Multiple Generations Beyond "You Are What You Eat": Transgenerational Inheritance of Nutritional Programming of Longevity and Reproduction after Postnatal Dietary Manipulations

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Unhealthy diets are one of the leading causes of non-communicable diseases (NCDs) which lead to 16 million premature deaths annually; maternal and childhood malnutrition alone is responsible for 11% of global disease burden and 35% of child death under the age of five. This project seeks to examine whether appropriate postnatal dietary manipulations would program longevity and fecundity, and whether such nutritional programming would propagate across generations through transgenerational inheritance. 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 or a control diet for 7 days as postnatal dietary manipulations. Then these F0 flies and their F1, F2 and F3 offspring were maintained on the control diet all the time for lifespan and fecundity analyses. As compared with the control diet, postnatal treatments with both low- and high-protein (LP or HP) diets shortened longevity significantly, while intermediate-protein (IP) dietary manipulation extended longevity in the F0 and up to the F3 generation. In addition, LP reduced while IP diet increased fecundity across F0, F1 and F2 generations. 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. My observations therefore support the feasibility to improve reproduction, combat NCDs, and extend the human health and eventually longevity through optimizing early-life nutritional environment.