# The interaction between environmental temperature and metal toxicity tolerance in zebrafish (*Danio rerio*)

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Zebrafish has become a valuable vertebrate model organism in a wide range of biological research including ecotoxicology. Although there are several studies on metal toxicity in zebrafish, investigations on the interaction between thermal background of the organism and metal uptake and toxicity are really rare.
Changes in environmental temperature can profoundly change species physiological condition. By this study we aim to see if different temperature regimes affect the organism tolerance against metal toxicity. For this purpose, we have defined two scenarios: Acute: in which fish were shocked in 5 different temperatures (17, 22, 25, 32 and 34 °C) and subsequently introduced to metal contaminated water including Cu, Cd or Cu+ Cd for 10 days. Chronic: in which fish were acclimatized to 5 different temperatures for 28 days and then they were challenged by the same metal pollutants.
The condition of the fish was monitored during the experiment, including behavioural and physiological metrics and also water quality monitoring. At the end of the exposure period, whole body metal and essential electrolyte concentrations were determined using ICP-OES.
The results showed that Cu was much more toxic than Cd. However, Cu and Cd together showed a large synergistic effect. A low temperature shock appears to be protective while a high temperature shock increases sensitivity. Whereas, acclimation to warm temperatures increase the tolerance against metal toxicity in comparison to acclimation to cold temperatures.
The results of whole body metal analysis showed that the metal burden in heat shocked fish is significantly higher than the cold shocked ones. While, the fish which acclimatized to cold temperature show a higher metal level in comparison to the fish which acclimatized to a warm temperature.
Considering the major role of electrolytes in keeping the body homeostasis constant. We have also investigated electrolyte levels (Na, K, Ca and Mg). We found a consistent and significant drop in sodium levels between the alive and dead fish. Such an effect was not observed for the other major cations.
The results of these experiments show that the thermal prehistory plays an important role in determining the tolerance of zebrafish towards metal exposure and likely also other stressors.

*keywords: thermal prehistory, metal toxicity, electrolyte levels, zebrafish*

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