Introduction:

Ethanol consumption occurs worldwide and is one of the most common drugs to interfere with pregnant women. Drinking alcohol during the time of gestation causes fetal alcohol exposure, which is associated with the onset of fetal alcohol spectrum disorder (FASD) and includes fetal alcohol syndrome (FAS). There has been a lot of research conducted on fetal alcohol spectrum disorder (FASD), which is a developmental disorder that occurs from alcohol consumption that in turn affects up to 0.2% of births. FASD and fetal alcohol syndrome (FAS) can cause a number of different abnormalities to arise including various physical, cognitive and behavioral issues. This problem is easily preventable if the woman abstains from drinking any alcohol during her pregnancy. The diagnosis of both FASD and FAS occurs after the baby has been born, therefore the effects of the alcohol are already present and cannot be changed. It is important to realize that alcohol has a devastating effect on an organism’s development. Understanding more about FASD and FAS through research is critical in order to prevent future abnormalities from alcohol exposure. (Chabenne et al., 2014). A study from 2004 examined ethanol exposure in zebrafish and found that ethanol exposed zebrafish embryos had lower heart rates than those of control zebrafish embryos. This study stressed the idea that ethanol impacts external and physical development (Bilotta, Barnett, Hancock, & Saszik, 2004). In this study, we tested the effects of embryonic exposure to alcohol on Gallus gallus to test the hypothesis that higher amounts of alcohol would produce lower pulse rates.

Materials and Methods:

Ten-day chick embryos (Gallus gallus) were explanted from their shells as per the method of Morris (2015) and Armstrong, et al. (1994), except that a sterile weigh boat was used instead of a sterile hammock described by Armstrong. Ethyl alcohol was administered to each embryo to achieve a final concentration on-the-cells of 0.0% (for control), or 0.002% (for low ethanol dose), or 0.02% (for high ethanol dose). Penicillin/streptomycin was also added to each embryo to achieve a final concentration on-the-cells of 100 U mg/ml.

Pulse was obtained by counting the number of beats in the chick embryo for 15 seconds and then multiplying that number by 4 to get a result in beats per minute. The number of beats per minute was recorded in the lab notebook. Pulse was recorded on day 3 at 4:15 p.m., day 4 at 3:27 p.m., day 5 at 12:30 p.m., day 6 at 5:00 p.m., day 7 at 5:30 p.m., day 8 at 7:00 p.m., day 9 at 11:20 p.m. and day 10 at 3:05 p.m. Once all the data were collected, the pulse was averaged in accordance to the experimental group. The averages were then graphed using Excel to display the effect of alcohol exposure on pulse. Experimental controls were crucial to the results. The control group was used as a reference to indicate healthy chick development, which served as a comparison between the experimental groups that were treated with ethanol. Therefore any
differences between the experimental groups and the control group were probably due to the difference in ethanol content.

**Results:**

Figure 1: Effect of ethanol on pulse over time in chick embryos.

![Effect of Ethanol on Pulse Over Time in Chick Embryos](image)

Figure 1 data are derived from day 3: 9 control, 3 low, 11 high, day 4: 13 control, 2 low, 11 high, day 5: 11 control, 1 low, 11 high, day 6: 8 control, 1 low, 11 high, day 7: 7 control, 10 high, day 8: 5 control, 9 high, day 9: 5 control, 9 high, day 10: 5 control, 9 high. Figure 1 represents the average pulse rate of the chick embryos throughout the experiment. The high concentration group increases within the first four days and then levels off. The control group follows a similar pattern, increasing in the first four days and then stabilizing into a plateau. The low concentration has a steeper increase compared to the other groups that occurs in the first two days and then decreases rapidly the next two days which results in the death of the embryo after day 6. Both the control group and the high concentration groups span the entire experiment or the full 8 days of observations, whereas the low concentration only contains data for the first 4 days of the experiment. The low concentration data stands out against the control and high concentration results. The pattern from the low concentration group varies from both the control group and the high concentration group and stands out in the graph.

**Discussion:**

The results suggest that both the control group and the high concentration group follow a similar pattern in their pulse rates over time. Perhaps, the high concentration group had lower pulse rate than the control at various points, but overall the two groups were very close throughout the experiment. The low concentration line suggests that there were either errors from the data, given that it relied heavily on a small sample size, but this could also be what the results are supposed to look like when using low levels of ethanol. It could be that the low dose of ethanol used in the experiment was enough to produce such a unique response that within the first two days pulse rate rose quickly and then rapidly declined in the following two days until
the embryo perished. In addition, it is possible that the low concentration embryos were exposed to an external factor that caused them to perish earlier than those from the control and high concentration groups. The results were not expected, and in turn do not support or refute the current hypothesis. Perhaps, the closeness of the control and high concentration group suggest that there is no relationship between alcohol and pulse rate. The low concentration data suggests that there could be other factors contributing to the pulse results, therefore more studies must be conducted examining the effects of alcohol on pulse before any major conclusions can be reached. Future studies should implement a wider range of alcohol increments to analyze over a longer period of time with a larger sample size, further advancing the field of fetal alcohol research.

References:

