Expression of mitochondrial metabolic regulation gene Sirtuin 2 significantly downregulated in female compared to male D. melanogaster

Sinha A.1, Valencia I.2, Gonzalez E.2, Myers C.3, Feng Z.4
1AD Public School, 2Sweetwater High School, 3Great Oak High School, 4Boz Life Science Research and Teaching Institute.

Abstract

GenX is a synthetic chemical used in food packaging, nonstick coatings, and firefighting foam, but there is limited information on the effects this chemical has on living organisms. To gain a better understanding of the potential impacts of this chemical on the transcriptional level, male and female D. melanogaster were exposed to GenX through their diet. The expression of Sirtuin 2 (Sirt2), a gene involved in the regulation of mitochondrial energy metabolism in D. melanogaster brains, was analyzed at control conditions between sexes and after exposure to GenX using qRT-PCR. Females upregulated Sirt2 1.04-fold (p=0.903) and males upregulated Sirt2 1.49-fold (p=0.718) after exposure to GenX, and females express 331-fold less Sirt2 than males at control conditions (p=0.019). We conclude that females express significantly less Sirt2 at control conditions compared to males.

Introduction

Hypothesis: GenX exposure will change the expression in Sirt2 in D. melanogaster.

Methods

Female flies were fed GenX or control food for 7 days. RNA extraction was performed using Trizol. The expression of Sirt2 was analyzed using qRT-PCR. Statistical analysis was performed using GraphPad Prism.

Results

Figure 1. Adult male and female flies. Male flies (left) have a solid black lower abdomen, and female flies (right) have a stripped lower abdomen.

Figure 2. Flowchart of experimental design.

Figure 3. Heatmap showing gene expression fold change in control and experimental conditions for exposure to GenX, including sexual dimorphism differences. CF represents Control Female, EF represents Experimental Female, CM represents Control Male and EM represents Experimental Male. Green indicates downregulation of a gene and red indicates upregulation of a gene. Sirt2 has a 1.03-fold upregulation in experimental females compared to control females (p-value=0.903). 1.49-fold upregulation in experimental males compared to control males (p-value=0.717) and 331-fold downregulation in control females compared to control males (p-value=0.0194).

Discussion

• Sirt2 is involved in the determination of lifespan and neurodegeneration.

• There is a 331-fold difference in gene expression between male and female control flies, with a p-value of 0.0194.

• We also report a 1.03 fold difference upregulation in experimental females compared to control females (p-value=0.903), 1.49 fold upregulation in experimental males compared to control males (p-value=0.717). These data are not statistically significant.

• This suggests that exposure to GenX does not affect gene expression of Sirt2.

• The sexual dimorphism of the gene in adult flies agrees with previously published data (2).

• Sirt2 is conserved in other species, which provides the potential for repeating the experiment in other model organisms and to potentially translate these results into human responses.

Study Limitations and Future Directions

• D. melanogaster were only exposed to a single dosage of GenX.
• Future studies can use varying concentrations of GenX.
• D. melanogaster were exposed to GenX in their adult life stage.
• Future experiments can assess GenX exposure during developmental stages
• Only acute exposures were expressed.
• Future studies can include different endpoints and longer exposures.

References

2. https://flybase.org/reports/FBgn0038788.html