Interactive Effects of Perchlorate and Temperature on *Daphnia magna* Growth Rate and Feeding Rate

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TBIOMD 495 Spring 2021

Abstract

Perchlorate, a known endocrine-disrupting contaminant, can have adverse effects on aquatic ecosystems worldwide. Lakes are increasing in temperature due to climate change which presents multiple stressors for aquatic biota. It is observed that high concentrations of perchlorate in water can inhibit the growth of *Daphnia magna*. Therefore, our study aimed to investigate the effects of combined stressors on the growth and feeding rate of *D. magna* to further examine the effects of perchlorate and temperature on invertebrates. We hypothesized an increase in average growth and feeding rates of *D. magna* introduced to warmer conditions containing elevated concentrations of perchlorate. *Daphnia* were exposed to six experimental conditions with low (10mg/L) or a high (20mg/L) perchlorate concentration, a low (20°C) or a high (26°C) temperature condition, with control conditions. *Daphnia* body morphology was evaluated using morphometric analyses in ImageJ while feeding rate was measured using spectrophotometry. Overall, exposure to 10 mg/L or 20 mg/L perchlorate exposure alone did not significantly affect the cumulative growth and feeding rate of *D. magna*. However, our data suggested higher temperature was not a significant factor for growth, but was significant for higher feeding rates. The relationship between perchlorate concentration and temperature on the cumulative growth and feeding rate requires further research.
When talking about global climate warming the first thought that comes to our mind is high temperatures, however we don’t always relate it with chemicals. That is why we have decided to mix these two components, evaluate the interactive effects of and work together with \textit{Daphnia magna}, a planktonic crustacean inside the phylum Phyllopoda which are characterized by flattened leaf-like legs used to produce a water current for the filtering apparatus (Ebert, 2005), to see two specific end points: the changes in their growth rate and feeding rate when they are exposed to a room temperature 20°C and 26°C together with perchlorate of 10mL/g and 20mL/g in concentration.

It was decided to use perchlorate, an inorganic ion widespread in the environment that is generated as a natural and anthropogenic pollutant (Rosa-Acevedo et al, 2018), because it is a frequent chemical of soil and water contaminant and results in high toxicity to animals, humans and plants (Loureiro et al, 2012) (Bianchi, 2003). By using a microscope and Image J (app used to edit, measure, analyze, print and save raster image date) it was measured: core body length, caudal spine length, body width, head width, head width and head length (Ranta et al, 1993). After collecting the morphometrics for the growth rate part, the \textit{D. magna} was placed in the test tube with the respective media and their algae. In order for us to collect an approximately amount of feeding rate, we placed the test tube into the spectrometer at a 685mm wavelength.

Our hypothesis was that the average growth and feeding rates of \textit{D. magna} introduced to warmer conditions that contain more elevated concentrations of NaClO$_4$ would be higher than that of \textit{D. magna} in optimal/control conditions. There was definitely a change in growth comparing from 0hrs to 96hrs, we started with juvenile daphnia and ended up with adult ones. It was great to see how much they growth: physically we did see a difference in cumulative growth however in the p-value obtained from ANOVA showed us that there was not really a significance on the data. The hypothesis, referring to the growth part, was not reached since the change in both temperatures were pretty similar and there were not results that we can tell if either of the temperature worked better or not. However, if we talk about the feeding rate, there was definitely a great change in the 26 °C set of experiment, in all data obtained there was a
decrease on the absorbance, meaning that there was a decrease on the algae therefore the Daphnia ate more while in the warmer temperature.