



GSJ: Volume 7, Issue 1, January 2019, Online: ISSN 2320-9186

www.globalscientificjournal.com

ADDITION OF SPIRULINA PLATENSIS TO COLOR QUALITY OF KOI FISH (CYPRINUS CARPIO) IN THE NURSERY POND

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ABSTRACT

Koi fish is one of the ornamental fish that has a beautiful body shape and color with a high economic value. One of the indicators of beauty in ornamental fish is the quality of the fish color. Color in fish is created by the presence of chromatophore cells in the dermal part of the skin. Carotenoids are the main natural component of color pigment formation which have a fairly good influence on red and orange colors of koi fish (*Cyprinus carpio*). One of the sources of carotenoid is Spirulina powder. This study aimed to determine the effect of spirulina powder addition in feed on the quality of koi fish color. This was an experimental study with 2 treatments, namely: koi fish that received 5% spirulina powder and koi fish without spirulina powder administration. Data were analyzed using paired t-test with F count of 5%, meaning comparing one treatment with another treatment to reveal which treatment is better between the two. Koi fish with 7-9 cm size was used. The fish were reared in 2x2x1 cm³ hapa net for 40 days. Parameters measured in the study included color quality, which was measured using Tocco Color Finder; survival; absolute growth; pH; temperature; and DO. Results showed that the addition of spirulina powder to feed affect the quality of koi fish color, which was evident from a significant difference in fish color quality.

Keywords: Koi Fish , Carotenoids, Color Quality, Growth, Spirulina Powder

1. INTRODUCTION

Koi fish (*Cyprinus carpio*) is one of the ornamental fish that has beautiful body shape and color with a high economic value. Indicators of beauty in ornamental fish include brilliant colors; physical shape and perfection; behavior; and health or stamina. In addition, koi fish are often used as aquarium ornamental fish and is considered an art by those who are interested in this fish (Lesmana 2007)¹.

Color is one of the reasons why ornamental fish are in demand in the community. Therefore, fish farmers need to maintain the beautiful color of ornamental fish by providing feed that contains color pigments. Color in fish is created by the presence of chromatophore cells found in the dermal part of the fish skin. Carotenoids are the main natural component of color pigments that have a good influence on red and orange color (Budi, 2001).² According to Hidayat and Saati (2006)³, several food ingredients contain carotenoids including carrots, sweet potatoes, corn, pumpkin, and other green vegetables.

Carotenoid can also be derived from spirulina because spirulina contains phycocyanin, chlorophyll-a, and carotene (Vonshak, 1997). Carotene consists of xanthophyll (37%), β -carotene (28%), and zeaxanthin (17%) (Tongsiri *et al.*, 2010)⁴. Addition of color pigment source in fish feed is one of the efforts to create bright colors that are evenly distributed in fish. Many studies have shown the effect of Spirulina provision on the color of ornamental fish and shrimp or lobster. A study by James (2010)⁵ stated that feed containing 8% Spirulina is effective in increasing color pigmentation in Red Swordtail fish (*Xiphophorus helleri*). Furthermore, Novianti *et al.* (2015)⁶ also stated that the addition of 1.2% spirulina powder into manufactured feed has a very significant effect on increasing color intensity and gives the highest result in terms of increasing the intensity of the color in goldfish. The purpose of this study was to determine the effect of Spirulina addition into feed on improving the quality of color of koi fish.

2. METHODS

2.1. Material and Tool of Research

This study was conducted in July-August 2016 at the PBC fish farm, Cisaat Subdistrict, Sukabumi District. The materials used during the study were manufactured feed, which was added with Spirulina powder according to the predetermined dose. Fish used in this study was 7-9 cm koi fish with a density of 50 fish per 2x2x1 cm³ fish net. The duration of culture was 30 days with sampling every five days to determine the increase in color intensity.

2.2. Research Methods

This was an experimental study with 2 treatments, namely: koi fish that received 5% spirulina powder and koi fish without the addition of spirulina powder. The observations on the color intensity of koi fish was performed using a color measuring device, i.e. tocca color finder, by 5 panelists who did not have any visual impairment (color blindness and low vision). Observations were made

visually by comparing the original colors of fish with the colors on the weighted color measuring paper.

2.3. Data Analysis

Data on growth and survival were analyzed using the paired t test with f count of 5%, meaning by comparing one treatment with another treatment to reveal which treatment is better between the two. Meanwhile, other water quality data were compared with the water quality standards for culture based on regulations the government of the Republic of Indonesia number 82 of 2001.

3. RESULTS AND DISCUSSION

3.1.1. Changes in Color

Based on the results of the study, differences in the color quality of koi were identified in each treatment. Koi fish that was given Spirulina powder 5% had better colors than those without Spirulina powder.

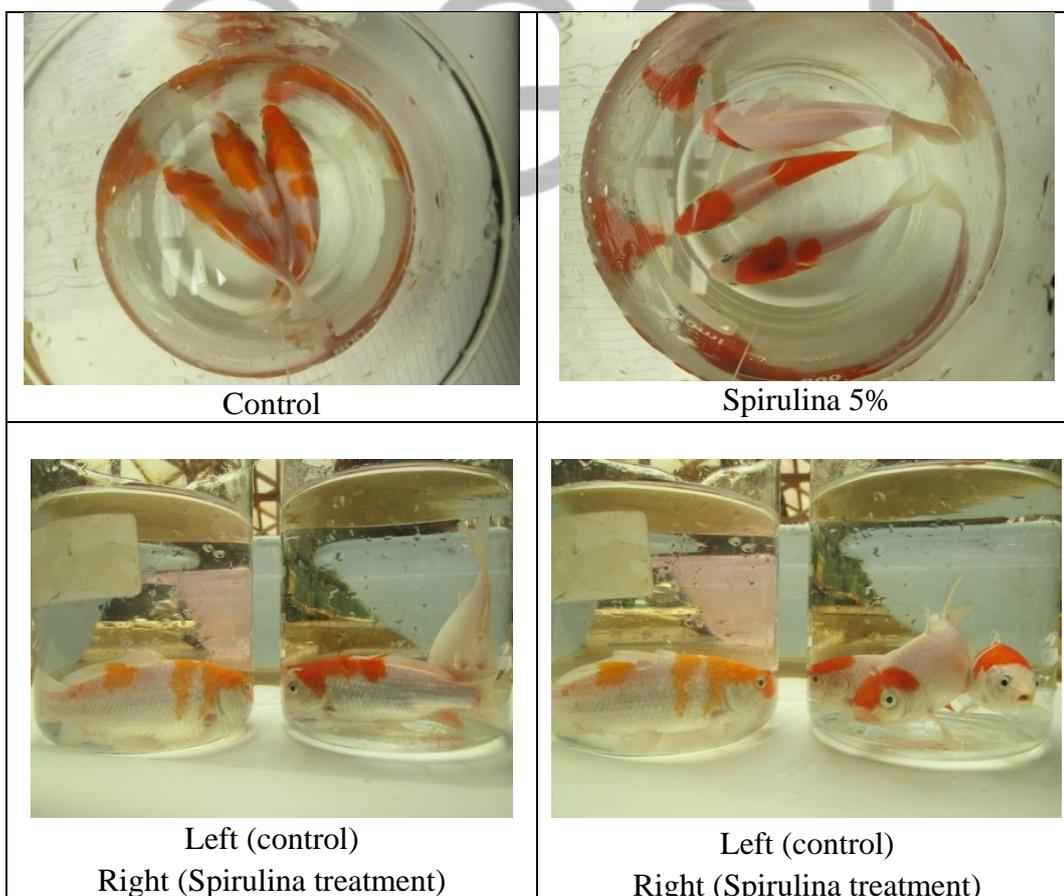


Figure 1. Koi Fish Performance after Study

Based on the results of the study, koi fish in the treatment group that received Spirulina powder had a thicker and brighter dominant color with smooth, clear and clean base color (Figure 1) whereas fish that did not receive Spirulina powder had less bright colors and less smooth base colors. This shows that the fish is able to absorb the carotenoid content in the feed to produce a brighter color intensity (Vonshak 1997)⁷. Spirulina powder has an effect on increasing color intensity in koi fish because spirulina contains carotenoids which can increase the color intensity in fish (Sasson, 1991)⁸.

According to Kusuma (2012)⁹ the process of increasing the intensity of color begins with the absorption of carotene (color pigment) in the feed. The carotene then circulates in the bloodstream and is stored in fat tissue. The pigment is then deposited in the color cells (chromatophores) found in the dermis (Amin, , 2012)¹⁰. Pigment cells in fish body have the ability to change that they can affect the color of the fish. If pigment cells are spread evenly, the color of the fish will appear more concentrated. However, if pigment cells are located in one cell's nuclear, the color will become pale (Kusuma, 2012⁹).

3.1.2. Koi Fish Weight Gain and Length Growth

During the study, the koi fish grew, both in length and weight. This growth is influenced by the nutrients contained in the food consumed by fish. The weight gain and length growth of the koi fish are listed in Table 2.

Table 2. Koi Fish Weight Gain and Length Growth

Treatment	Initial Measurement		Final Measurement	
	Length (cm)	Weight (g)	Length (cm)	Weight (g)
With Spirulina Powder	7.54	13.37	11.14	21.33
Without Spirulina Powder	7.57	13.35	12.17	23.33

It was revealed that koi fish grew in length during the study. The value measured on day 0 as the initial fish length continued to increase during the study up to day 30. The length growth value was not always the same every day of observation and treatment. The daily length growth is depicted in Figure 2 below.

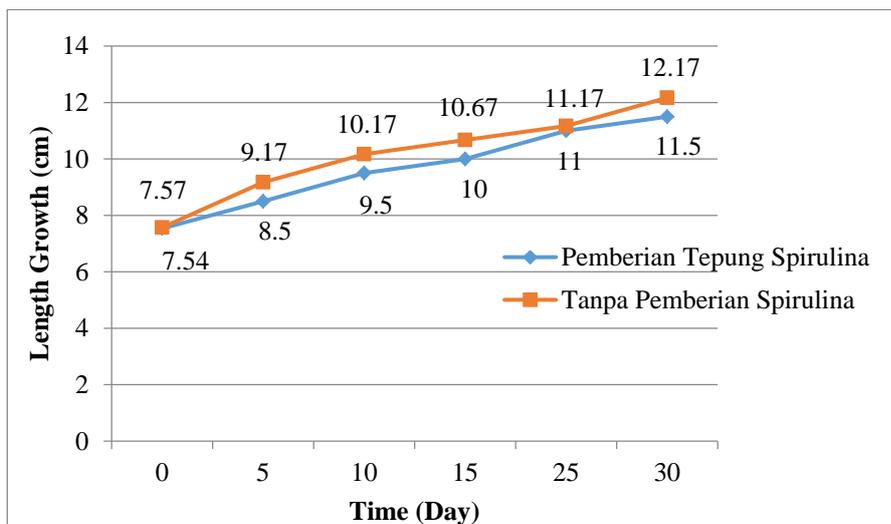


Figure 2. Koi Fish Length Growth during Study

During the study, the fish in both treatments experienced weight gain. The daily growth rate of koi fish generally continues to increase from day 0 to day 30. The increase in fish weight gain was different for each treatment but it was directly proportional to the length growth. The daily weight growth of fish can be seen in Figure 3.

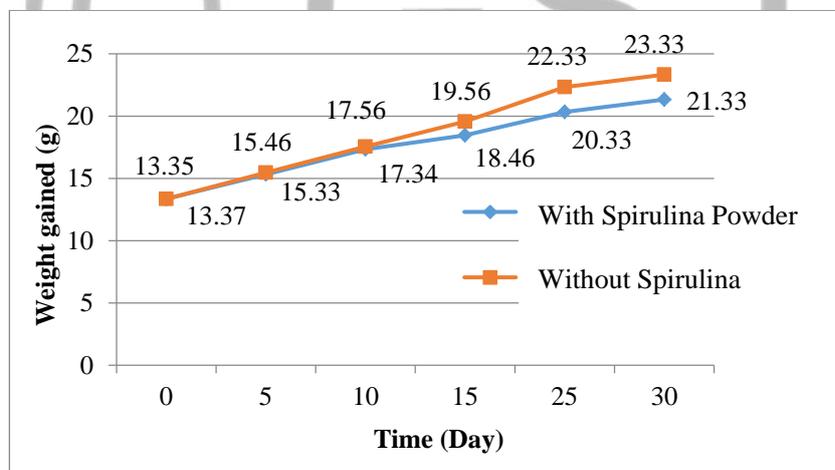


Figure 3. Koi Fish Weight Gain during Study

Based on the results of the statistical, koi fish length growth and weight gain at the end of the study were not significantly different in both treatment. The following is a table of analysis of the variance of koi fish growth.

Table 3. Variance Analysis of Koi Fish Mean Growth

Treatment	Final Measurement	
	Length (cm)	Weight (g)
With Spirulina Powder	11.14 ^a	21.33 ^a

Without Spirulina Powder	12.17 ^a	23.33 ^a
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Note: Value that is followed by the same small number shows insignificant difference with 95% confidence level

3.3 Survival Rate

Survival rate is the percentage of the number of fish that live during the culture period (Effendie, 1997)¹¹. Survival rate is influenced by several factors including age, environment (water quality), food, and disease. The survival rate in this study was high. This is thought to be related to the adequate feed provision and water quality for the koi fish.

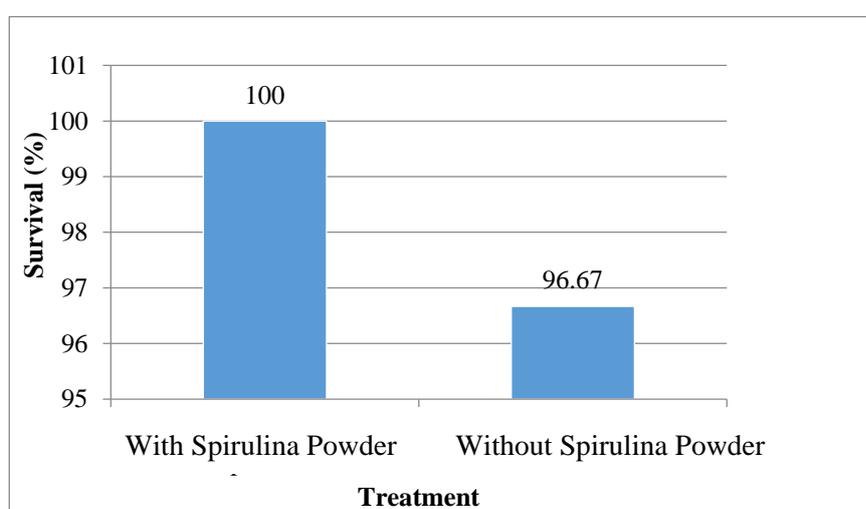


Figure 4. Koi Fish Survival Rate during Study

3.4. Water Quality

Water quality parameters measured during the study were temperature, pH, and DO. Water quality measurements were carried out to determine the quality of water that supported the life of the koi fish during the study. The temperature of the culture media was still in the normal range, which was 26°C-28°C with a pH within the normal range or between 6.5 -7 (Satyani 2005)¹². Meanwhile, the DO during the study was 4-5 ppm. The range of water quality parameters during the study are listed in Table 4.

Table 4. Mean Water Quality during Study

Water Quality	Treatment		Standar
	With Spirulina	Without Spirulina	
Temperature (°C)	26-28	26.5-28	25 – 32 Satyani (2005) ¹²
DO (mg/L)	4-5	4.5-5	3 – 5 Murtidjo (2001) ¹³
pH	6.5-7	6.7-7	6 – 9 Murtidjo (2001) ¹³

4. CONCLUSION

The addition of spirulina powder into manufactured feed influences increase in color intensity and produces the highest result in increasing the intensity of koi fish color.

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