Effect of Nicotine on Zebrafish Embryos

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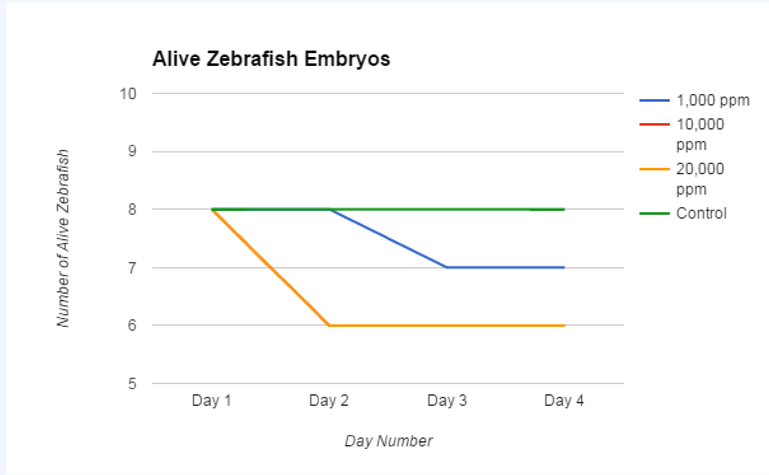
Abstract:

- The zebrafish embryos were exposed to different concentrations of nicotine to see how they would develop opposed to the control group that was not exposed to any nicotine
- The embryos in a higher concentration of nicotine grew at a slower pace than embryos in lesser concentrations, but all were hatched on the fourth day
- The higher the concentration, the more birth defects were present including slightly curved backs
- The embryos had a lower heartbeat rate, about 130 bpm, and they seemed to be more sluggish after hatching, evident by some not moving out of their egg after hatching.
- Since zebrafish embryos resemble human embryos as they are developing, it is reason to believe that if a woman smokes while pregnant, it can majorly slow the baby's heart rate and have the baby become more at risk for having a birth defect.



	1,000 ppm	10,000 ppm	20,000 ppm	Control
Day 1	8	8	8	8
Day 2	8	6	6	8
Day 3	7	6	6	8
Day 4	7	6	6	8

Introduction:

In our hypothesis we believed the Zebrafish would become addicted to nicotine, and as a result, they would not be as active and have a slow heart rate. We decided on nicotine after it gave the best results among the other experimental substances, then studied the fish for about 2 weeks. We experimented using the question, could the fish survive in the nicotine? Nicotine itself is an oily chemical substance produced in the roots and collected in the leaves of tobacco plants (Mandal). In another study, ti was found that women that smoke during their pregnancy tend to have babies be more at risk for dying, having mental disabilities, behavior problems, and ADHD (Polito).

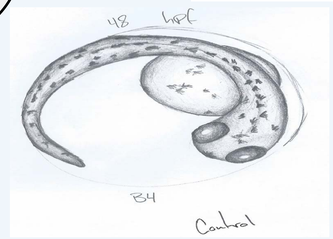


Figure 2B

This is a drawing of one embryo from the control group. It has a curved back and has a well-developed yolk.

This is an embryo from 10,000 ppm of nicotine. Its yolk is not developing straight and it has a bubble beneath the head that is not supposed to be there.

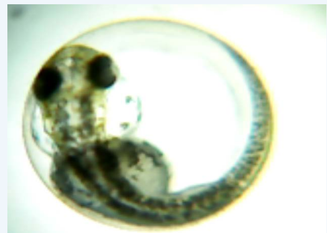


Figure 2A

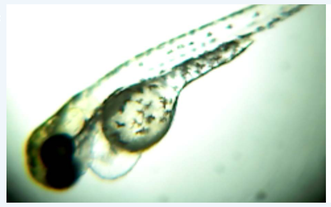


Figure 1B

This embryo from 1,000 ppm of nicotine has pericardial effusion or "fluid around the heart". It has a lot of fluid which increases the pressure around the heart, therefore negatively impacting the heart. It is the little bubble next to the yolk.

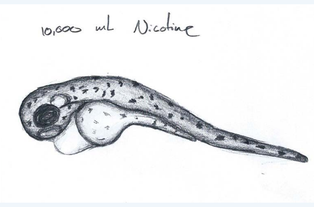
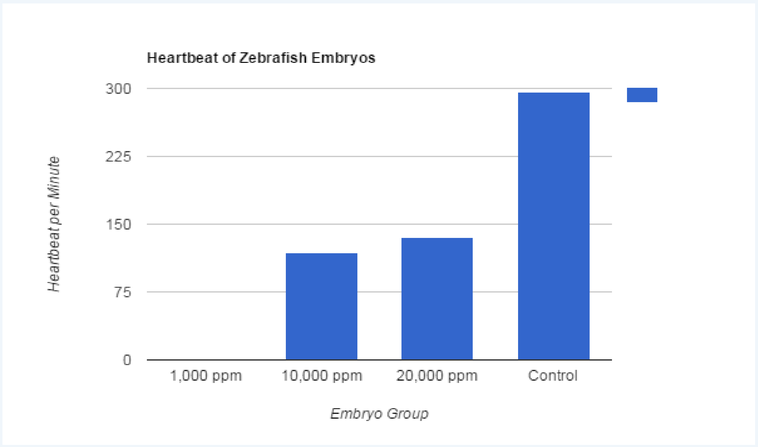


Figure 1A

Embryo from 10,000 ppm of nicotine not only has pericardial effusion, but also has a very curved back. The normal, healthy development of zebrafish includes straight backs.

Materials/Methods:

- Used a falcon dish and used four of the wells to place different concentration levels of nicotine and a control group
- On the first day, 8 zebrafish embryos were placed in each well
- In the first well, 1,000 ppm of nicotine was placed, in the second well there was 10,000 ppm of nicotine, in the third well was 20,000 ppm of nicotine and the fourth well contained the control group.
- Every day, the embryos were placed under a microscope so the dead ones could be removed and recorded, then the water concentrations were replaced in each well, and finally the embryos were looked at individually under the microscope to record any observations, and finally return the embryos to the incubator.
- Recorded observations included dead embryos, deformities, heart rate, movement, hatchings, and color of the embryos.



	1000ppm	10,000 ppm	20,000 ppm	Control
Heartbeat per minute		118	136	296

Results:

- Independent variables- different ppm of nicotine in each of the wells
- Dependent variables- number of alive zebrafish embryos per day, heartbeat of the embryos after being exposed to different ppm of nicotine after four days
- The control group didn't get any nicotine in order to compare their development with the development of the three other groups that got different ppm of nicotine
- This study was completed in order to show how intake of nicotine could affect embryos. The reason for using zebrafish embryos is because they are very similar to human embryos when developing, so by studying the effects of nicotine on zebrafish, we can infer that it will affect a developing human in the same ways.

Discussion:

To begin our experiment we hypothesized the zebrafishes problems would start with a slow heartbeat. Which was soon proved correct as it became obvious the fish grew slow and underdeveloped. Other problems we did not hypothesize became clear as well. Deformities quickly arose as bubbles formed under their skin and an abnormally curved spine, as shown in figures 1A and 1B compared to the healthy control zebrafish, shown in 2A and 2B. These deformities could easily cause problem for survival as their swimming skills could be affected, which in turn will affect their ability to eat or mate. Some limitations included the short number of days and limited supply of zebrafish.

Works Cited:

Mandal, Ananya, MD. "What Is Nicotine?" *News-Medical.net*. N.p., 08 Oct. 2014. Web. 06 Jan. 2017.

"Pericardial Effusion." *WebMD*. WebMD, n.d. Web. 06 Jan. 2017.

Polito, John R. "Nicotine Damages First Trimester Embryo." *Nicotine Damages First Trimester Embryo*. Why Quit?, 6 Feb. 2008. Web. 4 Jan. 2017.