
INCREASED COLOR BRIGHTNESS WITH THE ADDITION OF ASTAXANTHIN IN KOI FISH (*CYPRINUS RUBROFUSCUS*) FEED

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ABSTRACT

Introduction: This research was conducted experimentally from May to July 2021 at the Teaching Factory Cultivation Laboratory (TEFA) of the Jakarta Fisheries Business Specialist Polytechnic. This study aims to determine the effect of astaxanthin feeding on increasing color, survival and growth of koi fish. **Method:** The research method used is quantitative. The design used was a completely randomized design (CRD) with four treatment levels and three replications. Analysis of variance used was analysis of variance (ANOVA). **Results:** The results showed that the addition of astaxanthin to feed had a significant effect on changes in the color quality of koi fish. The best result was the addition of astaxanthin 125 mg/kg feed (20.29 ± average weight measurement results) (ABW) at the end of the study obtained the highest value in treatment A (control) of 10.37 g. The results of the average weight measurement (ABW) at the end of the study obtained the highest value in treatment A (control) of 10.37 g, Specific Growth Rate (SGR) was the highest in treatment A (control) of 12.00%, the best Feed Conversion Ratio (FCR) was in the treatment with the addition of 100 mg astaxanthin 1.12. **Conclusion:** The use of astaxanthin in koi fish feed can increase the selling value of koi fish in the market because of the bright color is one of the important criteria in assessing the quality of koi fish. Koi fish farmers can consider adding astaxanthin and need to pay attention to the right dosage.

Keywords: *astaxanthin, cyprinus rubrofusculus*, fish colour.

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INTRODUCTION

Koi fish (*Cyprinus rubrofusculus*) is well-known and popular with ornamental fish lovers and business people (Iskandar et al., 2021). The selling price of koi fish continues to increase, and the price classification is very varied. The main factors determining the price of koi fish are beautiful colour patterns and exotic body shapes, beautiful body shapes and movements, as well as very lucrative economic value, causing koi fish to continue to be studied both from the aspect of feed nutrition and a genetic standpoint (Simbolon, et al., 2002).

Beautiful body shape and colour of koi fish (*Cyprinus rubrofusculus*) make this fish have high economic value (Irawati et al., 2022). Indicators of beauty in ornamental fish can be seen in their brilliant colours, physical shape and completeness, behaviour, and health or stamina conditions (Andriani et al., 2019). According to (Malini & Agustin, 2018), the beauty of koi fish lies in its back, which has an attractive colour. The colour of koi fish is related to the number and location of pigment cells (chromatophores) in the dermis layer. It is said by (Simbolon et al., 2002) that the body colour of the fish is caused by the availability of carotene from natural food, while the fish that are reared get their carotene source from artificial feed.

The primary function of pigments in fish food will naturally form colour changes in fish so that fish scales are more contrasting. The addition of pigmentation ingredients in the feed will encourage an increase in colour pigments in the fish's body and be able to maintain the dyes in the body (Nur et al., 2020). The increase in colour intensity in fish is influenced by two factors, namely internal factors and external factors (Collins et al., 2022). Internal factors are factors originating from within the body of the fish that are fixed, such as age, size, genetics, sex, and the fish's ability to absorb the nutrients in the feed (Indarti et al., 2012)

The pigment manipulation technique by enriching the content of pigment cells in the fish's body through feeding containing astaxanthin (chlorophyll pink) is a way to obtain bright and even colours in fish (Sitorus, 2015). Provision of feed-containing supplements needs to be done in order to improve and improve colour quality (Maolana et al., 2018).

Carotenoids are dye-forming components that give red and yellow colours. Astaxanthin is the most effective and widely found type of carotenoid pigment for colouring (Yulianti *et al.* , 2014). Nasution (1997) in (Andriani et al., 2019) stated that the greater the carotenoid content in the fish's body, the brighter the colour of the fish. According to (Sukarman & Hirnawati, 2014), astaxanthin is a synthetic carotenoid commonly used in aquaculture. Thus the need for carotenoids must be provided through feed, especially in intensive rearing systems (Sukarman & Hirnawati, 2014).

Based on the background above, this study aimed to determine and evaluate the effect of adding astaxanthin to feed on increasing the colour of koi fish (*Cyprinus rubrofusculus*).

METHODS

This research activity was conducted from May to July 2021 at the Cultivation Laboratory of the Jakarta Fisheries Business Expert Polytechnic. The materials used in this study were 120 koi fish of the Kohaku type with a size of 6 ± 7 cm. Other ingredients used are artificial feed, prologue and astaxanthin. The design used was a completely randomized design (CRD) with four treatments and three replications with doses A (Control/without astaxanthin), B (75 mg/kg feed), C (100 mg/kg feed), D (125 mg/kg feed). Kg of feed). The feed is poured into the astaxanthin solution, mixed with a prologue of as much as 2gr/kg of feed and 150 ml/kg of water, and then dried.

The research method used is quantitative. The analysis of variance used was an analysis of variance (ANOVA) with a 5% degree of freedom. If the statistical test results show a significant difference between the treatments ($P < 0.05$), proceed with the Tukey HSD test. Then the data were processed using SPSS software version 26 to find out whether there was an effect on each treatment.

The increase in colour in koi fish was observed using the Modified-Toca Color Finder (M-TFC), carried out six times during 60 days of rearing. The fish colour was observed visually by three panellists with eyes that were not myopic and not colour-blind (Indarti et al., 2012). (Sitorus, 2015) said that determining the colour score using M-TCF paper on each fish. The score on the paper starts with the numbers 1,2,3, with colour gradations starting from light orange to dark red, where the higher the value, the darker the colour.

RESULTS AND DISCUSSION

The results showed that adding astaxanthin to the feed had a significant effect ($P < 0.05$) on the brightness of the koi fish's colour. Based on the Tukey HSD test output, sig < 0.05 was obtained

between the treatments of adding astaxanthin 125mg/kg of feed to other treatments. The increase in the colour of koi fish at the end of maintenance can be seen in Figure 1

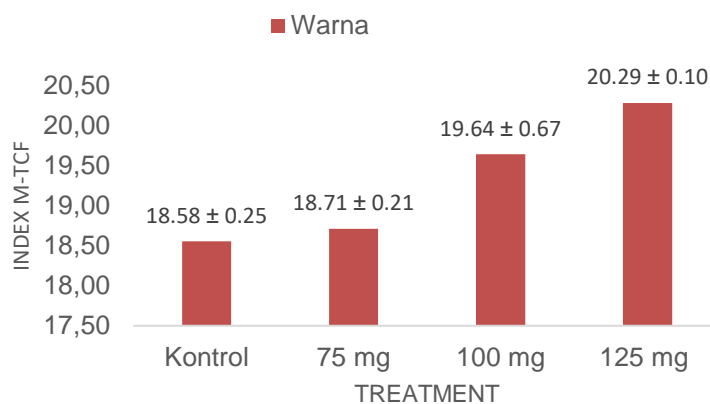


Figure 1. Koi Fish Color Enhancement

Table 1. Average Color Value of Koi Fish

Astaxanthin dosage	Absolute Color Change
Control	18.58 ± 0.25 ^a
75 mg/kg feed	18.71 ± 0.21 ^b
100 mg/kg feed	19.64 ± 0.67 ^b
125 mg/kg feed	20.29 ± 0.10 ^c

The results of the average weight measurement (*Average Body Weight / ABW*) at the end of the study obtained the highest value in treatment A (control) of 10.37 g, the highest specific growth rate (*Specific Growth Rate / SGR*) in treatment A (control) of 12.00 %, the best Feed Conversion Ratio (*FCR*) in the treatment with the addition of 100 mg astaxanthin 1.12.

Survival or survival is the ratio between the number of individuals who live at the end of the experiment with the number of individuals who live at the end of the experiment at e start of the experiment. Koi fish survival at the end of rearing can be seen in Figure 2.

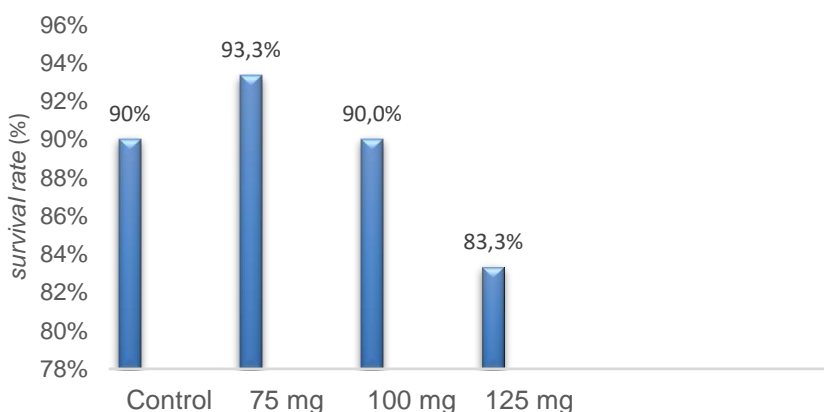


Figure 2. Koi Fish Survive at The End of The Ring

The best survival was obtained in treatment B with 75 mg of astaxanthin w, a value of 93.3% and trin treatment C of 90.0%.

Good water quality plays a vital role in the life of fish, where fish need a suitable and qualified environment to grow properly. The results of measuring water quality parameters during maintenance can be seen in Table 2.

Table 2. Koi Fish Rearing Water Quality

Parameter	Unit	Average
Temperature	°C	26.5-28.7
pH	-	7,6-7,9
<i>Dissolved Oxygen/DO</i>	mg. l ⁻¹	4.8-5.5

The results of water quality parameter measurements in Table 2 show that the temperature ranges from 26.8-29.5°C, the pH ranges from 7.6-7.9 a, and the DO ranges from 4.8-5.5 mg. l⁻¹. This water quality range can be said to be optimal for fish life. According to (Purba et al., 2021), a suitable temperature range for koi fish is 27-29°C. According to (Kelabora, 2010) that temperature can affect the growth and appetite of fish. The ideal pH for freshwater biota is 7-8.5 (Muslim & Atjo, 2021). The minimum dissolved oxygen concentration for keeping koi fish is mg. l⁻¹ (Simamora et al., 2021).

CONCLUSION

The addition of astaxanthin to fish feed had a very significant effect ($P < 0.05$) on increasing the brightness of the colour of koi fish (*Cyprinus subfuscous*). However, it did not significantly affect the average growth (Average Body Weight / ABW), specific growth rate (SGR), Feed Conversion Ratio (FCR) and survival rate (SR). The best results were obtained at the additional dose of 125 mg/kg of feed with an average colour increase of 20.29 ± 0.10 .

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