



CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

Name(s) Triya Roy	Project Number S2208
Project Title The Effect of a High-Sugar Diet on Drosophila melanogaster	
<p style="text-align: center;">Abstract</p> <p>Objectives Type 2 Diabetes (T2D) is a metabolic disorder that is caused by insulin resistance which results in elevated blood sugar and is associated with heart disease, obesity, and chronic inflammation. There has been widespread concern that high sugar diets (HSD) are key contributors to the hallmarks of T2D (hyperinsulinemia, insulin resistance, obesity, hyperglycemia, and inflammation). This study examined the progression of T2D by establishing D. melanogaster as a model for the disease.</p> <p>Methods In order to mimic the development of T2D, wild-type D. melanogaster were reared on standard fly mediums (formula 4-24) supplemented with sucrose, fructose, or glucose for 2 weeks until the flies were assayed. During rearing period, flies were monitored for growth and development. Terminal assays to assess the effect of a HSD included measurements of circulating hemolymph glucose, trehalose, and triglycerides.</p> <p>Results Initial experiments using purely high sugar content were toxic, so further experiments incorporated a combination of standard fly medium with various sugar contents to enable the flies to advance to adulthood. Interestingly, development was delayed in the high-sugar diets and growth was stunted when compared to the standard (control) diet. All diets produced significantly elevated amounts of circulating glucose, trehalose, and triglycerides, with fructose supplementation eliciting the most change compared to the standard diet (p-value < 0.01).</p> <p>Conclusions Fruit flies reared on a HSD had high hemolymph sugars which indicated hyperglycemia, while increased triglyceride levels and adipose growth indicated obesity and insulin resistance. Stunted growth and development indirectly signaled insulin resistance due to the interference of secreted dILPs (Drosophila insulin-like peptides) with the IGF/insulin pathway that regulates fly growth, development, and metabolism. A HSD based on fructose produced the most diabetic phenotypes amongst all the assays. This finding affirms survey-based studies associating High-Fructose Corn Syrup with obesity and associated metabolic complications in humans. This invertebrate model can be used as a baseline to investigate associated complications of T2D prior to advancing to complex mammalian models. Current study involves measuring dILP and NF-kappaB transcripts in diabetic adult flies.</p>	
Summary Statement Establish D. melanogaster as viable model for T2D in order to determine the morphological and cellular effects of a high sugar diet.	
Help Received My mentor (Dr. Inez Yuwanita) provided guidance while I independently designed experiments and collected data. She taught me how to use lab equipment at Schmahl Science Workshops.	