CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

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Project Number

35398

Project Title

Transgenerational Inheritance of Nutritional Programming of Longevity & Fecundity after Postnatal Dietary Manipulations

Abstract

Objectives/Goals

Unhealthy diets are one of the leading causes of non-communicable diseases (NCDs) which lead to 16 million premature deaths per year; maternal and childhood malnutrition alone is responsible for 11% of global disease burden and 35% of child death under the age of five. Optimizing early-life nutritional environment thus has the essential potential to combat the burden of NCDs and extend the human health and eventually longevity. This project seeks to examine whether appropriate postnatal dietary manipulations would influence (program) longevity and fecundity, and whether such nutritional programming of longevity and fecundity would be long-lasting and inheritable across generations through transgenerational inheritance.

Methods/Materials

In the parent generation (F0), virgin male and female flies were collected within 4 hours of eclosion, and placed on 3 different experimental diets with different protein/carbohydrate contents (i.e., LP, IP and HP or low-protein, intermediate-protein and high-protein diet) or a routinely used (or control) diet for 7 days as postnatal dietary manipulations. Then all the F0 flies and their F1, F2 and F3 offspring were maintained on the control diet all the time for lifespan and fecundity analyses.

Results

As compared with the control diet, postnatal treatments with both LP and HP diets shortened longevity significantly, while IP dietary ma-nipulation extended longevity significantly in the F0 and up to the F3 generation. In addition, LP reduced while IP diet increased fecundity across F0, F1 and F2 generations. The HP diet increased fecundity in all three generations, but the effect was barely significant in the F2 offspring (P=0.055).

Conclusions/Discussion

These observations demonstrate that (1) postnatal dietary manipulations may induce nutritional programming of longevity and fecundity in the F0 generation; and (2) such nutritional programming may be transmitted to the F1 generation through parental effects, and further transmitted to the F2 and even F3 generation through transgenerational inheritance. As stated in a recent review discussing transgenerational epigenetic inheritance, "the quality of the life of our grandchildren depends on our current actions and exposures." My observations therefore support the feasibility to improve reproduction, combat NCDs, and extend the human health and eventually longevity through optimizing the early-life nutritional environment.

Summary Statement

I employed several postnatal dietary manipulations to examine the transgenerational inheritance of nutritional programming on longevity and fecundity in Drosophila.

Help Received

My parents provided the ingredients to make the LP, IP and HP diets at home; Dart Neuroscience LLC provided the control diet and lab equipment for me to perform my experiments under the supervision of my adviser Dr. de Belle.