The Effect of Ethanol on Zebrafish Embryos

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Abstract

This experiment was conducted to test how a concentration of ethanol could affect the development rate of zebrafish embryos. This information could be used to better understand how these substances will affect human fetuses exposed to a high concentration of ethanol, since they contract embryonic development abnormalities. These abnormalities include internal damage to the brain, social and behavioral problems, delays in development, low IQ, and poor growth. Testing zebrafish embryos for these problems has proved helpful because of the similarities between human and zebrafish embryonic development. During the experiment, it was concluded that the embryos in the wells with a higher concentration of ethanol experienced a higher number of deaths and a slower rate of development. First the Zebrafish embryos were placed in 96 well plates. The wells were filled with 1 mL of different concentrations of ethanol ranging from 0 mM to 300 mM. Every day the solution was replaced and pictures were taken to document the zebrafish development. The error occurred in the experiment because of the limited time and the modified amount of solution that was available. Testing was done over the course of 3 days, but more days would’ve been needed in order to get a conclusive answer. Also, more concentrations would’ve been helpful in order to get a better result as well.

Introduction

Throughout the duration of a week, zebrafish embryos were placed in different concentrations of ethanol in order to determine the effects. According to research on gestation in humans, if a mother consumes any amount of alcohol while pregnant, the child may be born with birth defects. These may include facial abnormalities and central nervous system deficiencies. The hypothesis formed for the experiment was if the embryos were placed in a higher concentration of ethanol then they would develop at a slower rate. This is because human fetuses tend to develop differently when exposed to alcohol.

Methods

1. 40 zebrafish embryos were received and ten were placed in each of the four wells using a coarse pipette, which caused no injuries to the eggs.
2. The first well was filled with 1mL of the control solution, using a coarse pipette. (Anyone handling a solution of ethanol should wear gloves to promote safety.)
3. The second well was filled with 1 mL of solution with a 30mM concentration of ethanol, while using a fresh coarse pipette to insure there is no cross contamination.
4. The third well was filled with 1 mL of solution with a 100mM concentration of ethanol, while using a fresh coarse pipette to insure there is no cross contamination.
5. The fourth well was filled with 1 mL of solution with a 300mM concentration of ethanol, while using a fresh coarse pipette to insure there is no cross contamination.
6. Each day the dead fish and empty egg shells were extracted with the coarse pipette.
7. The fine pipette was then used to remove the old solution and replace it with fresh solution, in order to keep from sucking up and harming the live fish.
8. Pictures were taken of each well through a stereoscope every day, and all findings were recorded. These findings include deformities, mutations, deaths, and the interactions between fish.

Materials

- 40 zebrafish embryos
- 3×4 well plate
- coarse and fine disposable pipettes
- 1 beaker of control solution
- 1 beaker of 30mM concentrated ethanol solution
- 1 beaker of 100mM concentrated ethanol solution
- 1 beaker of 300mM concentrated ethanol solution
- disposable gloves
- stereoscope

Effect of Ethanol on Zebrafish Embryos

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Results

The results of the experiment showed that the most deaths and slowest hatch rates occurred in the well with the 300mM concentration of ethanol, while the lowest number of deaths and fastest hatch rates occurred in the well with the 0mM concentration. This data coincides with the hypothesis created around the experiment, which was that a higher concentration of ethanol would result in slower hatch rates. The lab was performed in order to research how ethanol could affect the hatch rate of zebrafish embryos, and gain a comparison result towards the effect on human fetuses. Throughout this test the 0.0mM ethanol solution was used as the control, the different concentrations of ethanol were independent variables, and the hatch rate was the dependent variable. The information that was previously found stated that when human fetuses are exposed to alcohol, they develop differently than those who aren’t exposed to it at all. This research relates to the results because the zebrafish embryos that were exposed to the higher levels of ethanol developed much later than the ones who weren’t.

Discussion

Research showed that the effect of ethanol on human fetuses was harmful and it caused developmental issues. Knowing this, the hypothesis of this experiment was just to see if the embryos would develop as high as a concentration of ethanol, then they would develop at a slower rate. The results of our experiment concluded that the concentration of ethanol may not have affected the development rate of the zebrafish embryos. This doesn’t mean that ethanol couldn’t have affected the embryo, but the Chi Square value placed it at a 50/50 chance of being insignificant. In the investigation, the data found did not coincide with this research, but it may prove similar as a result of more extensive experiments. However, the data did prove that the slowest rate of development occurred in the 300mM concentration solution, and the highest rate of development occurred in the control solution. The Chi Square value for this experiment was 2.38, giving the it about a 50/50 chance of the results being statistically insignificant. The degree of freedom was 3, and the critical value used was 7.82. This means that in order for this experiment to be conclusive, the Chi Square value would have to be 7.82 or higher. Errors occurred in the experiment because of the limited time and the modified amount of solution that was available. Further testing would be necessary to find a conclusive result. The research would be more promising if fish, different levels of ethanol, and more time to find a conclusive answer. In order to reach a definite answer, different levels of ethanol would be needed because there would be more data to compare to reach that final answer.

Resources