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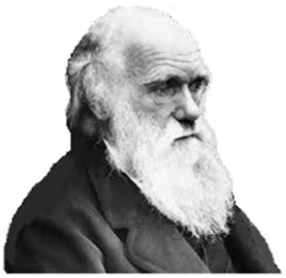

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Effect of Adding Pumpkin Flour and Carrot Flour on Changes in Color Intensity of Goldfish (*Carassius auratus* L.) Strain Oranda

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ABSTRACT

Goldfish is one of the most famous ornamental fish because of its body shape and color which was interesting to be maintained. The purpose of this research was to find the optimum dose of pumpkin and carrot flour combination on artificial feed to increase color brightness of goldfish. Complete Randomized Design with four treatments and four replications were used in the experiment. For the treatments, pumpkin flour 15%, pumpkin flour 7.5% with carrot flour 2.5% and carrot flour 5%, were studied. The parameters observed were color intensity, survival rate, and water quality. The results showed that supplementation of combination of pumpkin flour 7.5% with carrot flour 2.5% gave the highest color intensity of goldfish with TCF code 0815 and score 2.11 with 100% survival rate. Water qualities during the research were still in optimal condition.

***Keywords*:** Goldfish, Color intensity, Pumpkin flour, Carrot flour, *Carassius auratus*

1. INTRODUCTION

One of the freshwater aquarium fish which is quite popular among fans of ornamental fish is the goldfish. Goldfish has diverse body shapes and vary in colors ranging from red, yellow, green, black to goldish. Varieties of goldfish that are now scattered among the ornamental fish were recorded.

There are at least 14 varieties such as *wakin, veiltail, oranda, fantail, lionhead, pearl scales, balloon eye, nirvana, kaliko, telescope, pompom, blackmoor, peacock tail* and

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shubunkin. The *oranda* goldfish belongs to the variety of goldfish that has round body with small head and wide tail. These fish originate from mainland China, but it can already be cultivated in Indonesia. The prospect of cultivating *oranda* goldfish is promising because it targets the market within the country, also it can be exported and the price is quite high.

Assessment of the beauty of ornamental fish can be seen in the quality of its colors. Colors of the fish that determine the value of selling. This is why the method of feeding can be changed by adding carotenoids to increase brightness with red color on the fish. Aquatic animals cannot synthesize carotenoids in their body and therefore they should get these pigments from the feeding. Feeding containing supplements need to be done in order to improve and enhance the quality of color.

Pigmentation on fish is related to the work system of the hormones. Melanosite-Stimulasing Hormone (MSH) caused the color on skin of a fish that has a limited ability to work, and the excess on the giving of source of pigment can cause a decrease in hormone. Pigment of the red, yellow and orange depended a lot on the source of vitamin A, where as the green color comes from the combined basic colors of Chromatophora. Sources of carotenoids for fish are found a lot in plants or animal products.

Carrot and pumpkin are one of the producers of natural carotene. The color orange in carrots contain β-carotene. Carrots are rich in β-carotene, can enhance the color on the fish. It is expected that using addition of flour pumpkin and carrot flour to the feed can change the intensity of the colors in *oranda* goldfish.

2. MATERIALS AND METHODS

This research uses a few tools like 16 Aquarium (30×20×20 cm^3), hoses, blower, DO meter, pH meter, thermometer, digital scales, and *Toca Color Finder*. The materials used in this research is the oranda goldfish aged 3 months with an average length of 5 cm, commercial feed, pumpkin flour, and carrot flour.

The research method used Complete Random Design, which consists of four treatments that are repeated four times. Treatments in this research are: Treatment control; pumpkin flour 15%; pumpkin flour 7.5% and carrot flour 2.5%; carrot flour 5%.

Implementation of the study lasts for 40 days with an aquarium density of 1 head/litre, frequency of feeding twice a day at 09.00 AM and 15.00 PM, statistically. Color intensity observations were done visually by using the default value of the *Toca Color Finder*. Assessment starts from the smallest score 1 to score the biggest 7 with gradation from green-orange to dark red (Table 1). Observations of color, survival, and quality of water were done every 10 days during the research.

Measurements of water quality include water temperature, dissolved oxygen, and pH. Water quality measurements performed routinely, i.e. once in 10 days. In addition, the survival is calculated using the formula:

$$SR = \frac{Nt}{N0} x\ 100\%$$

Description:

SR = survival (%)

Nt = the amount of fish at the end of the research (head)
N_0 = the amount of fish at the beginning of the research (head).

Table 1. TCF color codes that are used for the research.

No.	TCF Image	Description
1		Score 1 TCF Code 0629
2		Score 2 TCF Code 0627
3		Score 3 TCF Code 0625
4		Score 4 TCF Code 0706
5		Score 5 TCF Code 0705
6		Score 6 TCF Code 0715
7		Score 7 TCF Code 0815

3. RESULT AND DISCUSSION

Color of the goldfish experiences discoloration after adding of carotene source treatment in the feeding. The original color of the goldfish before being given pumpkin flour treatment and carrot flour, which are black-pale green, and after being given the treatment changes into orange-red, the color of the fish that is better (Figure 1).

Treatment	Observation Result				
A					
	Day 0 Code 0629	Day10 Code 0629	Day 20 Code 0627	Day 30 Code 0625	Day 40 Code 0705
B					
	Day 0 Code 0629	Day 10 Code 0627	Day 20 Code 0625	Day 30 Code 0706	Day 40 Code 0705
C					
	Day 0 Code 0629	Day 10 Code 0627	Day 20 Code 0625	Day30 Code 0715	Day 40 Code 0815
D					
	Day 0 Code 0629	Day 10 Code 0627	Day 20 Code 0625	Day 30 Code 0705	Day 40 Code 0715

Figure 1. Changes in the color of Oranda Goldfish throughout the research

All the treatments have experienced an increase in the color value on the 40th day throughout the research. On day 40th, the fish treatment A experienced increase in color but the color enhancement was not very high if compared with the other treatments (Figure 1). This is probably because in the feeding content without pumpkin flour and carrot flour (0% dosage) contained substances, other carotene indirectly affects the color change on fish. Observations on the fish that are given yellow flour treatment and carrot flour show the color intensity averagely increased, but the increase has different values. Based on the observations one may state that giving pumpkin flour and carrot crumbs on the feeding will affect the changes in red color of the goldfish (Figure 2).

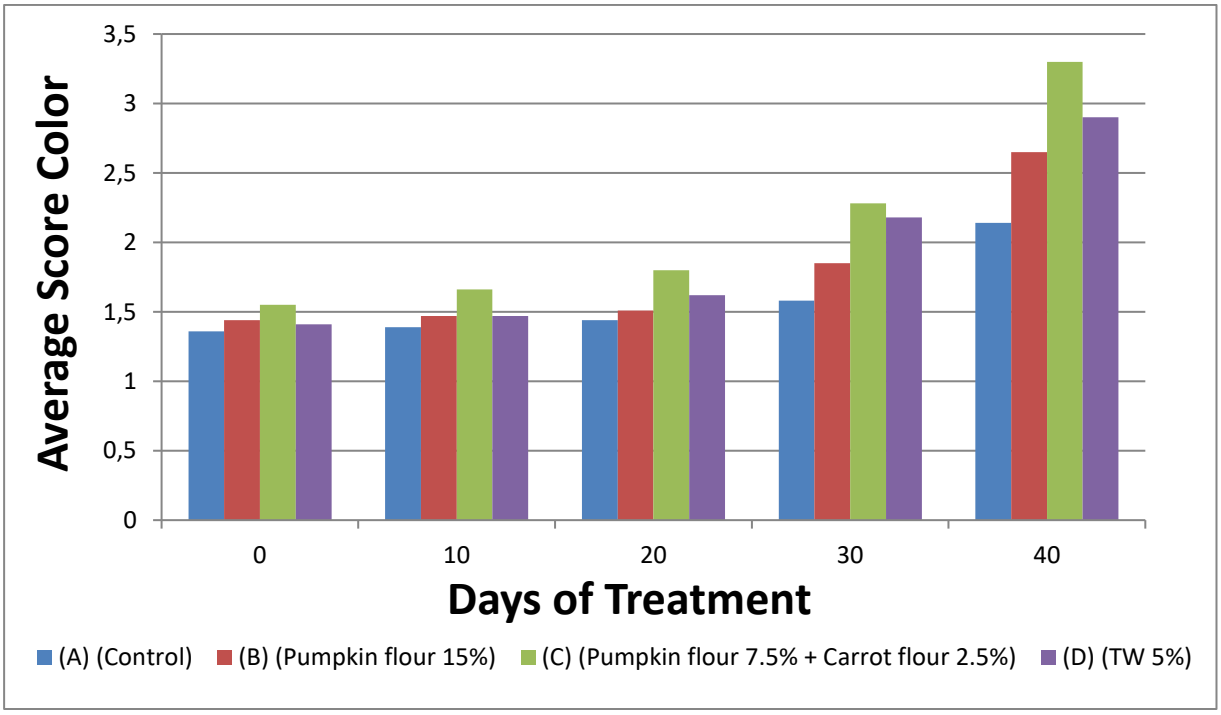

Figure 2. The increase of the average score color throughout the research.

The result of observation showed the highest color changes and effectively to enhance the color in the body of the goldfish, the treatment C with an average rating of 3.3 and lowest at the treatment A (control) with an average rating of 2.1, should be applied. On day 10th of the fish test, on the average changes go towards a brighter and rise, with that on the 20th growing due to an increase of carotenoid pigments in cells of the goldfish.

The fish score that was observed kept on increasing on the 30th day of the observation up to the 40th day with an increased score higher on each treatment. This increase is suspected because the Oranda goldfish still needs carotenoids material in the feeding to be synthesized to be orange to red. In addition, absorption and metabolism of fish work optimally because the dose is given in accordance with ability of the fish to synthesize carotenoids found in pumpkin flour and carrot flour. The best treatment results with highest color brightness value can be obtained with a non-parametric statistical test of Kruskal-Wallis (Table 2) against a scale of colors.

Table 2. Color brightness of goldfish.

Treatment	Color Brightness Score
A (Control)	1.58[a]
B (Pumpkin flour 15%)	1.78[b]
C (Pumpkin flour 7.5% + Carrot flour 2.5%)	2.11[c]
D (Carrot flour 5%)	1.92[bc]

Description: The letter that is followed with the same notation does not indicate a real difference between treatment based on Uji Z, with 95% level of trust.

Kruskal-Wallis test results come with an idea that the addition of carotene in the feed provides a response to the increase in red goldfish. Treatment C (Table 2) is the best because it has a treatment dose of the values being the highest and has real difference towards A treatment (control). The feed that is given with additional carrot flour 5% can already improve the color of the second largest fish with a value of 2.9, but with the combination of pumpkin flour 7.5% and carrot flour 2.5% the results are higher, amounting to 3.3. This is allegedly due to the addition of vitamin A in pumpkin flour and carrot flour so that it can influence the outcome of the color brightness.

Karatenoid is the active form of vitamin A, mainly consisting of vitamin A largely shaped life ether retinol which will dissolve in fat. The addition of vitamin A, for the need of pigment-forming substance on the goldfish, is getting high and can increase the brightness of the colors of the goldfish. The combination of pumpkin flour 7.5% and 2.5% carrot flour allegedly contain color pigment-forming substances that is sufficient for the needs of the goldfish when compared with other treatments. It is alleged that the orange color pigment absorption rate is influenced by the abundance of ingredients carotenoids contained within the feed and fish body surface area against the orange color. The longer the body length of the fish, the higher number of pigment cells in the body, so that the lutein that must be deposited will be a lot more.

The formation of color in the body of the fish is because the fat-soluble carotenoids will be digested in the intestine by pancreatic lipase enzyme. That will hydrolyze triglyceride to become monoglyceride and fatty acids. Bile salts serve as fat emulsifiers so the small-sized fat particles are to form micelle containing fatty acids, cholesterol and monoglyceride. Carotenoids in the intestine makossa cell cytoplasm are getting broken down into retinol and then are absorbed by the intestinal wall in conjunction with the adoption of the fatty acids in passive diffusion. Then, by combining with micelle, they are assembled to form bubbles to be absorbed through the lymphatic channels. Next the micelle in conjunction with retinol enters into the blood and is transported to the liver, leading to liver retinol in joining palmitic acid and stored in the form of retinol-palmitate. When needed by the body's cells, retinol palmitate will be bound by protein binding retinol that is synthesized in the liver. Subsequently it is transferred to other proteins, to be transported to the cells of the tissues. Thus carotenoids can be absorbed in the body of the fish.

Pumpkin flour and carrot flour are great sources of natural carotenoid that is added in artificial feed that is expected to be absorbed into the body of the goldfish and goldfish color can change for the better. Thus the addition of color source enhancer in feed will encourage increased pigment color to the body of the fish, or at least will be able to keep the color pigment to the body during maintenance. Observation of different colors on each treatment could be because the fish has different absorption rates against the type of color pigment depending on a number of sources of carotenoids.

The survival rate in this research is classified to be very high, i.e. it reaches 100%. The high numbers of survival at all treatments indicate that the containers that are used still support the lives of the goldfish for oranda goldfish. Besides, the quality of the water still belongs to the optimal. It is kept in a closed room which is always controlled. Feed that is mixed with pumpkin flour and carrot flour does not give poisonous effect to the fish. Feeding nutritious vegetables that are routine in satiation can reduce competition of food and level of stress to the fish.

The water quality parameters that have been observed in this research are temperature, pH, and DO. Goldfish can survive on the pH range of 6.5-8.5 and the temperature fluctuates between 10-36 ºC, with no sudden changes of temperature records. Observations of water quality were conducted every ten days (Table 3).

Table 3. Quality of water throughout the research.

Treatment	Parameter		
	Temperature (ºC)	DO (mg/L)	pH
A	24.0-28.4	5.1-7.3	6.68-9.01
B	24.0-27.5	5.2-7.6	6.94-8.89
C	24.0-27.8	4.5-7.0	6.87-8.79
D	24.0-27.8	4.9-6.6	6.79-8.49

Temperature observation during the research did not make a real difference on any treatment, because it was carried out at the same time and research place, i.e. at a closed room so that the outside circumstances that have often turned out, had no effect on the container research. Temperature obtained during the research was as follows: the lowest 24 ºC, and the highest 28.4 ºC. The measured pH value during research at any aquarium is not different from each other that is ranging between 7-8.

The average result measurement of pH above 7 is due to the high metabolism in fish or not given the feeding that caused high ammonia. The result of the DO observation during the research was obtained on average DO of any treatment that was 5.0-6.0 mg/L. From the average results of each treatment during that research it can be said to be eligible for maintenance of ornamental fish. The optimum temperature, pH and DO in sequence to the keeping of ornamental fish, are: temperature 26-30 ºC, DO 5-7 mg/L, and pH 5.5 to 9.0.

4. CONCLUSION

The addition of pumpkin flour 7.5% and 2.5% in carrot flour to the artificial feed is able to increase the color intensity on the oranda goldfish with code TCF 0815, and color brightness score 2.11.

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