Long-chain polyunsaturated fatty acids (LC-PUFA), are essential for multiple physiological processes, including the maintenance of cell membrane structural integrity [1,2,3,4]. Biosynthesis of these fatty acids involves sequential desaturation and elongation of PUFA precursors. Two groups of enzymes are implicated in this process: desaturases (FADS) which incorporate double bonds into fatty acyl chains and elongases (ELOVL) which catalyze the condensation step in the elongation process [5]. In ectotherms, temperature influences the extent of unsaturation of biological membranes, cold-acclimated animals expressing a higher percentage of membrane phospholipid polyunsaturation compared to warm-acclimated conspecifics [6]. This process is known as homeoviscous adaptation (HVA) and it ensures membrane function and integrity for a range of acclimation temperatures, likely through modulations of desaturase and elongase gene transcription and activity. Some metals, such as Cd and Ni, can induce the production of reactive oxygen species (ROS), which may in turn lead to lipid peroxidation, PUFA being particularly vulnerable to ROS.

Study objectives

The aim of this study is to understand the combined effects of temperature and metal contamination (Cd and Ni) in fathead minnow (*Pimephales promelas*) muscle and brain on (i) the fatty acid composition of membrane phospholipids; (ii) the transcription level of desaturase and elongase genes; (iii) Differences in desaturase and elongase transcription between the two tissues

Materials and methods

During warm acclimation (30°C) PUFA percentage decreased and SFA increased compared to 15°C and 25°C. Agrees with the HVA theory. Cd exposure interfered with the normal warm acclimation response of cell membrane composition at 30°C

Conclusions

- Combined heat stress (30°C) and Ni exposure exceed the metabolic tolerance of fathead minnows, leading to 100% mortality.
- Temperature-induced adjustments in cell membrane phospholipid composition in muscle agree with HVA.
- In contrast to muscle, brain phospholipid composition is largely maintained regardless of temperature, likely due to requirements for neural function.
- Metal exposure affected the normal response of membrane composition to temperature acclimation in muscle, but not in brain.
- Temperature and metal combinations had different effects on desaturase and elongase gene transcription levels.