

Effect of Dietary Copper Exposure on Accumulation, Growth and Hematological Parameters of the Juvenile Rockfish, *Sebastes schlegeli*

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Introduction

Although the sub-chronic toxic effects of metal on fishes are well documented, that is mostly in fishes exposed to waterborne metal but few studies have been conducted on the effects of dietary metal (Handy, 1996). The realization that dietary uptake of metal is a major cause of long-term contamination in wild fish has renewed interest in the nutritional and toxicological effects of metal in the food of fishes (Handy, 1996). Copper (Cu) is an essential metal for all organisms including fish, its function plays an important role in organism metabolism and its concentration is well regulated (Cousins, 1985). However, copper is one of the most toxic metals to fish and affects various blood parameters, growth, enzyme activity, and reproduction (Horning and Nieheisel, 1979). Despite the importance of the rockfish in Korea, relatively little information is available on the effect of Cu, particularly through dietary exposure. Therefore, the aims of the present study were to investigate the Cu accumulation, to estimate the growth and hematological change in tissue of juvenile rockfish, *S. schlegeli*, after sub-chronic dietary Cu exposure.

Material and Methods

Diets were supplemented with 0, 50, 125, 250 and 500 mg/kg diet, using $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$. It was dissolved in 1000 mL acidified water and mixed well with the other feed ingredients. All ingredients were mixed and stored at -20°C until they were fed to the fish. The juvenile rockfish (*S. schlegeli*) were obtained from rockfish nursery in Koge island, Korea. Rockfish were acclimated in 1-ton aerated running seawater tank for 1 month to the laboratory conditions. Fish were fed 2% body weight per day (as two 1.0% meals/day). After acclimatization, fish were selected by body length

11.83 ± 0.03 cm (mean ± S.E., n = 600), body weight 26.02 ± 0.23 g for the experiment of dietary Cu exposure. After 3week in acclimating tanks, fish were randomly transferred to 150L of tank which were running water test with continuous aeration.

The gill, intestine, kidney, liver and muscle were sampled every 10 days for analysis of metal concentration during 60days. Cu concentrations of livers were measured using a flame atomic absorption spectrophotometer. Blood samples were obtained using a heparinized syringe from the caudal vein of fish. Blood parameters were measured hematocrit, hemoglobin and red blood cells. Serum samples were analyzed for glucose, total protein, calcium and magnesium. Data are expressed as means standard error (S.E.). Statistics were using one-way analysis of variance (ANOVA) followed by Duncan's multiple comparisons test of mean values if significant differences were found (P<0.05).

Results and Abstract

Cu accumulation in liver, intestine and kidney was significantly increased with dietary exposure period and concentration for 60 days. Cu accumulation in the kidney were about an order of magnitude lower than those of the intestine and liver. Low Cu accumulation was observed in muscle and did not vary significant after 30 days with dietary exposure concentration. Liver of rockfish is a more important storage tissue than other tissues, and the order of Cu accumulation in tissues were liver > intestine > kidney > gill > muscle. Cu dietary exposure resulted in reduction of rockfish growth rate, and had inverse relationship between growth and Cu concentration. The present findings indicate that in the rockfish, sub-chronic dietary exposure to Cu was no significant affected blood parameters except magnesium.

References

- Cousins, R.J. 1985. Absorption, transport and hepatic metabolism of copper and zinc: Special reference to metallothionein and ceruloplasmin. *Physiol. Rev.*, **65**, 238~309.
- Handy, R.D. 1996. Dietary exposure to toxic metals in fish. In *Toxicology of Aquatic Pollution* E. W. Taylor (eds). Cambridge Univ. Press. New York. pp. 29~60.
- Horning, W.B. and Nieheisel, T.W. 1979. Chronic effect of copper in the bluntnose minnow, *Pimephales notatus* (Rafinesque). *Arch. Environ. Contam. Toxicol.*, **8**, 545~552.