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Effects of ibuprofen on duration of fear responses in red claw crabs

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Effects of ibuprofen on foraging time in red claw crabs

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Abstract

Pharmaceutical pollution is a growing environmental issue. Chemicals engineered to affect humans persist in the water system and may have unintended effects on animal behavior. Ibuprofen is an anti-inflammatory drug shown to reduce predator avoidance in fish. I chose to examine the effects of ibuprofen on the foraging behavior of red clawed crab (*Perisesarma bidens*) by measuring time spent in the open. Crabs typically spend most of their time hiding and only expose themselves to danger in order to forage for food. I predicted that crabs treated with the high dose of ibuprofen will spend less time hiding compared to the low dose, and both dosed treatments will spend less time hiding vs the control. I recorded whether the crabs were hidden or exposed over 5-minute intervals for nine days. I found no statistical difference between treatments. The result indicates that ibuprofen had no effect on crab risk taking behavior.

Introduction

Drug pollution is an important element of human caused environmental damage, but so far little research has been conducted. There may be as many as 1500 different pharmaceuticals in a given water system (Guo et al. 2016). This experiment focused on the effects of ibuprofen on crab risk assessment. Ibuprofen is used for its anti-inflammatory properties. Research has shown that ibuprofen may impact behavior. For example, Ibuprofen may increase the likelihood of humans undertaking risky behavior (Ratner et al. 2018). Anti-anxiety medications can alter predator avoidance in fish (Weinberger et al 2014), which supports the idea that drugs that affect human fear response may similarly affect animals. If so, it would likely increase predation rates and could have profound effects on the ecosystem at large.

I studied the red claw crab, *Perisesarma bidens.* It is a shore crab with adults reaching 5 cm in width. Its size is ideal for keeping in a tank. They are small in size which makes them easy to care for, and their fast metabolism should show the effects of the drug rapidly.

Objective

The object of this study is to determine if ibuprofen in water can alter the behavior of red claw crabs.

I predict ibuprofen will lessen crabs' aversion to risk resulting in crabs that have been treated will spend more time in the exposed area. This effect will be strongest on crabs with the higher dosage.

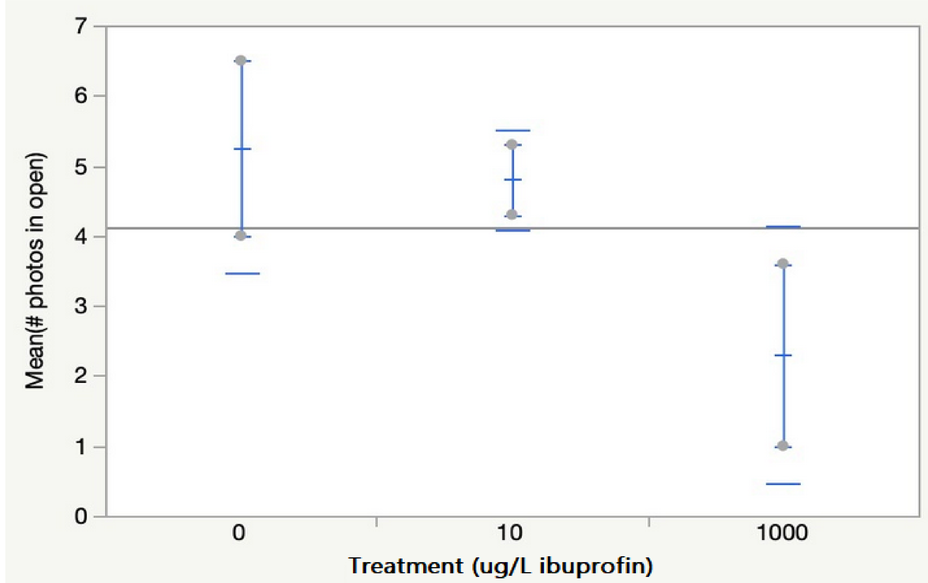
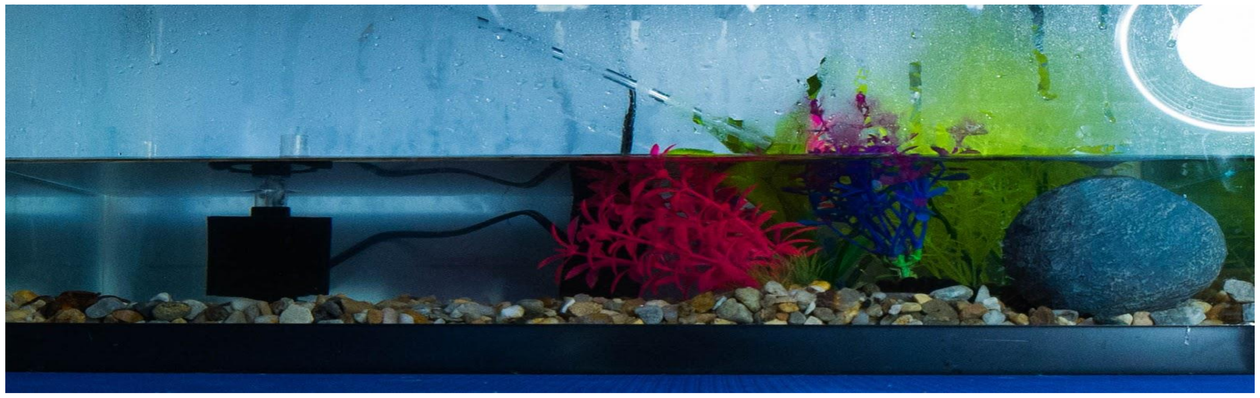


Figure 1. - Mean number of photos in which a crab was located in the exposed area for the 1000 ug/L ibuprofen, 10 ug/L ibuprofen, and control treatments. I found no statistical difference between the three treatments. The 1000 ug/L treatment does have a significantly lower mean than the other two.



Methods

I treated tanks with either 1000 µg/L of ibuprofen, which mimics the low blood concentration of ibuprofen in a human, or 10.0 µg/L of ibuprofen, which is a typical concentration found in polluted water (Aguirre-Martínez et al. 2015). One tank received only water and served as the control. I used children's liquid ibuprofen (Children's Motrin) to dose the water more easily. Correct concentrations were reached by dilution.

The dependent variable was time spent in the exposed area. The independent variable was the concentration of ibuprofen in the water. I recorded data using a digital camera, set to take a photo every 5 minutes over 9 days. Two crabs were placed in each tank. One crab was marked with white nail polish on its shell and the other crab was left unmarked.

Housing

The study took place in three 38-L saltwater (0.8 g/L aquarium salt) tanks, each with a dark sheltered area containing a hide and several large plants, and a completely exposed well-lit area where I placed food.

Water was changed every 4 days to keep the tanks clean. Each time the water was changed additional salt and ibuprofen was added to keep levels the same. Half the water was removed each time to keep bateria consistent. Water conditioner was used to treat all water before being used.

Crabs were fed shrimp pellets. Tanks were kept between 74 and 78 degrees C. Temperature was regulated with heaters and an aquarium thermometer.

Data Analysis

Data was analysed using JMPA nonparametric Kruskal-Wallis was conducted on the mean number of photos for each treatment. I analyzed the data using JMP. (SAS Institute, Inc., 2018).

Results

No statistics significance (Fig. 1) was found between treatments (df=2, p=0.1801). The 1000 ug/L treatment had a significantly lower mean than the other two treatments, however one of the crabs in this treatment died on day 4, leaving an n of 1.

Discussion

I predicted that ibuprofen would increase the time crabs spent in exposed areas. However the results indicate that this is not the case. Ibuprofen treatment did not significantly alter foraging behavior.

The results of the 1000 ug/L treatment indicates that ibuprofen may affect crabs when the dose is strong enough. The lower mean number of photos indicates that the animal spent more time hiding than the other four animals.

The lower mean (Fig. 1) of the 1000 ug/L tank combined with the fact that one of the animals died suggests that ibuprofen may be toxic to crabs at this dose.

This experiment used a small sample size, and took place over a short period. It is possible repeated experiments with larger sample sizes may find a more subtle effect on crab behavior.

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