The Effect of Lead Exposure on Male Reproductive Behaviors

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Abstract

People all around us are unknowingly endurering the effects of lead exposure. This could be due to old pipes, and certain old paints that are still kept in houses. These fathead minnows live in certain areas in the environment that can be affected by the contamination of these old lead pipes. The purpose of this experiment was to determine how lead impacts the reproductive behaviors and secondary sexual characteristics in male fathead minnows. The data collected shows that the exposure to lead leads to an increase in hyperactivity.

Introduction

Lead, a chemical element, can largely impact the health of humans, animals, and many other species. Lead can be found in many common areas, such as the air, water, and even household dust, and it is evident that being exposed to lead is quite simple (1). In order to test the effects of lead exposure on reproduction, researchers have been found to choose fathead minnows, because lead decreases reproductive behaviors in male minnows (3). A main target in lead overexposure is male fertility. Being exposed to lead can cause testosterone production to decrease, and the reduction of sperm levels (2). Lead negatively affects humans as well as other animals. It is important to study the negative effects it displays on animals, and fathead minnows demonstrate an accurate representation of changes in behaviors in the minnows that can correspond with the effects on humans (4). It was hypothesized that the effect of lead on fathead minnows will result in a lack of reproductive behaviors in male fathead minnows.

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Materials & Methods

This was a single-blind experiment, meaning that during the experiment students, we were unaware of the lead status of the fish. The minnows were exposed to 1 ppm lead solution for two weeks at UWM prior to their arrival. In order to view all reproductive behaviors of the fish, the tanks contained halved PVC pipes to represent common places of spawning. In each tank contained 3 pairs of fish - a total of 12 fish - and dividers between each pair. Each student group was assigned to a new pair and tank each day to observe and make a note of both physical characteristics (dorsal fin spots, tubercles, and side bars) and reproductive behavior (Nest prep, patrolling, hovers, chases, and spawning). These fish were watched over a five minute period. This data was analysed using a fisher test, and standard error of the mean to check for a significance difference between the lead and controlled fish.

Figure 1

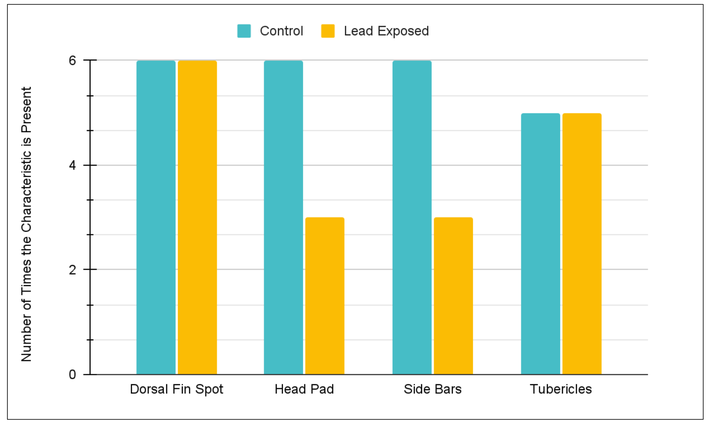
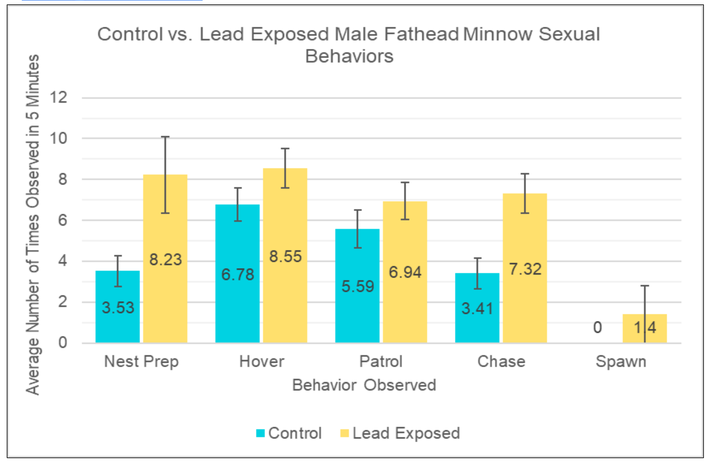


Figure 2



Figures 3 & 4

Data Analysis and Results

Figure one's data collection shows that secondary sexual characteristics of a fathead minnows indicates no significant difference in minnows not exposed to lead, in comparison to those that were exposed to lead. Therefore, the graph shows data that was collected, but has no significant difference. The P value derived from the Fisher test was 0.757 which shows that there isn't a significant difference in the secondary characteristics of the two types of minnows. It can be concluded that the difference between characteristic presence is likely due to chance, not due to the treatment type.

Figure 2, average number of times the sexual behaviors of nest preps, hovers, patrols, chases, and spawns were observed in a five minute time period. The error bars set to 1 SEM, show a significant difference in nest preps, hovers, and chases between the control fish and the lead exposed fish. The lead exposed fish showed significantly more of these behaviors. Lead exposure, being the independent variable, had an impact on three out of the four sexual behaviors, being the dependent variable.

Continued Data Analysis

Figure 3: This is a photo of a male and female fathead minnow that were not exposed to lead. The male is seen to have a dorsal fin spot, head pad, and tubericals. It is also important to note that the fish is noticeably larger than the fish in figure 4.
Figure 4: This is a photo of a male and female fathead minnow that were exposed to lead. The male is seen to have only a dorsal fin spot. It is also important to note that the fish is noticeably smaller than the fish in figure 3.

Discussion

Our hypothesis that exposing fathead minnows to lead will result in a lack of reproductive behaviors in males is not supported by our evidence. Many factors could have caused this, but our lead exposed males showed more reproductive behaviors, than the control males (Figure 2). This figure also shows that one group of the minnows did spawn, and that group was a part of the lead exposed. Although some of the lead exposed minnows showed less or equal secondary characteristics than the control group, this data cannot support our hypothesis, as the P value in the Fischer test from Figure 1 does not show significant results (P= 0.757). Although this data is not significant, lead did still seem to have a qualitative effect on fathead minnows. The minnows exposed to lead seemed to be more aggressive, and much more active. Other factors that may have influenced our results were that the minnows were 2 years old when we received them, when typically they are younger, as well as only a small sample size being studied. Other potential evidence may indicate that when fathead minnows were exposed to lead, they spawned fewer eggs than the control group. We are able to make the conclusion that lead has no effect on the reproductive behaviors in fathead minnows.

Sources

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2. Assi, M. A., Hezmee, M. &. M., Haron, A. W., Sabri, M. Y. M., & Rajion, M. A. (2016, June). *The detrimental effects of lead on human and Animal Health*. Veterinary world. Retrieved January 28, 2022, from
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