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Growth and hematological changes of rockfish, *Sebastes schlegeli* (Hilgendorf) exposed to dietary Cu and Cd

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Introduction

Cd is a non-essential element that has severe toxic effects on aquatic animals when present in excessive amounts (Sorensen 1991). In fish, Cd has adverse effects on growth, reproduction, and osmoregulation (Handy 1996). In contrast to Cd, 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, Cu is one of the most toxic metals to fish and affects various blood parameter, growth, enzyme activity, and reproduction. Although the sub-chronic toxic effects of metals on fishes are well documented, that is mostly in fishes exposed to waterborne metals, relatively few studied have been conducted on the effects of dietary metals (Handy 1996). The aims of present study were to determine effects on growth and hematological parameter in juvenile rockfish of sub-chronic dietary Cd and Cu exposure.

Material and Methods

Diets were supplemented with 0 (control), 0.5, 5, 25 or 125 mg Cd/kg feed of $\text{Cd}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$ for dietary Cd exposure, and 0, 50, 100, 250 or 500 mg Cu/kg feed of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ for dietary Cu exposure. Ten fish were removed from each tank every 10 days during the 60 days of the experiment. Weight and total length were recorded for each individual.

Blood samples were obtained with a heparinized syringe from the caudal vein of the fish. Hematocrit values were determined using a micro-hematocrit reader. Hemoglobin concentrations of the blood were measured by the cyano-methemoglobin method. The red blood cell (RBCs) count was

determined in a 1:200 dilution of the blood sample in the Hendrick's solution with a hema-cytometer. Serum samples were analyzed for glucose, total protein, calcium and magnesium.

Data are expressed as means \pm standard error (S.E.). Statistics were performed with SPSS, using one-way analysis of variance (ANOVA) followed by the Duncan's multiple comparisons test of mean values if significant differences were found ($P < 0.05$).

Results and Abstract

Weight and length daily growth rates of the rockfish were significantly different from control, and a significant inverse relationship was observed between weight gain and the exposure concentration of dietary Cd at 25, 125 mg/kg ($P < 0.05$). Hematocrit and hemoglobin decreased significantly and were dose dependently in all Cd exposure. Glucose in serum was also increased significantly ($P < 0.05$). The concentration of total protein in serum was significantly lower than control at 5, 25 and 125 mg/kg. No differences were observed in serum calcium concentration. Magnesium concentration in serum was increased significantly with dietary Cd concentration. In the experiment of Cu exposure, rockfish exposed to 0, 50, 100, 250 and 500 mg/kg Cu diet for 60 days. Cu was inhibited weight gain and growth rate. No differences were observed in hematocrit, hemoglobin and RBCs compared to control. Contents of total protein, glucose and Ca in serum remained stable. Mg concentration in serum was increased significantly at 500 mg/kg.

References

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