Development of chick embryos affected with fetal alcohol syndrome

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Introduction

Testing alcohol's effects on a developing embryo is critical. Numerous birth defects can occur when alcohol is entered into the fetus's blood stream during development in the mother's womb. Of these defects include cardiac malformations (Stratton, 1996). Two of these malformations are ventricular septal defect (VSD) and atrial septal defect (ASD). VSD is a hole in the wall of the heart that separates the two lower chambers while ASD is a hole in the wall of the heart that separates the two top chambers. Some side effects of these disorders include fast heart rates and heart palpitations where one can feel their own heart beat (Burd, 2007). Although alcohol is a depressant, I believe that the added alcohol will add stress on the developing embryo and will result in a higher pulse. In this study, we tested the effects of embryonic exposure to alcohol on a 3-10 day chick to test the hypothesis that if a chick embryo is treated with alcohol solutions, then the heart rate of that embryo will be higher than that of its control.

Materials & Methods

The materials needed to perform this experiment include a lab notebook, a procedure by Armstrong *et al.* and other various resources used to complete the experiment. These supplies include three chicken eggs kept in an incubator at 35 degrees Celsius, a weigh boat, and a centimeter ruler. 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 Chick 3), or 0.002% (for low ethanol dose Chick 2), or 0.02% (for high ethanol dose Chick 1). Penicillin/streptomycin was also added to each embryo to achieve a final concentration on-the-cells of 100 U mg/ml. Each day photographs were taken of all three embryos under a microscope at a microscope magnification of 0.8 to fully understand the developmental processes taking place.

Results

As seen in Figure 1, chick 1 (0.02% ethanol) generally had the highest heart rate of the three chick embryos studied. The pulse of chick 1 was consistently around 150 beats per minute from day 5 and then for a majority of the experiment. There was a slight drop in

pulse on day 8, but was back to 150 beats the next day. Chick 2 (0.002% ethanol) reached 150 beats per minute on day 5, but this was a significant jump by 30 beats per minute from any other given day. Chick 3 (control) never reached these high level pulses throughout the entire experiment. Both chicks 1 and 2 were treated with an alcohol solution. These are the two chicks that had the highest heart rates. Chick 3 never had a heart rate that reached this high level.

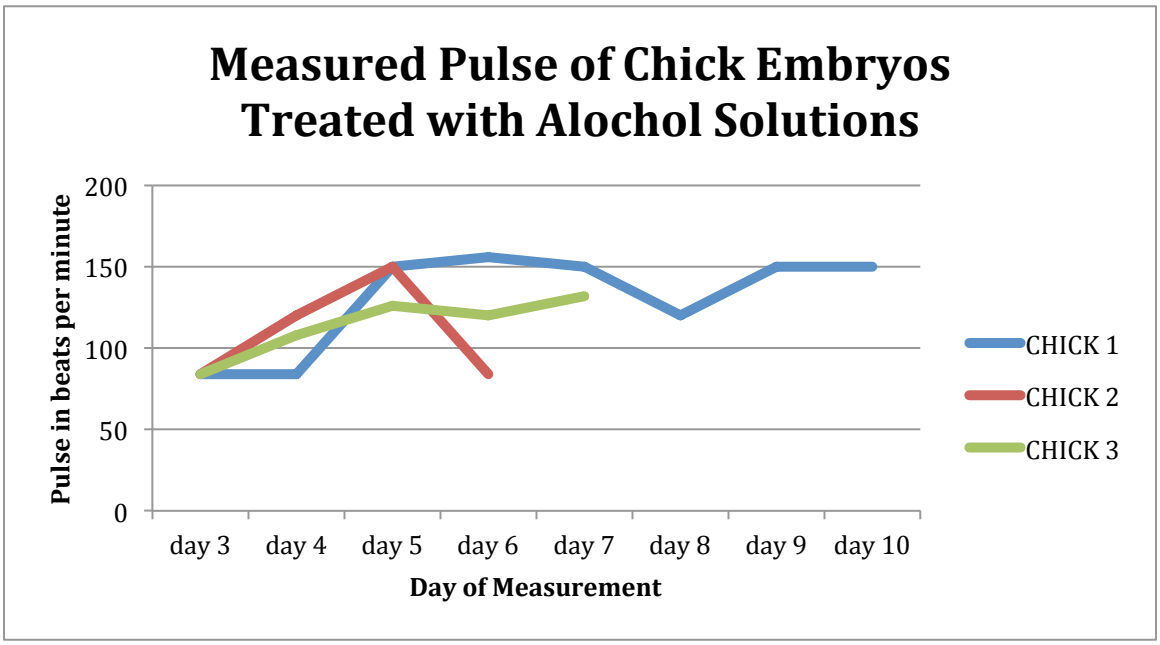

Figure 1. Data show the pulse of observed chick embryos treated with high alcohol concentration (0.02%), low alcohol concentration (0.002%), and control (0.00%) over the course of day 3 to day 10 of development.

Compared to the data from my personal experiment discussed above, data averaged from the entire class showed some different results (Figure 2). Although the average pulse for Chick 1 (0.02%) was still very high, the average pulse for Chick 3 (control) was almost identical. This does not correlate with the data I collected from my personal experiment. I noticed a few outliers within the combined data that may have caused the control's numbers to increase drastically. This could be due to many things, but the most likely would be human error.

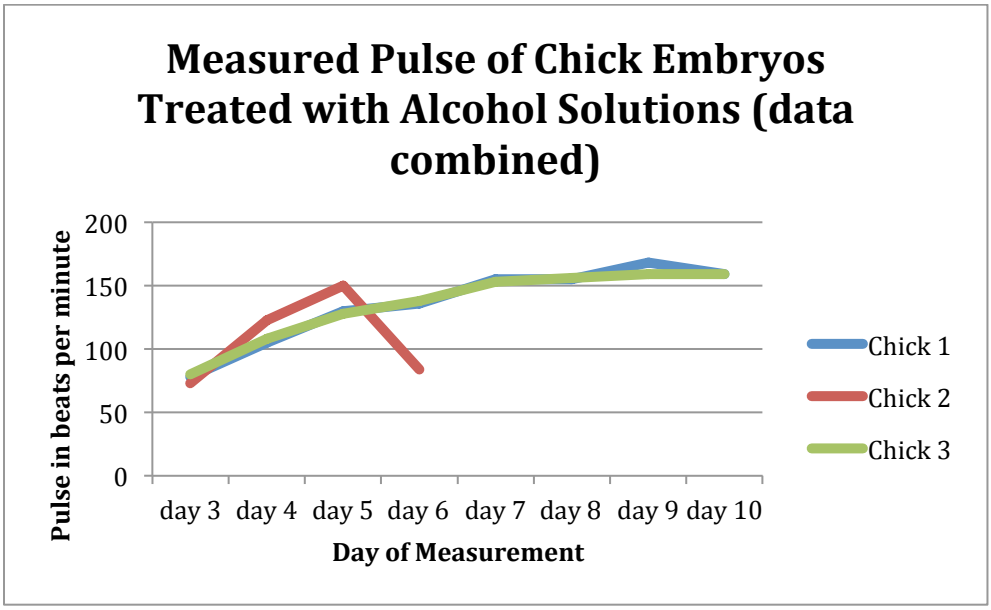

Figure 2. Data show the average pulse from class data of observed chick embryos treated with high alcohol concentration (0.02%), low alcohol concentration (0.002%), and control (0.00%) over the course of day 3 to day 10 of development.

Discussion

From the data I collected, the chick treated with the highest level of alcohol experienced the highest heart rates for the longest period of time. I expected these results to occur because the added alcohol to the embryo also added stress. The embryo had to deal with this, which usually results in an increased heart rate. This drastic increase in heart rate seen through my data collected shows the detrimental effects fetal alcohol syndrome can have on an embryo. Such high pulse rates could lead to detrimental issues later on in life. Although on average, the class data did not support my results as strongly, there is still much room for error. If I were to redo this study or expand on the subject, I would make sure all embryos are treated and handled in the same manner. When one embryo is handled less carefully than another, that embryo undergoes more stress which will likely increase the heart rate. If the covers on certain embryos are taken off for longer periods of time than others, the possibility for bacteria to enter the weigh boat is possible which may also change the stress level of the embryo. To expand on this experiment, I would like to add a higher alcohol concentration to see if the heart rate on the embryos affected would support or refute my original hypothesis.

References

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