

HEAVY METAL CONCENTRATIONS IN DIFFERENT TISSUES OF *MULLUS BARBATUS* AND *MULLUS SURMULETUS* FROM ISKENDERUN BAY, EASTERN COST OF MEDITERRANEAN, TURKEY

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Abstract

Along the coast of Iskenderun Bay, there are agricultural lands and industrial plants (iron–steel plants, LPG, plants, oil transfer docks and cargo ship’s ballasts water). Due to heavy industrial and agricultural activities in the region, the Bay is under stress of the many pollutants. In this investigation, muscle was generally, accumulated the lowest levels of metals for two species. The results showed that metal accumulation in *Mullus surmuletus* was higher than *Mullus barbatus* tissues.

Keywords: *Metals, Fishes, Monitoring*

Introduction

The pollution of aquatic ecosystems by heavy metals is an important environmental problem as heavy metals constitute some of the most hazardous substances that can bioaccumulate [1]. Fish species are often the top consumers in aquatic ecosystems and thus metal concentrations in fish can act as an environmental indicator of the state of the environment [2]. Iskenderun Bay, in which there are large quantities of untreated industrial and domestic sewage, has one of the polluted coastal waters of Turkey and also has high economic importance for fishery. The aim of this work was to evaluate selected metal (Fe, Zn, Al, Cu, Pb, Mn, Ni, Cr, Cd) concentrations in different tissues of fish from two demersal species collected from Iskenderun Bay, which is situated on the eastern Mediterranean coast of Turkey.

Material and Methods

Red mullet (*Mullus barbatus*) and striped red mullet (*Mullus surmuletus*) samples were caught by fishermen’s nets in 2009 from Iskenderun Bay. Total size and weight of fishes were for *M.barbatus* 36.05±2.45 g, 14.08±0.27cm; for *M. surmuletus* 60.76±2.30g, 16.32±0.23 cm, respectively. The sample preparation and analysis were carried out according to the procedure described by UNEP reference methods [3]. The tissues digested with concentrated nitric acid and perchloric acid (2:1, v/v) at 60°C for 3 days. All samples assayed using ICP-AES. The accuracy of analytical procedure was checked by analyzing the Standard reference materials (National Research Council of Canada; dogfish muscle and liver) DORM2 in three replicates for each batch of fish samples digested. Recovery rates ranged from 93% to 100% for all investigated elements.

Result and Discussion

For skin; the highest Al (17.21 µg/g dw), Fe (20.28 µg/g dw), Cr (10.47 µg/g dw) concentration were detected in *M. barbatus*; the highest Pb (11.87 µg/g dw), Zn (5.58 µg/g dw), Ni (1.99 µg/g dw) concentration was detected in *M.surmuletus* from Iskenderun Bay. For muscle tissue; the highest Al (7.52 µg/g dw), Pb (8.10 µg/g dw), Fe (4.51 µg/g dw), Zn (0.77 µg/g dw), Ni (1.51 µg/g dw) concentration were detected in *M. surmuletus*; the highest Cr (6.56 µg/g dw), concentration was detected in *M.barbatus* from Iskenderun Bay. For liver tissue the highest Al (13.94 µg/g dw), Pb (15.18 µg/g dw), Fe (161.41 µg/g dw) was detected in *M.surmuletus* from Iskenderun Bay (Tab. 1, 2).

Tab. 1. The mean concentrations and Standard deviation of metals in the different tissues of *M.barbatus*

| Metals | Heavy Metal Concentrations | | |
|--------|----------------------------|------------------------|-------------------------|
| | Skin | Muscle | Liver |
| Al | 17.21±1.09 ^b | 6.67±0.17 ^a | 13.35±0.33 ^b |
| Pb | 5.85±0.64 ^b | 2.26±0.26 ^a | 4.99±1.07 ^{ab} |
| Fe | 20.28±1.56 ^b | 3.31±0.28 ^a | 102.8±4.01 ^c |
| Zn | 1.04±0.71 | 0.11±5.93 | nd |
| Ni | 0.12±0.27 | nd | nd |
| Cd | nd | nd | nd |
| Cu | nd | nd | nd |
| Cr | 10.47±2.01 | 6.56±1.03 | 6.76±3.90 |
| Mn | nd | nd | nd |

Tab. 2. The mean concentrations and Standard deviation of metals in the different tissues of *M.surmuletus*

| Metals | Heavy Metal Concentrations | | |
|--------|----------------------------|------------------------|--------------------------|
| | Skin | Muscle | Liver |
| Al | 9.39±0.39 ^b | 7.52±0.15 ^a | 13.94±1.56 ^c |
| Pb | 11.87±0.84 ^{ab} | 8.10±0.87 ^a | 15.18±1.71 ^b |
| Fe | 12.67±0.66 ^b | 4.51±0.33 ^a | 161.4±11.37 ^c |
| Zn | 5.58±0.75 ^b | 0.77±0.17 ^a | 5.22±0.94 ^b |
| Ni | 1.99±0.55 ^a | 1.51±0.18 ^a | 2.55±0.73 ^a |
| Cd | 0.03±0.01 ^a | 0.14±0.04 ^a | 0.02±0.01 ^a |
| Cu | 0.53±0.07 ^a | 1.21±0.15 ^b | 0.70±0.32 ^{ab} |
| Cr | 0.22±0.15 | 0.48±0.17 | nd |
| Mn | 0.01±0.01 | 0.01±0.00 | nd |

Generally the levels of metals found in tissues of the *M. surmuletus* were generally higher than those found in *M. barbatus*. Our results show that generally metal accumulation is highest in liver and skin, while it is low in muscle in two species. This is probably due to their physiological roles in fish metabolism. It is well known that large amount of metallothionein induction occurs in the liver tissue of fishes, therefore the liver tissue is highly active in the uptake and storage of heavy metals [4, 5, 6, 7]. Turkish legislation establishes maximum levels for four of the metals studied, above which human consumption is not permitted as; 0.1 mg/kg for Cd, 1.0 mg/kg for Pb, 20.0 mg/kg for Cu, 50 mg/kg for Zn [19]. Food and Agricultural Organization limits for Cd and Pb 0.5 mg/kg, for Cu and Zn 30 mg/kg [20].

In conclusion, the concentrations of these metals measured in the muscle of the three species studied were generally lower than the levels issued by FAO and Turkish legislation. Yet, Pb concentrations in the muscle tissues were higher than the maximum levels set by law.

References

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