The Effect of Astaxanthin and β-carotene on the Colour of the Kissing Gourami (*Helostomatemminckii*)

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Abstract

In this study, we have investigated the effects of astaxanthin and b-carotene on the skin colour of fish Kissing Gourami (*Helostomatemminckii*). 80 fishes were randomly selected into 2 groups (40 each group). The control group fish were fed with standard flake feed. Astaxanthin (100 mg/kg) and β-carotene (150 mg/kg) were added to the standard diet for experimental group. Fish skin colour was compare with colour scale. Colour change was recorded weekly for the 12 weeks of experiment. First colour change was record in 6th week in control group (light pink). No other change of colour was determinate. In experimental group was first colour change in 4th week (light pink) and the maximal influence of astaxanthin and β-carotene was recorded in 10th week (light red). Therefore, it was determined that these pigment sources have an effect on the colour of gourami fish.

Keywords: astaxanthin, β-carotene, colour scale, kissing gourami

1. Introduction

Microalgae, which are important in the production of larval fish because of their nutritive ingredient, can be used as a natural pigment source in fish feeds. The use of microalgal biomass has been recently investigated with regard to its potential as a colouring agent [1, 2]. But the use of synthetic pigment sources is more common because they are easy to obtain [3]. Astaxanthin is another high-value carotenoid produced from microalgae that is achieving commercial success. Astaxanthin is ubiquitous in nature, especially in the marine environment, and is probably best known for eliciting the pinkish-red hue to the flesh of salmonids, as well as shrimp, lobsters and crayfish. Because these animals are unable to synthesize astaxanthin*de novo*, carotenoid pigments must be supplied in their diet [4, 5]. Dietary carotenoids play an important role in regulating fish colour because fish, like other animals, are unable to synthesize carotenoids and their skin colour is highly dependent on carotenoids from the diet [6]. Ornamental fish obtain carotenoids from feeding upon algae, coral or prey that have accumulated these pigments. One of the greatest challenges in the tropical marine ornamental industry is to accurately replicate the natural colour of fish that are maintained in captivity. Numerous operations that have mastered the art and science of propagation have failed to successfully market their fish as a result of the loss of pigmentation. Various products have been introduced to alleviate this problem, but none have performed as effectively and consistently as natural astaxanthin from *Haematococcus*. On a commercial scale, an inclusion rate of 30 ppm astaxanthin is used to supplement live and flaked foods resulting in a significant colour improvement in most species of tetras, cichlids, gouramis, goldfish, koi and danios [7].

The focus of this study were to manipulate the type of carotenoids (astaxanthin, β-carotene) in

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the diet of Kissing gourami (*Helostomatemminckii*) and to examine if fish colour expression is related to pigment intake.

2. Materials and methods

Trial was undertaken with Kissing Gourami (*Helostomatemminckii*) in 8 weeks age for period 12 weeks. 80 homogenous fishes were randomly distributed in 2 tanks. Their sex was not taken into consideration.

First tank (control group) fishes were fed standard flake feed and second tank (experimental groups) fishes were fed standard flake feed with astaxanthin and β-carotene (Table 1). In both groups, fishes were fed by hand *ad libitum* three times a day (6:00 am, 2:00 pm and 10 pm). The water condition of tanks is shown in Table 2.
Two air pumps and one sponge filter were used in the aquariums for filtration and airflow. The aquariums were placed side by side in two lines. Natural photoperiod was used during the experiment.

Table 1. Composition of the control and experimental diets

Composition	Control group	Experimental group
Crude protein	48%	48%
Crude fat	6%	6%
Ash	8%	8%
Astaxanthin	-	100 mg/kg
β-carotene	-	150 mg/kg

Table 2. Water condition in control and experimental group

Water condition	Value
water temperature	26°C
pH	6.5
NO_2	max. 0.1 mg/l
water hardness	15°dGH

Fish skin colour was compare with us designed scale shown in Picture 1. The compare were performed on both sides of the dorsal fish skin weekly and colour changes was recorded. Colour scale present 5 colour described by degree (Table 3).

Picture 1. Colour scale

Degree	Colour
0	silver (unchanged)
1	light pink
2	pink
3	light red
4	red

Table 3. Colour scale

3. Results and discussion

Colouration is controlled by the endocrine and nervous system, but dietary sources of pigment also play a role in determining the colour of fish. The effectiveness of carotenoid source in terms of deposition and pigmentation is species-specific. In addition, all fish species do not possess the same pathways for the metabolism of carotenoids, and therefore, there is no universal transformation of carotenoids in fish tissues [8].

According to the results obtained from the experiment, it was observed that the gourami fish responded to colouration effected by the use of pigment sources.
Table 4 and 5 shows the number of fish and the colour change during the experiment. Significant colour change in the control group occurred at week 6, when 24 fish were coloured light pink. At 8 weeks, all fish were already coloured light pink. Another colour change was not observed. In the experimental group the first

significant change was in week 4, where 31 fish were coloured light pink. At 6 weeks, the 30 fish was pink. At 10 weeks, the 33 fish was light red. At the end of the experiment all 40 pieces of fish red light.

Table 4. Number of fish and the colour change in control group

Degree	Weeks											
	1	2	3	4	5	6	7	8	9	10	11	12
0	40	40	38	9	0	0	0	0	0	0	0	0
1	0	0	2	31	40	10	5	0	0	0	0	0
2	0	0	0	0	0	30	35	40	38	7	1	0
3	0	0	0	0	0	0	0	0	2	33	39	40
4	0	0	0	0	0	0	0	0	0	0	0	0

Table 5. Number of fish and the colour change in experimental group

Degree	Weeks											
	1	2	3	4	5	6	7	8	9	10	11	12
0	40	40	40	40	37	16	1	0	0	0	0	0
1	0	0	0	0	3	24	39	40	40	40	40	40
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0

Table 6 present chronological colour changes in both tanks (control and experimental) during 12 weeks. In control group fed with standard flake feed from begin of experiment to 5 weeks was not record colour change. First colour change was determinate in 6th week of experiment. From 6th week to end of experiment was not record other colour change and the colour of fishes was similar with 1 degree of colour scale. Subsequently, 1% *Haematococcus* algae meal was used to augment the diet of red velvet swordtails, rainbow fish, 24K mollies, topaz cichlids, discus, rainbow sharks, pink kissing gouramis and rosy barbs. Within one week, in each of the species, there were significant improvements in pigmentation, and some species had faster growth rates. Although a relatively high concentration of *Haematococcus* algae was used in the feed, many commercial producers prefer to use an acute pigmentation treatment to prepare fish for the market. Much lower dosages could effectively be used to maintain pigmentation [7].

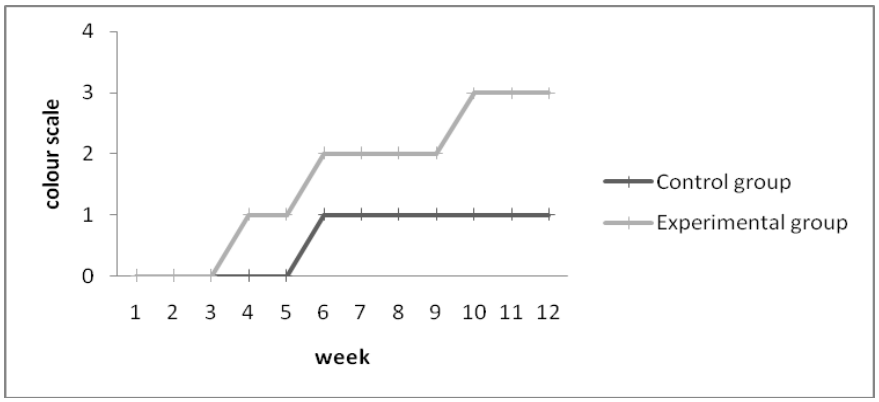
Table 6 Colour change in control and experimental group

Weeks	Colour scale			
	Control group		Experimental group	
	degree	colour	degree	colour
1.	0	silver (unchanged)	0	silver (unchanged)
2.	0	silver (unchanged)	0	silver (unchanged)
3.	0	silver (unchanged)	0	silver (unchanged)
4.	0	silver (unchanged)	1	light pink
5.	0	silver (unchanged)	1	light pink
6.	1	light pink	2	pink
7.	1	light pink	2	pink
8.	1	light pink	2	pink
9.	1	light pink	2	pink
10.	1	light pink	3	light red
11.	1	light pink	3	light red
12.	1	light pink	3	light red

In our experiment during 3 weeks of was not record colour change in experimental group. In the 4th week was record colour change equal with 1 degree of colour scale. The colour of fishes was similar with 2 degree of scale in 6th week during 9th week of experiment. The most successful in inducing red coloration in the skin of gouramis was most apparent after 10 weeks of feeding.

Additionally, natural esterified forms of astaxanthin such as Naturose are known to increase skin redness and total carotenoid content in red porgy [8].

No other colour change was record to end of experiment. Maximal colouring of fishes was compare with 3 degree of scale caused by Astaxanthin and β-carotene (Picture 2).



Picture 2. Schematic colour change in control and experimental group

4. Conclusions

In conclusion, we observed that these pigment sources have an effect on the colour of kissing gourami fish.

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