

The Effect of Nicotine on Developing Zebrafish Embryos

By: **Natalie Moeller**
Muskego High School

Abstract

Nicotine can be a harmful chemical, especially to pregnant mothers. We used zebrafish embryos to act as a model for human embryos to test how nicotine affects their development. The results showed that there were slight deformities in the zebrafish in the different concentrations of nicotine, but not in the control solution. Unexpectedly, there were deaths in every well except the 0.1 mg/mL medium solution. These results show that a pregnant mother should not use any type of nicotine product because it can result in harm or death to an embryo.

Introduction

Nicotine is a chemical that is highly addictive, very dangerous and can negatively affect development. Nicotine is a health danger for pregnant women and developing babies and can damage a developing baby's brain and lungs (1). Through scientific observations and tests, scientists have discovered that nicotine accesses the brain and interrupts the traditional function, such as changed brain function and can add deformities. Fetuses' bodies can't break down nicotine, so it can lead to birth defects in the fetus. We used zebrafish embryos as a model for human embryos to show the effects of nicotine. Humans and zebrafish have 70% of the same genes and have the same major organs and tissues (2). They are comparable, so they should have similar effects from nicotine. It was hypothesized that the more nicotine that is added, the more developmental side effects and a more significant mortality rate would be present.

Figure 1:

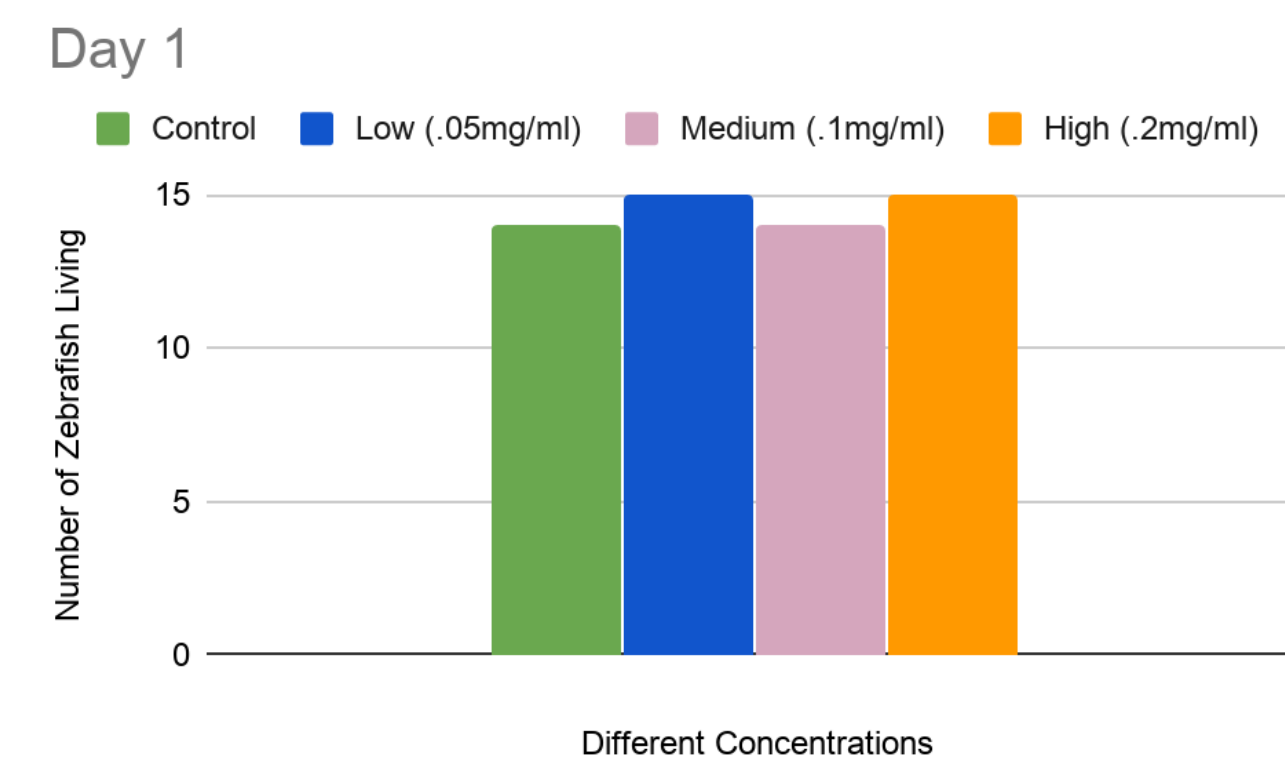


Figure 2:

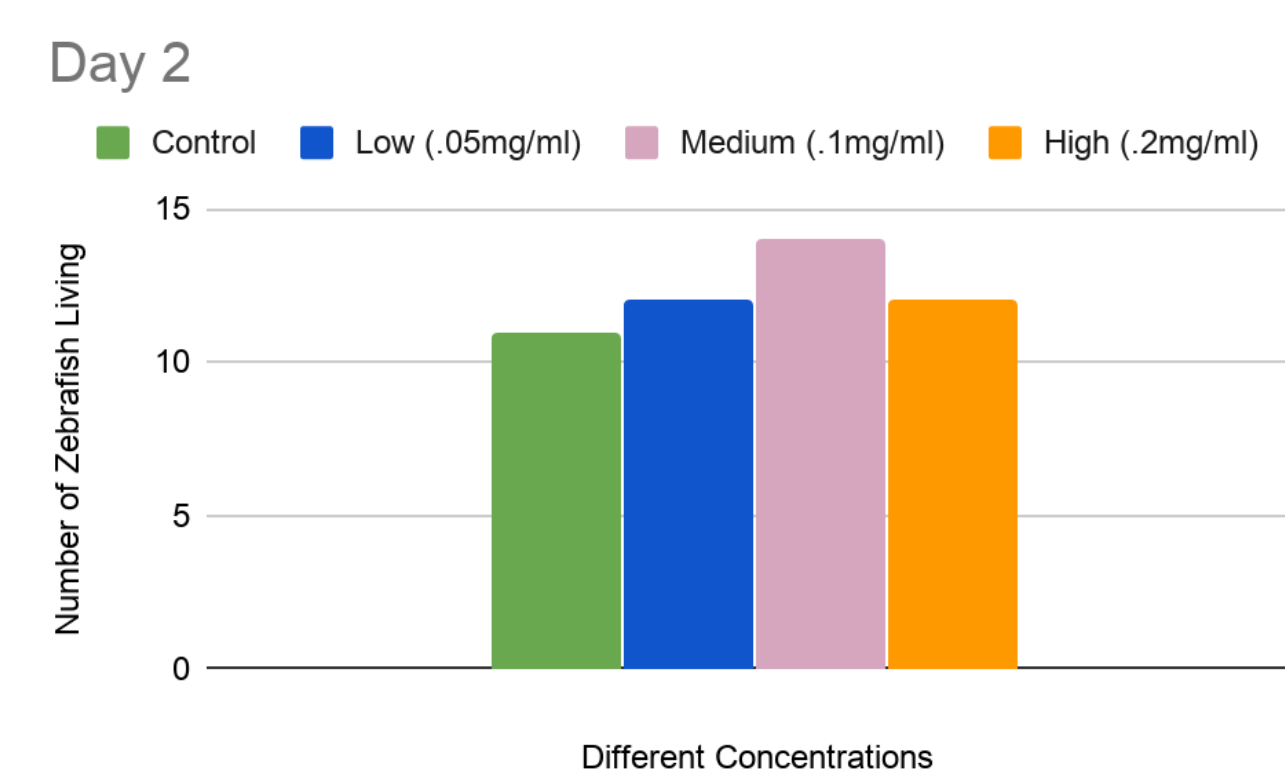
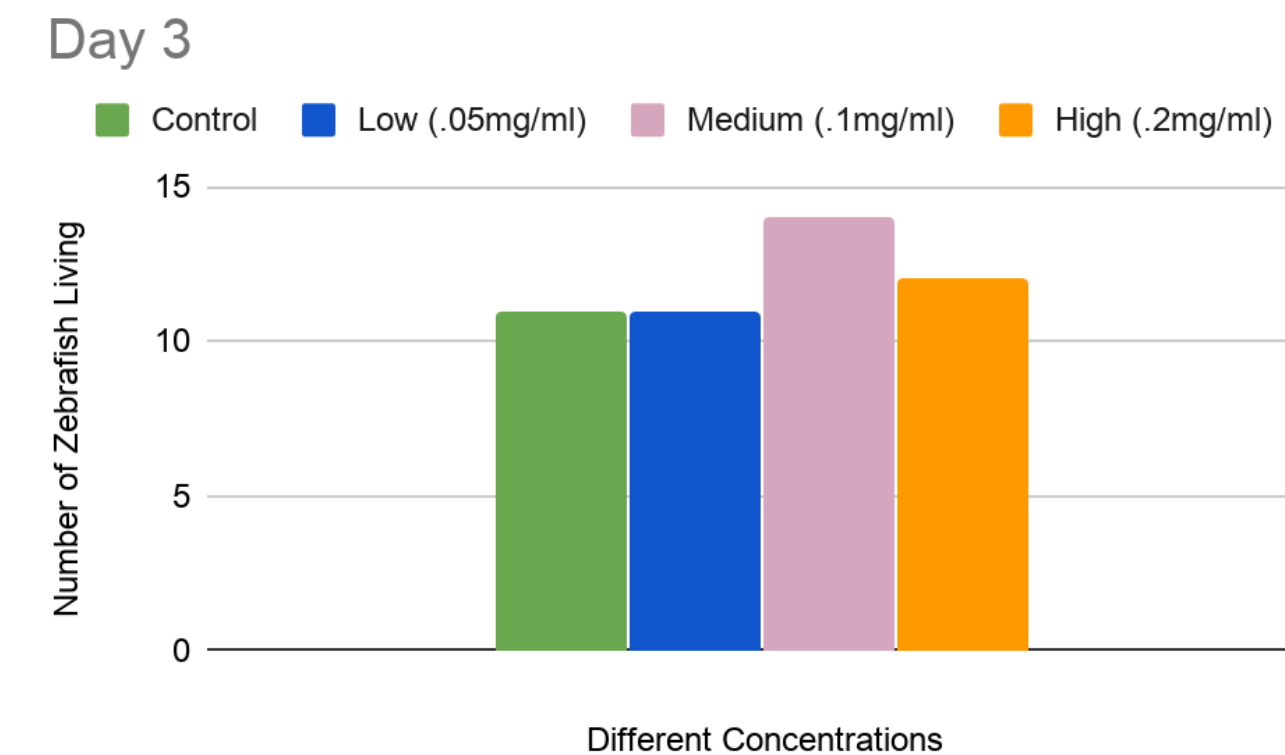


Figure 3:



Results

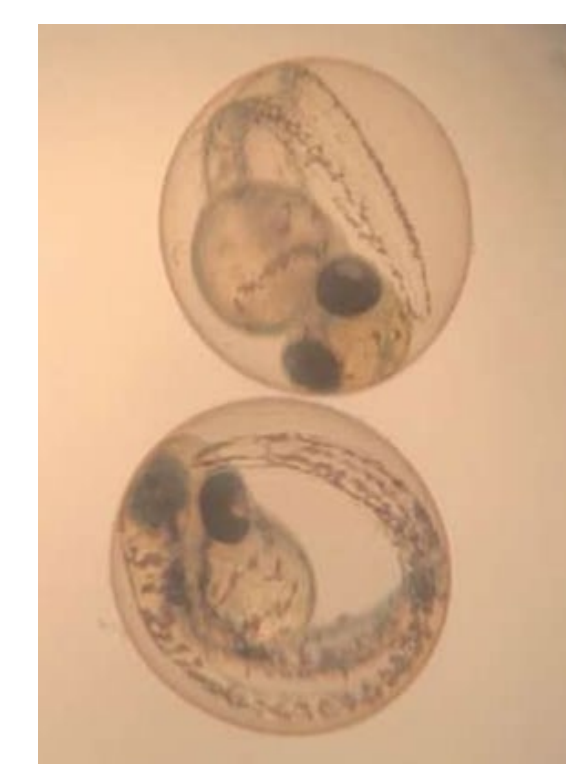
Figure 1 Analysis: This was the first day they were in the solution. Low concentration is .05 mg/mL, medium concentration is .1 mg/mL, and high concentration is .2 mg/mL. The independent variable was the concentrations of nicotine. The dependent variable was the number of embryos that were living or dead. Chi-squared analysis was performed to find the significance of our findings. The value was 0.33, which is denied with the one degree of freedom.

Figure 2 Analysis: On the second day, 3 died in the control, 3 died in the low concentration, zero died in the medium concentration, and 3 died in high concentration. There was not a significant difference in our findings because the chi-squared analysis showed a value of 0.33 and doesn't accept the null hypothesis.

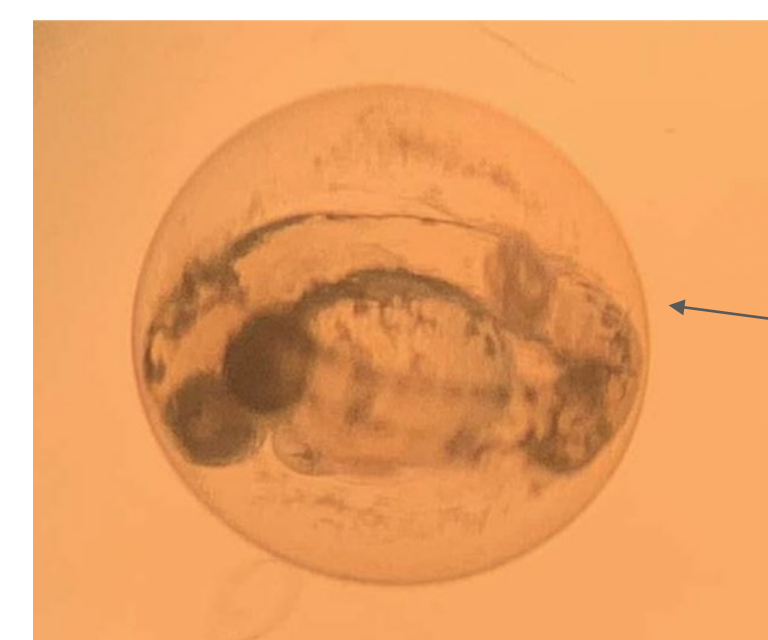
Figure 3 Analysis: On the third day, none died in the control, one died in low concentration, none died in the medium concentration, and none died in the high concentration. The chi-squared analysis showed a value of 0.33 which does not show a significant difference and doesn't accept the null hypothesis.

Discussion

We did not find a significant effect on the survival of the embryos from nicotine. However, there were some deformities, but only in the concentrations, not the control. We did notice some slight deformities including shorter tails, growth on the spine, lump on yolk, and one was shaking. We also noticed that there were more deformities in the medium concentration compared to the high concentration. Something that could have changed our data is we mixed up the pipettes for the different solutions so it may have been contaminated. If the solutions were mixed, it would alter the concentration of the solution and could change the results in the process.



Day 2: Control
No deformities were noted



Day 2: High
The deformity shown was a shorter tail



Day 3: High
The deformity shown was a lump on the yolk



Day 3: Medium
The deformity shown was the tail is crooked

Materials & Procedure

1. Four small beakers, pipettes, and Falcon dish were collected and labeled
2. The 3 solutions, .05 mg/mL, 0.1 mg/mL, 0.2 mg/mL and control, were mixed with the correct amount of embryo media (Instant Ocean - 200 mg/L)
3. The wells in the Falcon dish were filled with 3mL of the solution, and 5 embryos were added
4. They were left in the incubator at 28°C overnight
5. Observations were taken, the number of dead, living, and any deformities found were recorded
6. Steps 5 and 6 were repeated daily over 3 days
7. We did a Chi squared analysis to know if the differences between the treatments were significant or not

References

1. "Substance Use During Pregnancy." *Centers for Disease Control and Prevention*, 24 July 2019
2. "Why Use the Zebrafish in Research?" *Facts*, The Public Engagement Team at the Wellcome Genome Campus, 17 Nov. 2014