HEAVY METALS IN THE MALLARD *ANAS PLATYRHYNCHOS* FROM EASTERN AUSTRIA

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Introduction

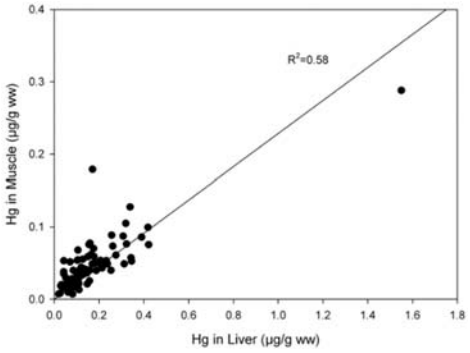
The global anthropogenic distribution of heavy metals has led to multiplied environmental concentrations in particular for lead, copper, zinc and others in all regions of the world (Nriagu, 1996). Anthropogenic sources of heavy metals often end up in wetlands (Levengood, 2003), where all aquatic biota, including waterfowl, may be exposed to this pollution. Mallards might be exposed to heavy metals by uptake through contaminated food. In addition to this common way of metal uptake, a hazard has been observed for waterfowl: uptake of lead shotgun pellets. Added up with lost plummets from the fisheries, an annual input of 600t of metallic lead into the environment in Austria has been estimated recently (Reisinger et al., 2009). Although metallic lead is not readily bioavailable, it has been shown that the low pH and mechanical abrasion in the bird's stomach leads to partial dissolution of these pellets. This combined exposure to contamination may lead to accumulation of metals in the tissues of these birds.We had the opportunity to investigate levels of heavy metals in muscle and liver tissue from mallards before the ban of lead shotgun pellets. In addition to Pb, it seemed appropriate to analyze Cd and Hg as metals of priority concern within the EU as well as Cu, Cr, Ni and Zn, which are metals showing an enhanced anthropogenic distribution in the environment. For Hg we also included feathers, as they are known as an important way of elimination of Hg in birds. Moreover, we included Ag in the study, as nanoparticles of this metal start to be widely in use in consumer products and therefore will be increasingly included in waste streams, threatening also the aquatic environments (Yu et al., 2013).

Methods

Sampling for this study took place in the northeastern part of Austria, within the catchment area of the Danube River. In total, 77 specimens of *A. platyrhynchos* were received from eight hunting grounds situated in the eastern parts of Austria. They were shot by hunters, using commercially available lead ammunition. Sex and weight were determined and tissue, as well as feather samples were obtained. Microwave digestion was performed with HNO_3 34% and H_2O_2 30%. Hg was detected in the samples immediately after digestion with cold vapor atomic absorption spectrometry (CV-AAS). Zn was measured with a flame atomic absorption spectrometer (F-AAS) while for the detection of Pb, Cd, Ag, Cu and Cr a graphite furnace atomic absorption spectrometer (GF-AAS) was used.

Results

Mallards do not have a steady territory and show opportunistic migration behavior. Therefore, it is not guaranteed that sampled specimens fed for a longer period of time in the district they were hunted. For this reason, a separate presentation of results for each hunting ground seemed inappropriate and results are presented as means for the whole sample. Hg levels in feather were higher than in liver and muscle. This shows that mallards use feathers as an important way of elimination of Hg from the living organism, as it is also known for other birds. The levels of Hg in muscle correlate well with the levels in liver, as shown in Figure 1. Concerning Pb levels in the liver, all measured concentrations but one where below 2 mg/kg ww, indicating no toxic effect to the animal, one mallard has to be classified as clinical poisoned (Pain, 1996). Nevertheless, tissue concentrations higher than the maximum levels for poultry and poultry products, stated by the European Union, have been observed for lead in about 10% of the mallards. Therefore, a frequent consumption of mallards, especially the liver, may also pose a possible health risk to human consumers.



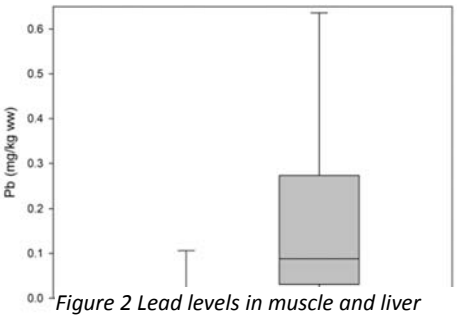


Figure 2 Lead levels in muscle and liver

Conclusion

This survey shows, that a contamination of mallards from the studied region with heavy metals exists but to a rather low extent. Nevertheless, Pb levels in some animals exceeded limits for food safety. This study may also present a good comparison for future studies to evaluate the benefits of the ban of lead shotgun pellets.

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