



21-22 November, 2024

Selenium - mercury molar ratios in blood serum of common carp (*Cyprinus carpio*) in association with body metrics

Marek Helczman^{1*}, Marian Tomka², Michal Lenicky¹, Denis Bazany¹ Anton Kovacik¹

¹Affiliation: Institute of Applied Biology, Faculty of Biotechnology and Food Sciences, Slovak University of Agriculture in Nitra, Tr. A. Hlinku 2, 949 76 Nitra, Slovak Republic

²Affiliation: Institute of Biotechnolgy, Faculty of Biotechnology and Food Sciences, Slovak University of Agriculture in Nitra, Tr. A. Hlinku 2, 949 76 Nitra, Slovak Republic

Abstract: This study aimed to measure selenium and mercury levels in the blood serum of common carp (*Cyprinus carpio*) and assess their interrelationship and effects on fish length and weight. Using ICP-OES, selenium and mercury concentrations were quantified, revealing selenium only in 7 out of 15 samples (others were below detection limits), while mercury was detected in all. The average Se molar ratio was 244.72 ± 101.15 . Despite hypothesizing that selenium might counteract mercury toxicity, statistical analysis found no significant correlation between Se ratios and fish physical parameters, likely due to the limited sample size.

• Introduction

Mercury contamination in aquatic ecosystems remains a concern despite regulations limiting its use. Fish, constantly exposed to mercury in these environments, serve as effective models for studying its accumulation and toxicity. Mercury's neurotoxic effects, particularly on the brain and liver, may cause oxidative stress and organ damage. Selenium, an essential trace element, can counteract mercury's toxicity by forming inert HgSe complexes, which neutralize mercury's harmful effects when the Se molar ratio exceeds 1. This study focused on measuring selenium and mercury in blood serum of common carp (*Cyprinus carpio*) to examine any correlation between their molar ratio and fish body metrics, specifically length and weight.

• Material and method

Fifteen common carp were collected with nets during the summer from an experimental pond near Kolinany, Slovakia (48°21'14.6"N 18°13'03.2"E). Although located near a sewage plant and agricultural areas, prior studies have not indicated any significant pollution risks for this pond. Fish of various sexes underwent on-site measurements, then were transported to a lab, where blood samples were taken from the caudal vein by a trained expert. Blood samples were centrifuged at 2000g for 10 minutes after clotting for 30 minutes. Serum was extracted and frozen at -20°C for later analysis. For microelement analysis, the serum was mineralized with nitric acid (HNO₃), and mercury and selenium concentrations were measured using ICP-OES 720 (Agilent Technologies, USA).

Conclusions

In our study, we were able to quantify the selenium and mercury concentrations in fish blood serum samples and calculate their molar ratios. However, we were unable to confirm the effect of the molar ratio of Se:Hg on body metrics. We consider one of the main factors for the absence of significant correlations to be the low number of samples that we could have included in the study. Yet, we plan to extend this topic with a higher number of individuals and tissues in the future.

Acknowledgement:

This study was supported by The Ministry of Education, Research, Development and Youth of the Slovak Republic under the project VEGA 1/0571/23. This work was also supported by the Slovak Research and Development Agency under the contract and No. APVV-21-0168.

• Results and discussions

Selenium is essential for antioxidative defense and metabolism, and it may counteract mercury's toxicity by forming inert HgSe complexes, especially at Se:Hg molar ratios above 1. Prior studies on various species and tissues have found such protective ratios, observing that larger body sizes often correspond with lower molar ratios, potentially reducing antioxidant protection. Our study on fish blood serum found high Se:Hg ratios, which may indicate selenium's protective effects, although no significant correlation with body metrics was detected—likely due to limited sample size and variability in serum measurements. Expanding sample size and tissue variety could clarify these Se-Hg interactions.

