DISTRIBUTION OF MERCURY AND SELENIUM IN SELECTED ORGANS AND MUSCLE TISSUES OF TUNA FROM THE MIDDLE ADRIATIC

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Abstract

The mercury and selenium contents are determined in organs (liver and gills) and muscle tissues (light and dark muscle) of the tuna caught in the Middle Adriatic. Atomic absorption spectrophotometry with hydride generation was used to determine the concentrations of mercury and selenium in tuna. The method is accurate and precise which is confirmed by using a standard reference material. It was shown that the mercury concentration reaches maximum in liver, then in dark muscle, and finally in light muscle while it is lowest in gills. Furthermore, it was found that the selenium content reaches maximum in liver, then in dark muscle, and finally in gills, while it is lowest in light muscle.

Key words: AAS, Hg-Se distribution, Middle Adriatic, Thunnus thynnus L., tuna

Introduction

Based upon acute toxicity tests, mercury is important in bioaccumulation and sublethal effects in marine organisms. In its ecological cycle Hg is found in a part of the Earth's crust, its water and atmosphere layer, but when incorporated in living organisms mercury may perturb vital bio chemical processes. The fish that live in marine waters could obtain their mercury load directly from the seawater and through the food web. This accumulated mercury may increase with fish age, and one such example is the tuna, *Thunnus thynnus* L. Since the Mediterranean is considered to be an area of enhanced natural mercury input (the biggest world mercury mines are situated on the edges of this basin) (1), it is possible that tuna in the Adriatic contain significant mercury levels. Toxic effects of mercury are expressed in different ways according to the chemical form of Hg, the dose, and the route of exposure in various species of animals.

Selenium as a rare metalloid is both essential and toxic within a relatively narrow concentration range. A biological interest in selenium has significantly increased during the last four decades when its useful influence in living organisms was established (2,3). The fact that selenium is essential in the metabolic defence of an organism against oxide stress (4) was an important discovery.

Materials and methods

The tuna were obtained by professional fishermen in middle Adriatic area (around the Islands of Vis and Jabuka) in the summer of 1996. After biometric measurements (weight, length and age defining of fish) were made, two organs (liver and gills) and two comestible tissues (light and dark muscle) were taken for analysis. The samples were homogenized, placed in polyethylene pots and stored in refrigerator at –20°C.

The quantitative analysis was carried out by A.A.S. (Perkin Elmer 1100B) with hydride generation after organic matrix digestion with HNO_3/H_2O_2 for Hg and $HNO_3/H_2SO_4/HClO_4/HCl$ for Se. The accuracy of the analytical procedures was tested and controlled using NRCC TORT-1 (lobster hepatopancreas) and DORM-2 (dogfish muscle) certified reference material. A comparison of the obtained results with the reference values is shown in Table 1.

Table 1. Results of standard reference-material analysis.

Standard reference material	w(Hg)/mg kg^{-1}	w(Se)/mg kg^{-1}
TORT-1		
Certified value	0.33±0.06	6.88±0.47
Our value	0.33±0.02	6.81±0.49
DORM-2		
Certified value	4.64 ± 0.26	1.40 ± 0.09
Our value	4.32±0.29	1.41 ± 0.11

The obtained results showed very good compliance with the reference values.

Results

Measured average values of mercury and selenium concentrations in the selected organs and tissues are shown in Table 2.

Table 2. Average values (±SD) of Hg and Se concentrations (mg/kg wet weight) in the selected organs and tissues

	Liver	Gills	Light muscle	Dark muscle
w(Hg)/ mg kg-1 w.w.	3.08±1.55	0.50±0.14	1.28±0.48	1.87±0.73
w(Se)/ mg kg-1 w.w.	19.24±7.20	9.58±2.32	1.46±0.30	14.68±5.01

Conclusions

The results obtained lead to the following conclusions:

- It is determined that the mercury concentration reaches maximum in liver, then in dark muscle and finally in light muscle, while it is lowest in gills.
- According to the mass contents in comestible parts of tuna a great number of specimens was not appropriate for human consumption, because the obtained values were higher than MPL of 1 mgHg/kg wet weight (Maximum Permissible Levels for tuna in Croatia).
- It is determined that the selenium content reaches its maximum in liver, then in dark muscle, and finally in gills, while it is lowest in light muscle.

References

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