Scales as an indicator of mercury biomagnification in consumption fishes

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Introduction: Humans are exposed to absorption of mercury, especially the highly toxic methylmercury, by consuming fish and crustaceans. According to the current recommendations of the National Institute of Public Health (NIPH) and the European Society of Cardiology (ESC), fish should be eaten twice a week, which is why it is very important to obtain fish from unpolluted environments that are safe for human health and life. Therefore, knowledge of the concentration levels of this element in fish organisms is needed in order to estimate the level of contamination of water bodies and the risk of human exposure. **The aim of the study** was to determine the total mercury (THg) content in selected tissues of freshwater fish species: common perch (Perca fluviatilis) and common crucian carp (Carassius carassius) which are commonly consumed in Poland and occupy different places in the trophic chain (biomagnification of mercury).

Material and methods: The reservoirs from which the fish (n=12) for the study were obtained are breeding ponds in Knyszyn, Ełk-Knyszyn fish farm (Podlaskie Voivodeship). Fish were killed by blunt head injury, destroying central nervous system activity. The gill arch was then cut for bleeding. Before the material collection, the individuals were weighed (model Radwag E425) and measured. Then, the material for analysis was collected: skeletal muscles and scales from the left side, from the area of the body over the lateral line under the dorsal fin and livers. In the case of scales, an additional procedure was used, consisting of preliminary cleaning to remove surface contamination, mucus, skin residues, and other tissues on the scales and rinsing the scales in deionized water for about 5 minutes. The spectrometer AMA 254 (ALTEC, Czech Republic) equipped with a mercury lamp and a silicon UV diode, detects mercury by atomic absorption at a wavelength of 254 nm. The results were expressed as average mean ± standard deviation (SD) in ppm of fresh weight (FW).

Results: The primary factors influencing the mercury content in fish organisms are the type of food consumed by them and their place in the trophic chain (biomagnification phenomenon). Compared to herbivorous and omnivorous species, relatively higher mercury content occurs in piscivores and other predators. In this study, significant differences were found in the average THg content in the muscles and liver of perch compared to common carp, which confirms the phenomenon of mercury biomagnification in the tissues of the studied fish species (Fig. 2.)**.** The obtained results emphasize that even small concentrations of Hg in the natural environment can accumulate in living organisms. The highest mercury contents were found in the meat of fish occupying higher links in the trophic chain (common perch), but it did not exceed the mercury content limits specified in the law (Commission Regulation (EU) 2022/617), i.e. 0.5 mg·kg-1.

Perch (Fig. 1. A) is a predatory fish that feeds on invertebrates, smaller fish and roe of other species. **Crucian carps (Fig. 1. B)** feed on benthic fauna and aquatic plants. The average weight of perches studied was 161±21 g and their length was 24±1 cm, while crucian carps measured 223±61 g and 23±2 cm.

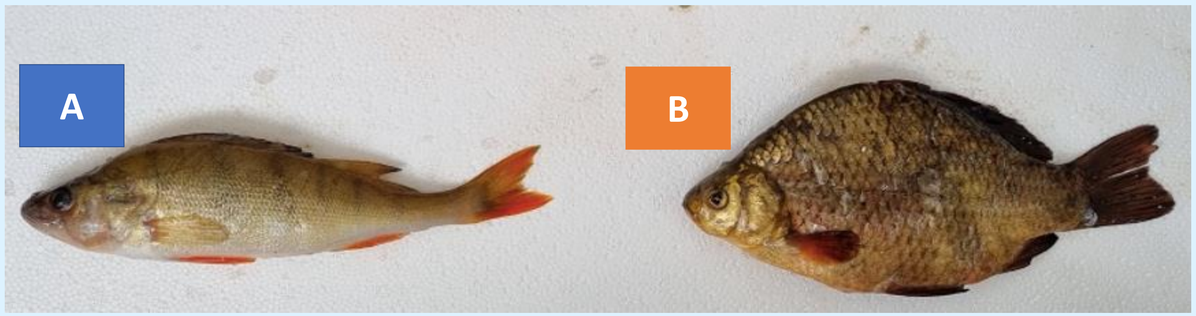

Fig. 1. Perch (A) and crusian carp (B)

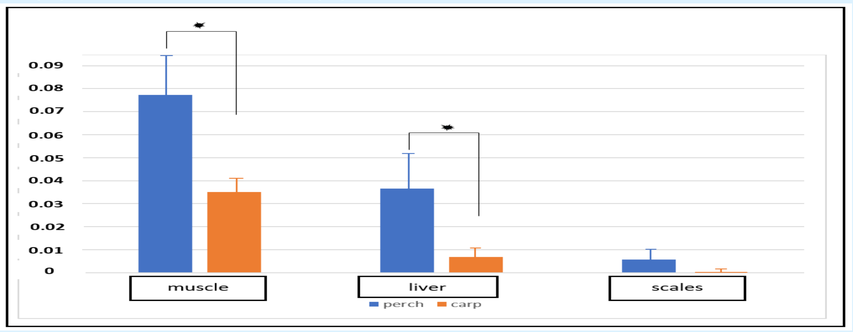

Fig. 2. THg content (ppm) in tissues of perch and crusian carp

Conclusion: Fish tissues are a good indicator of environmental pollution, including Hg. The mercury content was the highest in skeletal muscles, then in the liver, and the lowest content was noted in scales. Scales can be an interesting indicator of environmental pollution with mercury, however the THg content in the scales was signifficantly lower than in muscle and liver. Moreover, obtaining scales is a less invasive method than obtaining other tissues and could be used as a material, especially from predatory fish, for monitoring mercury pollution of the aquatic environment.