Effects of astaxanthin on chromatic, biochemical and tissue morphology characteristics in juvenile blood parrotfish astaxanthin (*Cichlasoma synspilum* ♀ × *Cichlasoma citrinellum* ♂)

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GLOBAL CONFERENCE FOR AQUACULTURE 2021
22–27 September 2021
Shanghai, China

INTRODUCTION

- The absence of carotenoid supplements in diet could affect the physiology and coloration of ornamental fish.
- To investigate this, the effects of astaxanthin on chromatic, biochemical and tissue morphology characteristics in juvenile blood parrotfish was carried out.

MATERIALS AND METHODS

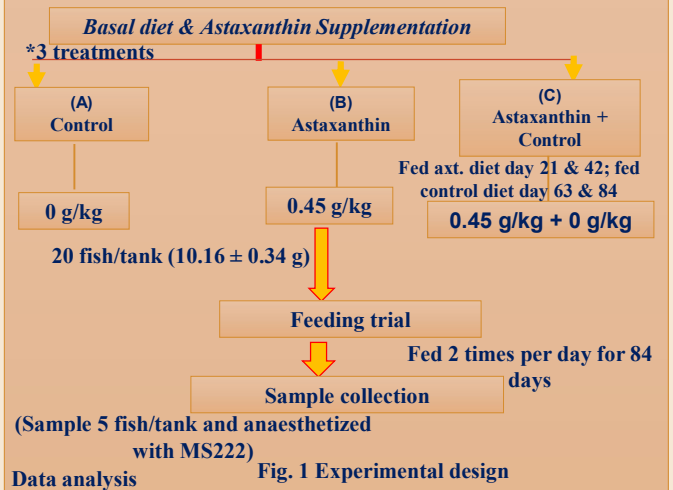

Fig. 1 Experimental design

Data analysis

Data obtained from this experiment were subjected to one-way ANOVA in IBM SPSS Statistics; version 24.0). Differences between means were tested by Tukey's multiple range test. All data are presented as means±SEM. Differences between the mean values from two groups were assessed using two-tailed student's t-test. P values <0.05 were considered to indicate statistical significance.

RESULTS AND DISCUSSION

Fig. 2 The skin chromatophores (erythrophores) of blood parrotfish fed control, ASX (0.45 g/kg), and ASX- (0.45 g/kg + 0 g/kg) diets, respectively, showing absence of erythrophores in control (a) concentrated erythrophores in coloration (b) and network of erythrophores in discoloration (c) group (Magnification x200) for 84 days.

Pigment cells were concentrated in the astaxanthin group compared with the discoloration group with dispersed and dentritic-shaped pigment cells and totally absent in the control group.

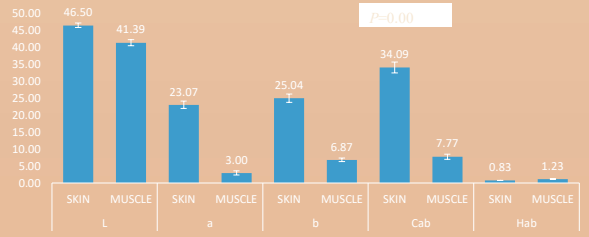

Fig. 3 Blood parrot fish skin and muscle L*, a*, b*, C_{ab*}, and H_{ab} ASX group for 84 days.

The saturation and deposition of astaxanthin take place in the skin faster than the muscle which may be due to the transforming ability of alimentary to ingest and transform carotenoids, thereby storing it in the skin of blood parrotfish.

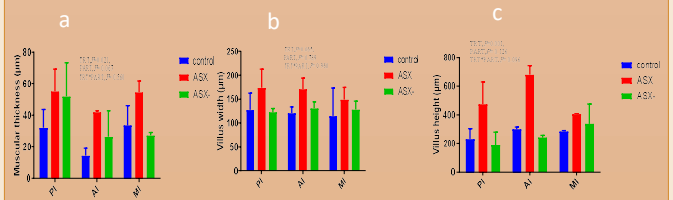

Fig. 4 The posterior-intestine (PI), anterior-intestine (AI), and mid-intestine (MI) of blood parrotfish fed control, ASX (0.45 g/kg), and ASX- (0.45 g/kg + 0 g/kg) diets, respectively, showing the (a) muscular thickness (b) villus width and (c) villus height for 84 days.

The increased VH, VW, and MT in the coloration group indicate that astaxanthin improves the intestinal health and surface area for nutrient uptake of the fish. This may be attributed to the supplementation of astaxanthin which increases the quantity of intestinal microflora and maintaining LDL-C concentration thereby preventing lipid peroxidation and boosting integrity of intestinal and liver epithelial wall enhancing nutrient assimilation and absorption.

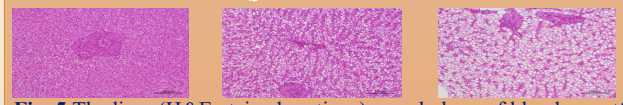

Fig. 5 The liver (H&E-stained sections) morphology of blood parrotfish fed control, ASX (0.45 g/kg), and ASX- (0.45 g/kg + 0 g/kg) diets, respectively, showing the hepatocytes (HP), sinusoids (SN) and Kupffer

Cells of control (a) coloration (b) and discoloration (c) group (magnification x400) for 84 days.

The presence of hepatocyte cells in all the groups is an indication of protein synthesis.

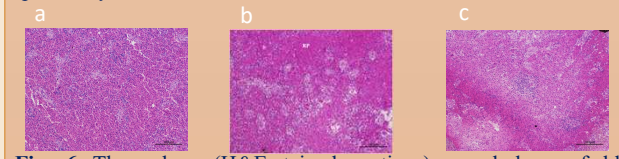

Fig. 6 The spleen (H&E-stained sections) morphology of blood parrotfish fed control, ASX (0.45 g/kg), and ASX- (0.45 g/kg + 0 g/kg) diets, respectively, showing the white pulp (WP), red pulp (RP), and central arteriole (CA) of control (a) coloration (b) and discoloration (c) group 9magnification x400) for 84 days.

In contradiction to the control and ASX-, more red pulp of the spleen was present in ASX which indicates removal of worn-out erythrocyte cells whereas increase in white pulp is an indication of proliferation of macrophages, thereby promoting the well-being of the fish against microscopic organisms.

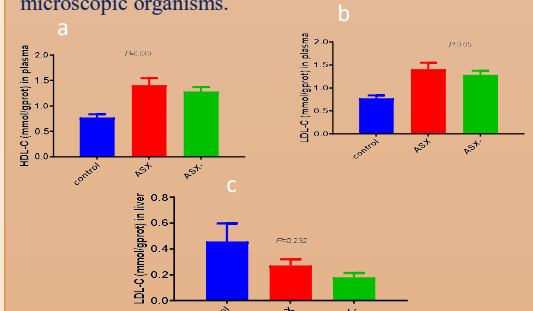

Fig. 7 The lipoprotein-cholesterol of blood parrotfish fed control, ASX (0.45 g/kg), ASX- (0.45 g/kg + 0 g/kg) diets, respectively, showing the HDL-C in plasma (a) and LDL-C in plasma and liver (b) & (c).

CONCLUSION

In conclusion, astaxanthin improves the concentration of pigment cells, chromatic parameters, villus height and thickness in blood parrotfish. More so, astaxanthin increases blood HDL-C and decreases liver LDL-C in blood parrotfish.

REFERENCES

Li, T., & He, C. (2016). Effects of Different Carotenoids on Pigmentation of Blood Parrot (Cichlasoma synspilum × Cichlasoma citrinellum). *Journal of Aquaculture Research & Development*, *07*(03).