The development of three types of chromatophores in *Sinibrama sinibrama* is regulated by thyroid hormone

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1 Introduction

Thyroid hormones play an important role in the regulation of chromatophores differentiation and pigment production in fish. In this study, we investigated the changes of chromatophores and pigment content by soaking the thyroid hormone in *S.taeniatus*, then combined with RNA-seq analysis to detect the expression of related genes. Through high-performance liquid chromatography (HPLC) analysis, we found that thyroid hormones promoted the synthesis of xanthophore and iridophores, inhibited the growth of melanophore and promoted melanin synthesis.

2 Thyroid hormone changes the pigmentation of *Sinibrama taeniatus*

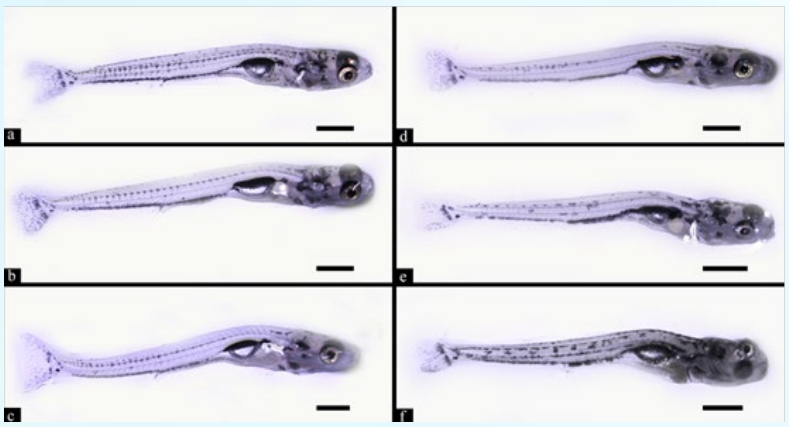

Figure 1 Effect of thyroxine on body color of *S. taeniatus*
a:control; b:1nM; c:10nM; d:20nM; e:40nM; f:80nM;The scale in the figure represents 0.5 mm.

The body color of *S.taeniatus* gradually became lighter with the increase of thyroid hormone concentration. The number of melanophore on the side of the fish in the experimental group was significantly lower than that in the control group.

3 Repercussions of thyroid hormones on the three pigment cells in *Sinibrama taeniatus*

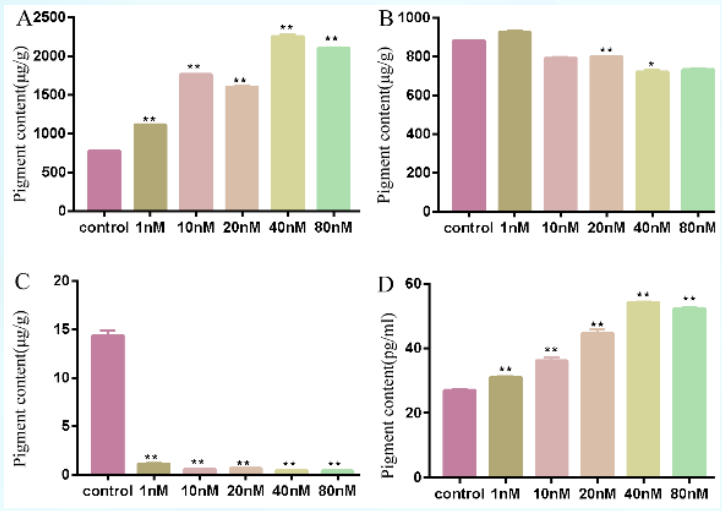

Figure 2 Effects of different concentrations of thyroxine on pigment content of *S. taeniatus*.
A: Effects on guanine content; B: Effects on pteridine content; C: Effects on β-carotene content; D: Effects on melanin content.

The content of guanine increased with the increase of thyroxine concentration. Thyroxine to pteridine was significantly reduced only in the 20 nM and 40 nM groups. The content of β-carotene in different treatment groups was significantly lower than that in the control group. Compared with the control group, the melanin content of the fish treated with thyroxine was significantly increased ($p < 0.01$).

4 Gene expression involved in melanin-related pigmentation

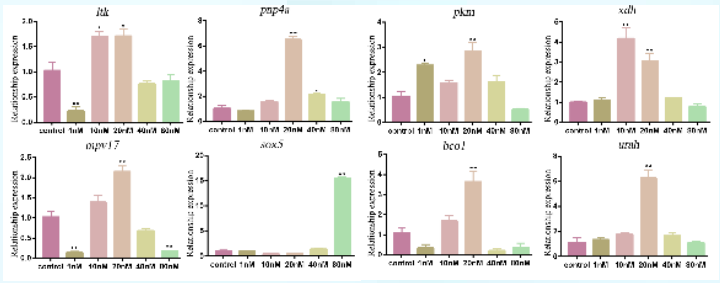

Figure 3 Expression analysis of iridophores and xanthophore related genes
N=3. (Note : * indicates $p < 0.05$; ** indicates $p < 0.01$.)

5 Gene expression involved in non-melanin-associated pigmentation

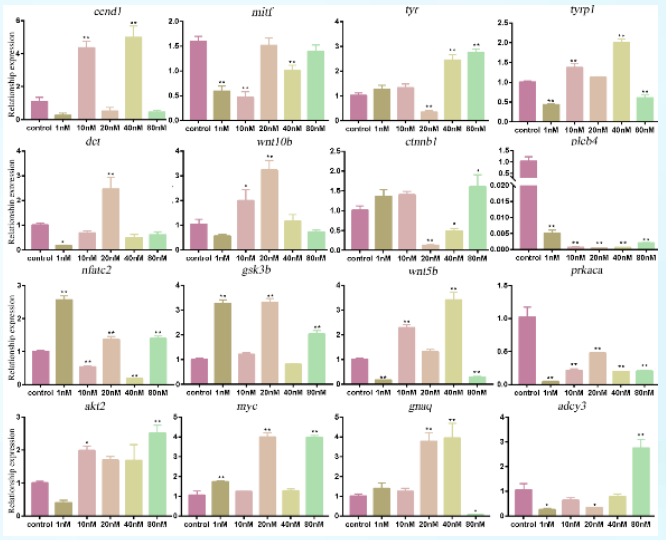

Figure 4 Expression analysis of melanocyte related genes
N=3. (Note : * indicates $p < 0.05$; ** indicates $p < 0.01$.)

Ltk, *pnp4a*, *mpv17* and *sox5* play an important role in the differentiation of iridophores and guanine synthesis. *pkm, xdh, bco1* and *urah* play an important role in the development of xanthophore. *ccnd1, mitf, tyr, tyrp1, dct, wnt10b, ctnnb1, plcb4, nfatc2, gsk3b, wnt5b* play important roles in melanophore formation.

6 Conclusion

In this study, it was found that thyroid hormone has a regulatory effect on the three chromatophores of *S.taeniatus*, among which it promotes the coloration and synthesis of xanthophore and iridophores, inhibits the increase in the number of melanophore and promotes melanin synthesis..