

Curcumin Mitigates the Detrimental Effects of Nicotine in a *D. melanogaster* Model of Diabetes

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Rationale: It has been proven that the use of nicotine worsens the effects of diabetes due to its ability to raise blood sugar levels and lessen the efficiency of insulin. However, minimal research has been performed for a treatment that mitigates nicotine's detrimental effects. *Drosophila melanogaster* will be used as a diabetic model as many biological properties and discrete organ systems are conserved between humans and fruit flies. Previous research has also confirmed the use of high sugar diets to induce diabetes in *Drosophila melanogaster*. Curcumin will be utilized as a plausible treatment due to its antioxidant properties and alleviating abilities.

Research Question: Does the consumption of curcumin mitigate the progressing effects of nicotine on diabetic *Drosophila melanogaster*?

Hypothesis: Since previous clinical trials have shown that diabetic patients are particularly susceptible to the detrimental effects of nicotine and that curcumin alleviates nicotine toxicity, I hypothesized that my experiment will confirm these results and that curcumin will mitigate the negative effects of nicotine on the diabetic fruit flies

Expected Outcome: By experimenting on male and female fruit flies exposed to differing concentrations of nicotine and restricting them to regular and high sugar diets before quantifying their locomotive abilities and foraging behavior as well as observing the changes in their metabolic rates after nicotine exposure, I expect to confirm the detrimental effects nicotine has on diabetic fruit flies. Additionally, by adding curcumin as a potential treatment, I expect the negative effects to be mitigated through its antioxidant properties.

Methodology: Fruit flies will be separated into 16 experimental groups based on the concentration of nicotine exposed, sex, diet, and whether they will be given the curcumin

treatment or not. Each vial will contain 4 flies in total and 20 grams of food media.

Concentrations of nicotine will include 0.01%, 0.02% and 0.03%, which will be mixed into the food media. 6 of the 12 experimental groups with nicotine will contain flies fed on a high sugar diet while the other 6 will contain flies fed on a regular diet. 4 control groups will also be accounted for and will be separated based on sex and diet only. The fruit flies will be placed into their respective vials one week prior to experimentation in order to become accustomed to their new diets. Nicotine concentrations will be added two days prior to experimentation.

Startle Induced-Negative Geotaxis Assay: A startle-induced negative geotaxis assay will be performed daily from Day 2-6 to test for fly activity and locomotive capacities. Flies will be placed into an empty vial labeled with 8 centimeters, before being startled and given 10 seconds to travel upwards. Each trial will be recorded in distance traveled for each group.

Food Seeking Assay: A single fruit fly assay will be performed on Day 1 and Day 7 to test for foraging behavior. Flies will be starved for 24 hours in advance before being placed one by one in a Petri dish containing a single drop of apple cider vinegar in the middle. Each singular fly will be recorded for 3 minutes and if the fly lands on the apple cider vinegar drop for more than 3 seconds, it is to be considered that they have found the food.

Metabolic Respirometry: The metabolic rates of the flies will also be measured using a homemade respirometer. The respirometer will be made by gluing a pipette tip to a glass capillary tube, before inserting a sponge, a small amount of soda lime, and another sponge and placing the flies into the pipette tip and closing the open top with modeling clay. The respirometers will be suspended into a fish tank with distilled water mixed with a visible dye. The tank will then be closed and monitored for 1 hour. Height differences in centimeters of each respirometer will indicate CO₂ levels of each fly group.

Data Analysis: T-tests will be used to test for the significance of the food seeking assay, and negative geotaxis assay data as well as the metabolic rates. T-tests were also taken to find a significant difference between the linear regressions.

Risk and Safety: The student has prior experience experimenting with *Drosophila melanogaster*. A potential risk will include usage of harsh chemicals such as concentrated nicotine, but this risk will be mitigated with the usage of gloves and protective eyewear.

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