DISTRIBUTION OF TRACE METALS IN DIFFERENT TISSUES OF BLUEFIN TUNA *THUNNUS THYNNUS*

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Abstract
Concentrations of Cd, Cr, Cu and Zn were analyzed in muscle tissue, gill and liver samples of the bluefin tuna *Thunnus thynnus* caught in the Middle Adriatic. Analytical results revealed variable distribution of metals in the examined tissues. Maximum levels of Cd, Zn and Cu were determined in the liver, while Cr concentrations were similar in all analyzed tissues.

Keywords : trace metals, distribution, bluefin tuna

Introduction

Data on trace metal content in different fish tissues are often used to study the physiological behavior of metals in the fish (1). The aim of this study was to determine the concentrations of some potentially toxic trace metals (Cd, Cr, Cu and Zn) in different tissues of the bluefin tuna *Thunnus thynnus*, in order to determine distribution patterns of metals in the organism.

Methods

Eighteen specimens of bluefin tuna were caught by purse-seine in the open waters of the Middle Adriatic, during August 1996. Collected fish were immediately frozen (-20°C) and transported to the laboratory for analysis. In the laboratory, the fork length (range: 123-240 cm; mean=157±25 cm) and weight (range: 35-165 kg; mean=69±27 kg) of each specimen were measured. Liver, gills, parts of light muscles near the head, from the middle part and the tail of the fish, as well as the red muscle from the middle part were cut out and frozen prior to analysis. Preparation of tissues for trace metal analysis included freeze drying, sample homogenization and wet digestion (2). Trace metal analyses were performed using graphite furnace atomic absorption spectroscopy. All results are reported in mg kg^{-1} dry weight. The accuracy of the analytical procedure was tested using certified reference material IAEA-350 (Tuna fish). Statistical differences between mean metal concentrations in different tissues were evaluated using non-parametric Sign Test.

Results and discussion

Heavy metal concentrations in the different fish tissues are shown in Fig. 1. Chromium concentrations were similar in all tissues ($P>0.05$). In contrast, the highest levels of Cd, Zn and Cu were determined in liver samples. Cadmium concentrations in liver were 45-55 times higher in comparison to all other tissues, among which there were no significant differences ($P>0.05$). Concentrations of Zn and Cu in liver were also 4-13 times and 9-66 times higher respectively in comparison to other tissues. Observed patterns of trace metal distribution between tissues match well with the results of other field and laboratory studies (1, 3-5). Differences between trace metal concentrations in analyzed tissues probably originate from differences in physiological functions of muscles, gills and liver (1, 6). However, distribution of Cu and Zn among the different muscle tissues also differed. Concentrations of Zn in red muscle samples and in muscles from near the head and the tail were higher than in the light muscle samples from the middle part of the fish. Unlike Zn, Cu concentrations were similar in the light muscle samples from three different parts of the fish, and 5-8 times lower than in the red muscle. This is probably due to differences in distribution and detoxification strategies of Cu and Zn in fish (1). Higher Cu concentrations in red muscle could also be related to the important metabolic role of Cu in respiratory pigments (1), which are present at high concentrations in the blood and the red muscle itself (6).

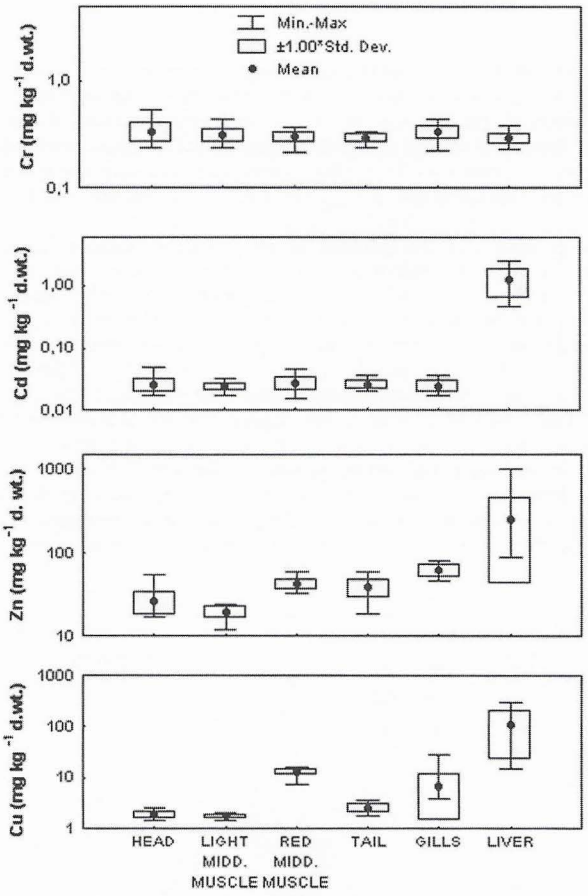

Fig. 1. Trace metal concentrations (in mg kg^{-1} dry weight) in liver, gills and muscle tissues of bluefin tuna (N=18; length: 123-240 cm; weight: 35-165 kg). Dots represent average values; lower and upper box edges represent average ± 1 SD; outlying bars are minimum and maximum values.

References

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