Name(s)

Atreyi Mukherjee

Project Number

S2112

Project Title

The Effect of Nicotine Strength and Inactive Material in E-Cigarette Liquid on the Pulse Rate of Lumbriculus variegatus

Abstract

Objectives

The purpose to this project is to test what the effects of different concentrations and varieties of electronic cigarette liquid have on the pulse rate of Lumbriculus variegatus. Research has shown similarities between the development of human epithelial cells and annelid cells. By finding the average pulse rates and toxicity of blackworms in different concentrations of e. cigarette liquid, a correlation between the effects of the liquid on blackworms and on human epithelial cells in developing human lungs will be deduced. 52% of the teenage population in the US used e-cigarettes in the past year, so it is important to test the possibly detrimental effects of e-cigarette usage. The research on e-cigarette liquid focuses on the brain with nicotine, which damages the PFC of the teenage brain. By testing the toxicity of the liquid on blackworms, similar to human epithelial cells, and the effects of inactive ingredients on the blackworms, impacts on human cells can be predicted.

Methods

To start this procedure, the effects of different concentrations of nicotine, 5% and 10%, on the pulse rates were tested by immersing the worms in diluted e-cigarette liquid and then observing the pulse through the translucent body under a dissecting scope. In addition, the effects of ingredients such as propylene glycol (PG) and vegetable glycerin (VG) were recorded with two LD50 tests for the 36mg PG and VG. This determined how toxic these two ingredients were to blackworms and allowed observation of physical effects like choked vessels.

Results

The general trend in the data showed that compared to the control: 0mg VG was 12.7 beats slower, PG was 35.3 beats faster, and 36mg VG was 24.4 beats faster. From the LD50 test: the 36 mg lethal dose of PG is 2% and VG is 2.75%-3%. After exposure to the ingredients, PG, all the blackworms become inflamed and 68% of the 110 in PG had ruptures in their epithelial tissue.

Conclusions

This has a connection to the background research I did on the effect that bronchiolitis obliterans, also connecting to the similarities between human epithelial cells and annelida cells. This is a visual representation of the popcorn lung disease and how it affects the growing lungs of teenagers using e. cigarettes. Therefore, this procedure and data can be used to simulate the effects of e-cigarette liquid on human epithelial lung cells by observing annelida cells that closely simulate them.

Summary Statement

I found that as nicotine strength increases in e. cigarette liquid, blackworms exposed to the liquid reacted with faster pulse, and that propylene glycol caused blisters on blackworms, correlating to the effect of the liquid on human lungs.

Help Received

I researched the background of my topic, designed the experiment, and analyzed the data on my own in my high school's biology lab. My supervisor assisted me by recommending the LD50 data analysis technique.