JCNaR
Journal of Chemical Natural Resources
Journal homepage: https://jcnar.usu.ac.id

Feed Modification Using Carrot Flour to Improve Growth and Brightness Koi Fish Color

Sahat Pangihutan Sihaloho, Emma Zaidar Nasution*, Hamonangan Nainggolan
Department of Chemistry, Faculty of Mathematics and Natural Sciences, Universitas Sumatera Utara, Medan, 20155, Indonesia
*Corresponding Author: ema3@usu.ac.id

ARTICLE INFO
Article history:
Received 17 December 2022
Revised 20 January 2023
Accepted 13 February 2023
Available online 18 May 2023

E-ISSN: 2656-1492

How to cite:
Sahat Pangihutan Sihaloho, Emma Zaidar Nasution, Hamonangan Nainggolan. Feed Modification Using Carrot Flour to Improve Growth and Brightness Koi Fish Color. Journal of Chemical Natural Resources. 2023. 5(1):35-39.

https://doi.org/10.32734/jcnar.v5i1.11989

ABSTRACT
Color is vital in determining the quality of koi fish (*Cyprinus carpio* L.) and is even seen as an important component in selecting ornamental fish. Therefore, alternative feed sources are needed, which are highly nutritious and increase the brightness of fish. This study aimed to determine the effect of adding carrot flour (*Daucus carota* L.) and the concentration that had a good impact on increasing the color of Koi fish (*Cyprinus carpio* L.). This study used six treatments where treatment A was fed containing *Spirulina* as a control. Treatment B was the addition of carrot flour with a concentration of 5%, C with a concentration of 10%, D with a concentration of 15%, E with a concentration of 20%, and F with a concentration of 25%. The results showed that adding carrot flour affected the brightness of the color of the fish. The best color improvement is found in treatment F, with a value of 6.

Keywords: Carrot Flour, Color, Koi Fish

ABSTRAK
Warna memegang peranan penting dalam menentukan kualitas ikan koi (Cyprinus carpio L.), bahkan dipandang sebagai komponen penting dalam proses pemilihan ikan hias. Oleh karena itu, diperlukan sumber pakan alternatif yang bernutrisi tinggi dan meningkatkan kecerahan ikan. Tujuan dari penelitian ini adalah untuk mengetahui pengaruh penambahan tepung wortel (*Daucus carota* L.) dan konsentrasi yang berpengaruh baik terhadap peningkatan warna ikan koi (Cyprinus carpio L.). Terdapat 6 perlakuan pada penelitian ini dimana perlakuan A pakan yang mengandung Spirulina sebagai kontrol, perlakuan B penambahan tepung wortel dengan konsentrasi 5%, C dengan konsentrasi 10%, D dengan konsentrasi 15%, E dengan konsentrasi 20% dan F dengan konsentrasi 25%. Hasil penelitian menunjukkan bahwa penambahan tepung wortel berpengaruh terhadap kecerahan warna ikan. Peningkatan warna terbaik terdapat pada perlakuan F dengan nilai 6.

Kata Kunci: Ikan Koi, Tepung Wortel, Warna

1. Introduction

Indonesia is a maritime country with large fishery product potential from consumption and non-consumption commodities. One non-consumption commodity that affects the community's economic system is ornamental fish [1]. Exports of ornamental fish are expected to generate foreign exchange and improve the welfare of the fishing community, especially ornamental fish farmers [2].

Freshwater ornamental fish, including Koi (*Cyprinus carpio*), is a fishery commodity currently receiving government attention for the development of its cultivation [3]. Koi fish are in great demand because of the attractiveness of their colors, namely red, white, yellow, black, or combinations. Koi have a reasonably high selling value [4]. The way for koi fish to look beautiful, healthy, and always have bright body colors must start with feed. It means that the feed given must contain balanced nutrition. Nutritional balance is regulated based on the type of Koi, body size, age, maturity of koi, and water temperature [5].

The main attraction of Koi is the variety of patterns and color combinations. Some types have scales and not scales, and some classes have metallic scales. There are some general criteria for all quality koi, regardless of type. The body shape as a whole can indeed vary greatly. The perfect head shape and proportional body

shape can be the characteristics of a quality koi. The skin must be shiny with a certain sheen so the color is not flat [6].

Many synthetic dyes are added to fish feed, but the results are not as good as using natural dyes or pigment sources. Farmers prefer to use natural pigment sources to enhance the color of ornamental fish. Natural pigment sources can be obtained from *Spirulina platensis*, S. *platensisis*, and blue-green algae rich in protein, vitamins, minerals, and other nutrients. S. platensis is naturally found in freshwater to alkaline (brackish) lakes or ponds [7]. Carrot (*Daucus carota* L) is a cheap and natural source of β-carotene. The source of β-carotene has a molecular structure almost the same as astaxanthin [8]. It's just that there are small differences in the structure of the single chain –OH and double chain -O, but this difference does not affect its work function [9].

According to Kjellenberg (2007), carotenoid levels in carrots are more abundant in the phloem than in the xylem. Carotenoids are divided into two groups. The first is carotene or hydro carotenoids, which contain carbon and hydrogen. And secondly, xanthophylls are derivatives of carotenes. The dominant orange and yellow carrots are α- and β-carotene. Besides that, yellow carrots also contain xanthophylls such as lutein [10].

Carotenoids are natural pigments that give yellow, orange, or red colors. Because the color ranges from yellow to red, the detection wavelength is estimated to be between 430 to480 nm [11]. The term carotene is used to refer to several related compounds which have the formula $C_{40}H_{56}$. Carotenoids are found in plant chloroplasts and act as catalysts in photosynthesis by chlorophyll [12]. The content of β-carotene in raw carrot tubers is 8285 µg/100g. β-carotene gives a bright orange color to carrot tubers. The body metabolizes β-carotene into vitamin A if bile salts are present in the digestive tract [13].

Utami (2014) has done VCombination of Yellow Pumpkin Flour (*Cucurbita moschata* D.) and Azolla Flour (*Azolla pinnata* R.br.) on the Brightness of Koi Fish (*Cyprinus carpio* L.) Colors. Feeding with variations of pumpkin flour 40% and 20% Azolla can increase the brightness of the color of koi fish [14]. Next, Riki (2015) has done The Effect of the Concentration of Carrot Flour (*Daucus carota*) in Feed on Increasing the Color of Goldfish (*Carassius auratus*) with variations in the provision of 1%, 3%, and 5% carrot flour resulted in a better level of color change in the addition of a 5% dose of carrot flour [15].

From the description above, the researcher was interested in knowing the effect of feed modified with carrot flour on the growth and brightness of koi fish color and the best variation for the growth and brightness of the color of Koi fish.

2. Materials and Methods

2.1. Equipment

The tools used in this study included: Aquarium, Halico HL 1200 water pump, Gallenkamp Oven, Fischer Sieve 100 mesh, National Blender, and Aluminum voil. The materials used in this study included carrots, FF-999 feed, and Kohaku feed.

2.2. Test Fish Preparation

Before the fish were put into the test container, the fish were fasted for 24 hours to eliminate the effect of residual feed on the fish's bodies. After the fish were fasted, the test fish were given the same treatment as pellet feeding. After adaptation, five fish were stocked per aquarium/test media. The observation of color was used to improve only for a month or 30 days.

2.3. Making Carrot Flour

Carrots are peeled and cleaned with water. Shredded and accommodated in a container covered with aluminum foil. Then it is dried in an oven at 40°C. After drying, the carrot slices are mashed using a blender. Sieved using a 100 mesh sieve.

2.4. Feed Preparation

2.4.1. Feed Control

One of the artificial feeds containing Spirulina is the Kohaku brand. The composition of Kohaku includes Spirulina, wheat flour, multivitamins (A, B complex, C, D, E, K), folic acid, minerals, and others. The nutritional content of Kohaku is 36% protein, 4% fat, 12% ash, 3% fiber, and 11% of water content (PT. Matahari Sakti, 1988).

2.4.2. Feed Modification

The feed used is artificial feed in the form of fish pellets (FF-999) which contain 35% Protein, 2% Fat, 3% Fiber, 13% Ash, and 12% Moisture content, mashed with a pestle and mortar and then mixed with beta carotene from carrot flour. With the addition of distilled water, slowly until evenly distributed. Variations in the mixture of pellets and carrot flour, namely, the 5% treatment contains 5gr of carrot flour in 100gr of feed, the 10% treatment contains 10gr in 100gr of feed, the 15% treatment contains 15gr in 100gr of feed, the 20% treatment contains 20gr in 100gr of feed and the 25% treatment contains 25 grams in 100 grams of feed. After the dough is evenly distributed, then printed in the form of pellets. Then let it air dry for 30-60 minutes.

2.5. Water Media Preparation

Media water preparation is quite important in fish rearing. Water as a living medium for fish should be treated first before use. The stages carried out during the research in preparing the media water were water from the Tuntungan River, which was collected in jerry cans so that the dirt could settle in the water. Water is deposited for about one day. Furthermore, the water can be used to maintain fish in the aquarium.

2.6. Fish Maintenance

The containers used were six aquariums measuring 40 x 20 x 20 cm3. The aquarium is washed using detergent until clean and dried. After that, the aquarium was filled with water, about 75% of its volume, and given an aerator to supply oxygen.

Previously, fish were first adapted to cultivation media. After the adaptation period is complete, the fish are fasted for 24 hours to eliminate the effect of residual food in the fish's body. Then the fish were weighed, photographed, and put into the aquarium. Fish rearing was carried out for 30 days with feeding twice daily at 10.00 and 15.00 WIB for each treatment. The amount of feed given per treatment is the same, namely 5% of the weight of the fish. The difference is the variation. Water quality parameters are also carried out to determine the condition of the water. The measured water quality is temperature and pH. Water quality measurements are carried out once every ten days. The change in the color of the test fish is the comparison of the initial color with the last color change.

2.7. Observation of Results

The results were observed every ten days from the start of stocking to the end of the study. Observation of effects includes observation of fish color and fish weight.

2.7.1. Observation of Fish Color

Color measurements were done once every ten days using a self-modified color meter. The way of observation is focused on two colors close to the entire body surface. Observation of the color intensity of koi fish using a self-modified color meter observed by five panelists who do not have visual impairments (color blind and myopic). A list of color-measuring panelists can be seen in Appendix 3.

The observations were made visually by comparing the original color of the fish on a weighted color measuring paper. Observation of the color intensity of koi fish is carried out by giving a value or weighting on color measuring paper. Assessment starts from the smallest 1,2,3 to the most significant score of 30 with color gradations from light orange to deep red (Arnol Hasudungan Pardosi, (Effect of Concentration of Carrot Flour in Feed on Increasing Koi Fish Color).

2.7.2. Fish Weight Measurement

Measurement of fish weight using digital scales. The formula calculates weight gain:

$Wm = Wt – W0$

Information :

Wm: Absolute weight gain of fish (g)

Wt: Fish weight at time t (g)

W0: Fish weight at time 0 (g)

3. Results And Discussion

3.1. Discoloration

The results showed a change in the color of the koi fish in each treatment. The color change value of koi fish can be seen in Table 1.

Table 1. Koi Fish Color Improvement Data from Each Treatment

Day	Variation of Carrot Flour (g)					
	1	2	3	4	5	6
0	20.4	20.8	18.8	17.4	23.2	24.8
10	21.6	21.8	20.2	17.6	24.2	25
20	23.2	24.2	21.8	18.6	25.4	25.8
30	25.6	26.8	23.6	21.6	26.8	27.4
Change	5.8	6	4.8	4.2	3.6	2.6

The biggest increase in color, with a value of 6, was found in the 25% carrot flour treatment. The color increased successively with a value of 5.8 in the control treatment, 4.8 in the treatment of 20% carrot flour, 4.2 in the treatment of 15% carrot flour; 3.6 in the 10% carrot flour treatment, and the smallest color increase with a value of 2.6 was found in the 5% carrot flour treatment.

3.2. Koi Fish Weight Gain

During the study, koi fish experienced weight gain. The nutrients influence this growth in the fish's feed. The growth value of koi fish weight can be seen in Table 2.

Table 2. Koi fish weight gain in each treatment

Day	Aquarium 1 (control)	Aquarium 2 (25%) (g)	Aquarium 3 (20%) (g)	Aquarium 4 (15%) (g)	Aquarium 5 (10%) (g)	Aquarium 6 (5%) (g)
0	36	34.6	35	35.9	32.3	35.5
10	45.7	41.3	40.8	40.4	36.4	38.7
20	58.2	50.8	46.7	45.8	42.1	43.3
30	61.6	61.4	57.2	55.3	48.8	49.2

The best weight gain was found in the 25% carrot flour treatment with a weight value of 26.8 g; then successive treatment on control (Spirulina) with a weight of 25.6 g; carrot flour treatment 20% with a weight value of 22.2 g; treatment of carrot flour 15% with a weight value of 19.4 g; and 10% carrot flour treatment with a weight value of 16.5 g. In contrast, the slowest growth was found in the 5% carrot flour treatment, weighing 13.7 g.

3.3. Water Quality

During the research, the quality of the water used remained in stable condition because it was under control. The average results of water quality measurements during the study can be seen in Table 3:

Table 3. Average results of water quality measurements during the observation

Parameter	Observation Day-			
	0	10	20	30
Temperature (0C)	26	27	27	27
water pH	6-7	6-7	6-7	6-7

4. Conclusion

The addition of a natural source of beta carotene from carrot flour can affect the increase in the growth of the weight and color of koi fish. And The 25% carrot flour variation treatment was better than the other treatments resulting in an increase in color brightness with a value of 6 and growth with an increase in weight of 26.8 g.

5. Acknowledgements

The authors thank the Department of Chemistry, Faculty of Mathematics and Natural Sciences, Universitas Sumatera Utara, for providing the facilities.

6. Conflict of Interest

Authors declare no conflicts of interest

References

[1] Yuliani, F., Dewi E. and Tutik K. 2013. Larvae Production of Rainbow Kurumoi Fish (Melanotaenia Parva) at the Research and Development Center for Hisa Fish Cultivation. Biology National Seminar. Depok.

[2] Mulyani, LF 2013. The Effect of Ketapang Leaf Extract (Terminalia cattapa) on the Survival and Growth of Botia Fish (Chromobotia cracanthus) Larvae. [Thesis]. Aquaculture Study Program. Mataram University.

[3] Mahasri, G., L. Wulandari and Kismiyati. 2001. Histopathological Changes in the Skin of Koi Fish (Cyprinus carpio) Infested with Ichthyophthirius multifiliis Cohabitation. Fisheries and Maritime Scientific Journal. 3(1).

[4] Sari, NP, L. Santoso and S. Hudidah. 2012. The Effect of Addition of Shrimp Head Meal in Feed on the Pigmentation of Koi Fish (Cyprinus carpio) of the Kohaku Type. E-Journal of Aquaculture Engineering and Technology. 1(1). ISSN: 2302-3600.

[5] Bakhtiar, Ir. Joseph. 2004. Freshwater Ornamental Fish Cultivation for Export. Agro MediaPustaka. Jakarta.

[6] Twigg, D. 2013. The Koi Smart Book. PT. Main Library Gramedia. Jakarta.

[7] Dwijayanti, Y. 2005. Effect of Use Spirulina Algae Powder in Feed Artificial Against Discoloration of Fish Botia(*Botia macracanthus Bleeker*). [Thesis]. Fisheries Department. University Padjadjaran. Fennema, OR 1996. Food Chemistry. 3rd Editions. Marcel Decker, Inc. New York.

[8] Lorenz, T. 2000. NatuRoseTM Natural Astaxanthin as a Carotenoid and Vitamin Source for Ornamental Fish and Animals. p.8

[9] Kjellenberg, L. 2007. Sweet and Bitter Taste in Organic Carrot. Swedish University of Agricultural Sciences.

[10] Fennema, O.R. 1996. Food Chemistry. 3th Edition. Marcel Dekker, Inc. New York.

[11] Almatsier, S. 2001. Basic Principles of Nutrition Science. PT. Main Library Gramedia. Jakarta.

[12] Lorenz, T. 1998. A Review of Carotenoids, Astaxanthin as a Pigment and Vitamin Source for Cultured Penaeus Prawn.

[13] Utami, DAT, et al. 2014. Combination Variations of Pumpkin Flour (Cucurbita moschataD.) And Azolla Flour (Azolla pinnata R.Br.) On Brightness Color of Koi Fish (Cyprinus carpio L.). Scientific Journal of Biology: 1-12.

[14] Riki. 2015. The Effect of Concentration of Carrot Flour (Daucus carota) on Feed Against Increasing Goldfish Color(Carassius auratus). Faculty North Sumatra University of Agriculture. Medan