,5±0,1 [a]
5	(B) BLACK	1,2±0,0 [b]

From the data above, it can be seen that the feed conversion ratio in the clear (B) treatment is significantly different from the black (H) treatment but not significantly different from the yellow (K), red (M) and white (P) treatments. The black (H) treatment was significantly different from the clear (B), yellow (K), red (M), and white (P) treatments.

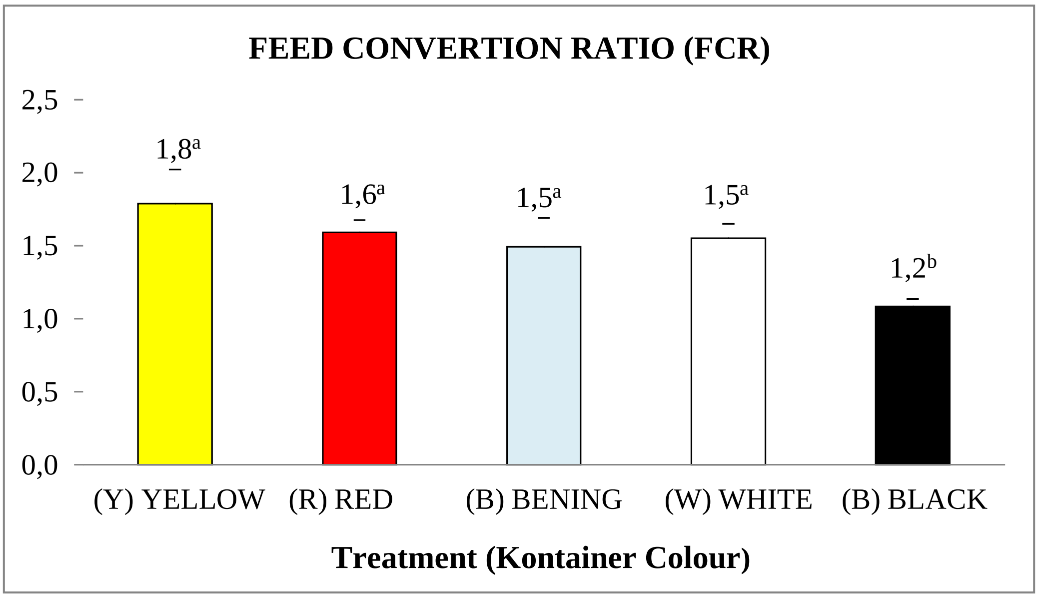

Figure 3. Feed Conversion Graph

The rate of feed conversion ratio (FCR) for koi fish during 45 days of rearing can be seen in Figure 3 and Table 4 showing the highest to lowest feed conversion ratio values, namely yellow (K), red (M), white (P), clear (B), and black (H), with values respectively 1.8 ± 0.2a, 1.6 ± 0.1a, 1.5 ± 0.1a, 1.5 ± 0.2a, and 1 .1±0.0b. The results of the one-way ANOVA analysis of variance showed that using different container colors to increase the feed conversion ratio showed significantly different results ($p<0.05$), so a further Duncan test was carried out. This shows that the use of different container colors has a real effect on increasing the feed conversion ratio in koi fish.

The feed conversion ratio value is where the lower the feed conversion ratio value, the better it is for fish growth and development. Therefore, the black treatment (H) with the lowest feed conversion ratio value of 1.1 ± 0.0b has the best feed efficiency value, where to get 1 kg of fish weight requires 1.2 kg of feed. Meanwhile, the yellow (K) treatment with the highest feed conversion ratio value of 1.8 ± 0.2a was the worst feeding efficiency value, where to get 1 kg of fish weight, 1.8 kg of feed was needed. This is confirmed by Aprilia et al., (2018), the higher the feed efficiency value indicates the less efficient use of feed by fish.

The lack of feed efficiency in the yellow treatment is thought to be caused by environmental stress and the fish's ability to see food. According to Zulfikar et al., (2018), the color of the container can influence fish eating behavior. The color of the container also affects the reflection of light which will affect the fish's vision of the contrast between the food and the background. Scabra et al., (2021b) stated that fish kept in limited containers with low light intensity can limit the fish's activity in carrying out various activities. Internal fish factors such as the ability to digest and utilize feed are thought to be factors limiting fish growth. The environmental conditions of fish in relation to the fish's ability to adapt to the environment are thought to be one of the causes of differences in absolute weight growth which influences the specific weight growth rate.

Water Quality

Water quality measurement data during the research is presented in Table 5. The data used is the average data for the range of water quality in all treatments during the research.

Tabel 5. Nilai Kualitas Air

No.	Parameters	Treatment (Container Colour)					Quality standards
		B (Bening)	(B) Black	(Y) Yellow	(R) Red	(W) White	
1	Temperatur	27,6-29,4	27,7-29,5	27,5-29,4	27,5-29,4	27,6-29,3	28-30ºC (Solichin *et al*., 2013)
2	DO	6,3-7,6	6,7-7,7	6,6-7,8	6,3-7,8	6,7-7,6	>6 mg/l (Sabrina *et al*., 2018)
3	pH	8-8,5	7,8-8,5	7,6-8,5	7,7-8,5	7,7-8,5	6,5 - 8,5 (Najib, 2018)
4	Amonia	0-0,5	0-0,5	0-1	0-1	0-1	<1,2ppm (Widiastuti, 2009)

The quality of water in the rearing media is one of the determining factors for success in cultivation. The water quality parameters in the maintenance media that were observed were pH, dissolved oxygen (DO), temperature, light wavelength and ammonia. Measurements of pH, DO, temperature and wavelength of light are measured every day 0, day 15, day 30 and day 45, while measurements of ammonia are measured on day 0 and day 45 which are can be seen in Table 5.

The results of measuring water quality parameters, namely temperature, Do, pH, and ammonia, in each treatment, namely, in the clear treatment (B) respectively 27.6-29.4ºC, 6.3-7.6 mg/l, 8-8 .5, and 0-0.5 ppm, black treatment (H) was 27.7-29.4ºC, 6.7- 7.7 mg/l, 7.8-8.5, and 0-0.5 ppm, yellow treatment (K) was 27.5-29.4 ºC, 6.6- 7.8mg/l, 7.6-8.5, and 0-1 ppm, red treatment (M) was 27, 5-29.4ºC, 6.3-7.8mg/l, 7.7-8.5, and 0-1ppm, and in the white treatment (P) 27.6- 29.3ºC, 6.7-7 .6 mg/l, 7.7-8.5, and 0-1ppm. Based on these data it can be concluded that in all treatments the water quality temperature value of 27.5-29.5 ºC is within normal limits which according to Solichin et al., (2013), that the ideal temperature for koi fish is around 28-30 ºC. Dissolved oxygen (DO) of 6.3-7.8 mg/l is within normal limits, where according to (Sabrina et al., 2018) the optimal DO for koi fish is more than 6mg/l. The degree of acidity (pH) of 7.6-8.5 is within the limits that koi fish can accept, where according to Najib (2018), the optimal pH for koi fish is 6.5-8.5. An ammonia content of 0-1 ppm is within the normal range, where according to Widiastuti (2009), koi fish can live optimally in an environment that has an ammonia content of <1.2 ppm. Firmansyah et al., (2021) stated that good water quality when keeping fish can cause the fish to live and grow well.

CONCLUSION

Conclusion

The use of different container colors had a significant effect on growth, but did not significantly affect the survival rate of koi fish and the increase in the color quality of the fish. The highest value for growth was found in the black treatment (H), namely absolute weight growth (PBM) of 12.9 ± 0.6 grams. Meanwhile, the lowest value was found in the yellow (K) treatment, the absolute weight growth rate (PBM) was 8.4 ± 2.0 grams.

Suggestion

To improve the production performance of koi fish, it is recommended to use black containers, with fish measuring 5-8 cm, with 30% protein feed measuring 1 mm ad libitum based on the fish's body weight, given 3 times a day, namely at 07.00, 12.00 and 17.00. For further research, it is recommended to use containers with the same color, measure the rubberonoid content in fish before and after rearing in different colored containers to determine the increase in fish color quality more accurately, and measure body plasma glucose levels to determine the stress level of the fish being tested.

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