

Perchlorate Pressure: Altering Gene Expression and Lipid Storage without Morphology

Abstract: Perchlorate, an obesogenic endocrine disruptor in vertebrates, has increased in water sources due to global industrial pollution. *Daphnia magna*, a common invertebrate bioindicator for contaminant monitoring, are essential to the freshwater ecosystems due to their large role in the food web and nutrient cycling. *D. magna* were chosen to evaluate effects from perchlorate exposure due to their clear carapace, parthenogenetic reproduction, and general sensitivity to environmental stressors. In this study, we exposed juvenile female *D. magna* to an environmentally-relevant perchlorate concentration, 10 ppm, in and assessed morphometrics, hemoglobin genes 1-3 (*dhb1-3*) expression (normalized to *beta actin* and *GAPDH*), and midgut lipid droplet storage. We hypothesized that perchlorate exposure would reduce growth, affect *dhb1-3* gene regulation, and increase lipid storage. After a seven-day exposure (n=24), there were no significant morphometric differences (measured via microscopy and ImageJ analysis) in total length, apical spine length, width, or head length. Following a two-day exposure (n=30), gene expression analysis (measured via RNA purification, cDNA synthesis, RT-qPCR, and gel electrophoresis) showed *dhb1* downregulation, while *dhb2* and *dhb3* remained unaffected. After a seven-day exposure (n=17), Nile Red staining (measured via fluorescence microscopy and ImageJ analysis) showed threefold higher midgut lipid droplet storage. To summarize, acute exposure to 10 ppm perchlorate resulted in *dhb1* downregulation, increased midgut lipid storage, and no morphometric changes. These results suggest altered gene regulatory or metabolic pathways in *D. magna* under perchlorate exposure. Further research is needed to identify the mechanisms by which these pathways are altered, such as the ecdysone signaling pathway and other major endocrine pathways.