

The Interaction Between Social Conditions and Ethanol on Zebrafish Behavior

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Abstract

Zebrafish (*Danio rerio*) are studied in behavioral pharmacology research because they are model organisms for animals of higher complexity. Therefore, studying how they respond to drugs of abuse, such as ethanol, may help researchers understand how these same drugs affect humans. This current study demonstrates that alcohol and social conditions influence behaviors related to anxiety in zebrafish. In humans and rodents, the effects of alcohol are modulated by social variables. Although zebrafish are a social species, potential interactions between social conditions and alcohol must be further explored. The goal of this experiment was to determine whether social conditions interact with alcohol to affect anxiety-related behaviors in zebrafish. In this experiment, zebrafish were housed individually, in pairs, or in groups of four. After at least one week, they were individually dosed with either 0%, 0.5%, or 1% ethanol. Using Ethovision tracking software and manual tracking, it was determined how much time the fish spent in the shallow side of a test tank (suggesting that the fish were less anxious). Preliminary results indicated that ethanol influences the duration in the shallow side of a test tank. Fish housed in pairs also spent more time in the shallow side than those housed alone or in groups of four. Finally, single-housed fish showed the largest change in behavior in response to ethanol. These results suggest that social conditions do affect how zebrafish respond to ethanol and build on the evidence that zebrafish are relevant model organisms for studying anxiolytic medications.

Methods

Zebrafish were housed in singles, pairs, and groups of four at least a week in advance prior to testing. During testing, fish were moved from the aquarium rack onto the counter where research was conducted. Fish were placed one at a time into a dosing tank of fish water with either 0%, 0.5%, or 1.0% of ethanol. After twenty minutes, the fish were moved into the testing tank (see below).



The testing tank was constructed so that the fish perceived a shallow and a deep end. This fish stayed in the testing tank for fifteen minutes. Videos of the fish in the testing tank were recorded using both Ethovision video tracking software and a video camera. Fish location was analyzed via Ethovision and manual tracking techniques. Fish locomotion was analyzed via Ethovision. Past research has indicated that anxious fish spend increased time in deeper water. Therefore, fish who spent more time in the shallow end of the tank were less anxious than those who spent more time in the deep end.

Results

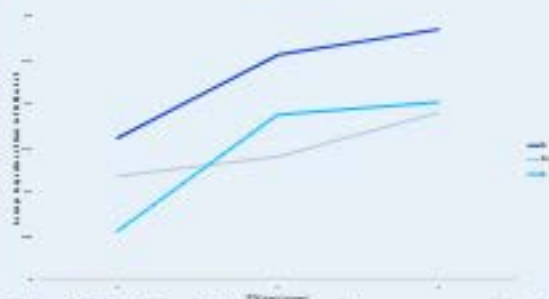


Figure 1: The effect of ethanol dosage on the average proportion of time fish spent in the shallow end based on 5-minute intervals.

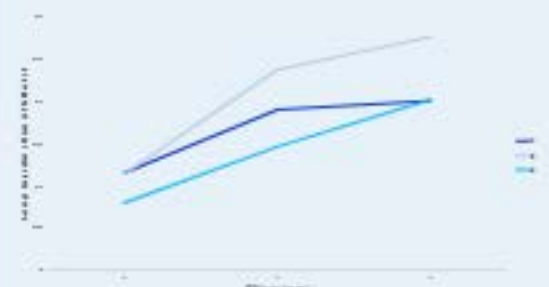


Figure 2: The effect of housing condition on the average proportion of time fish spend in the shallow end based on 5-minute intervals.

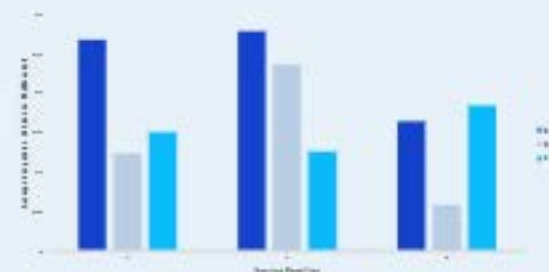


Figure 3: The interaction of housing condition and ethanol dose on the average proportion of time zebrafish spent in the shallow end of the tank.

Results Continued

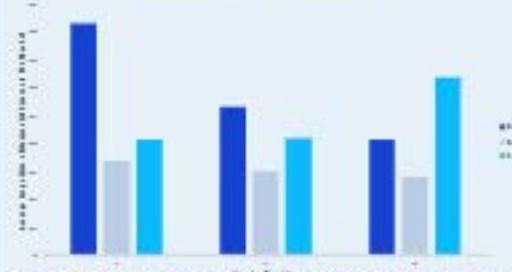


Figure 4: The interaction of housing condition and ethanol dose on the average proportion of horizontal crosses in the shallow end of the testing tank.

Discussion

Figures 1 and 2 demonstrate that there seems to be an increased average proportion of time spent in the shallow end of the tank as time goes on. As time increases in the novel environment, fish become more comfortable, and they become more willing to explore the more shallow area.

Currently, figure 1 shows that fish being exposed to ethanol actually reduces the amount of time that they are spending in the shallow end of the testing tank. Results are still being analyzed.

Figure 3 shows that when zebrafish are housed alone, ethanol makes them less likely to explore the shallow area of the testing tank. However, when they're housed in pairs or groups, ethanol modifies their behavior in different ways that we are looking to further explore.

Data is still being analyzed in depth in regards to figures 3 and 4. Current data, though, is very interesting. Fish exposed to ethanol are exploring the shallow areas less. Housing conditions may have a stronger effect on behavior than ethanol. Yet, ethanol may still be influencing behavior (even if less in comparison to housing condition).

Research can easily be applied to human beings, and more in depth study of data will be analyzed to further build on the evidence that zebrafish are relevant model organisms for studying anxiolytic medications in general, and in relation to social conditions.