Examining the Effects of a High-Sugar Diet on Aging Ovaries in *Drosophila melanogaster*

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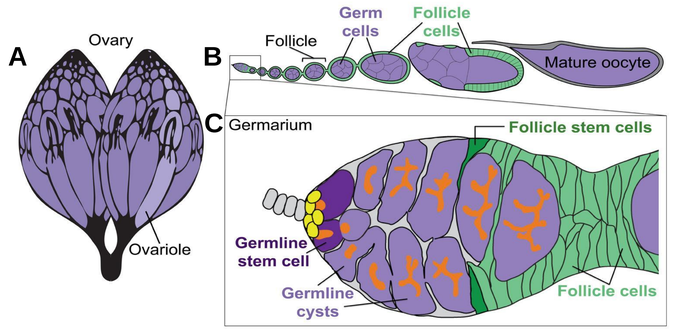
Background

Drosophila melanogaster, the common fruit fly, has a pair of ovaries (A) made of individual egg producing units called ovarioles (B). Each ovariole has a germarium (C) at the anterior-most end which contains germline stem cells. Ovarian germline stem cells support replenishment of oocytes for long-term egg production. Nutrition and aging affect germline stem cell activity, but it is unknown how these two physiological factors work together. *Drosophila* is an excellent model for studying how adult stem cells are regulated *in vivo*.

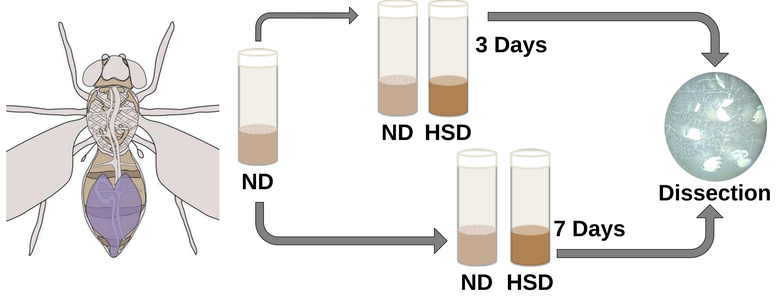


Objective

The goal of this project is to understand how aging and obesogenic diets work together to influence oogenesis. Data from this study will provide insight on how adult stem cell populations are regulated by physiology.

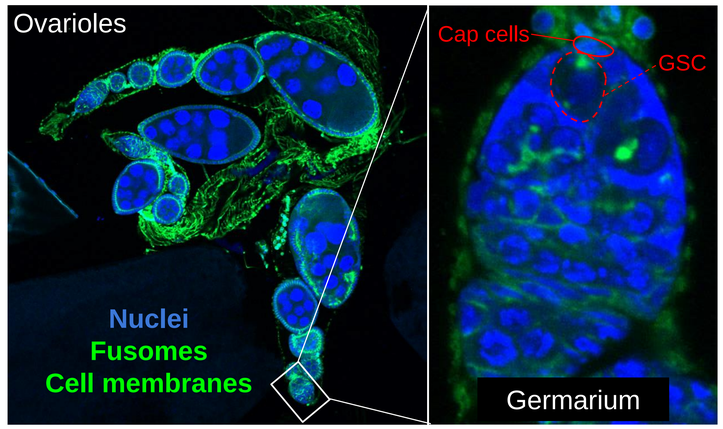
Methods: Feeding paradigm

Age-matched, adult females were fed a normal diet or high-sugar diet (0.8M added sucrose). After 3 days, ovaries were dissected and processed for immunostaining to visualize cap cells and germline stem cells.



Methods: Identifying ovarian cells

Immunofluorescence staining labels specific proteins that highlight cell components. This allows identification of cap cells (anti-Lamin C), germline stem cells (anti-alpha spectrin), and vitellogenic follicles (DAPI). Confocal microscopy at low (20X) and high (63X) magnifications were used to acquire images of germaria and ovarioles.



Results

A high-sugar diet does not affect cap cells or germline stem cells

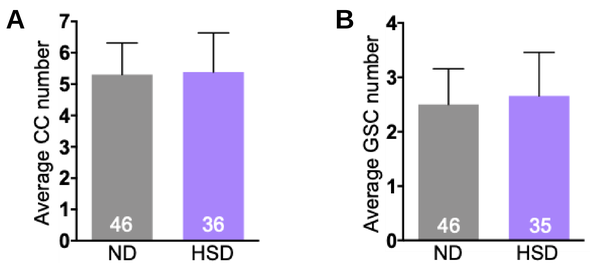


Figure 1. Cap cell (A) and germline stem cell (B) numbers were counted in several germaria from females flies fed a normal diet (ND) or high-sugar diet (HSD). Number of germaria counted are indicated in white text.

A high-sugar diet leads to blocks in vitellogenesis and ovulation

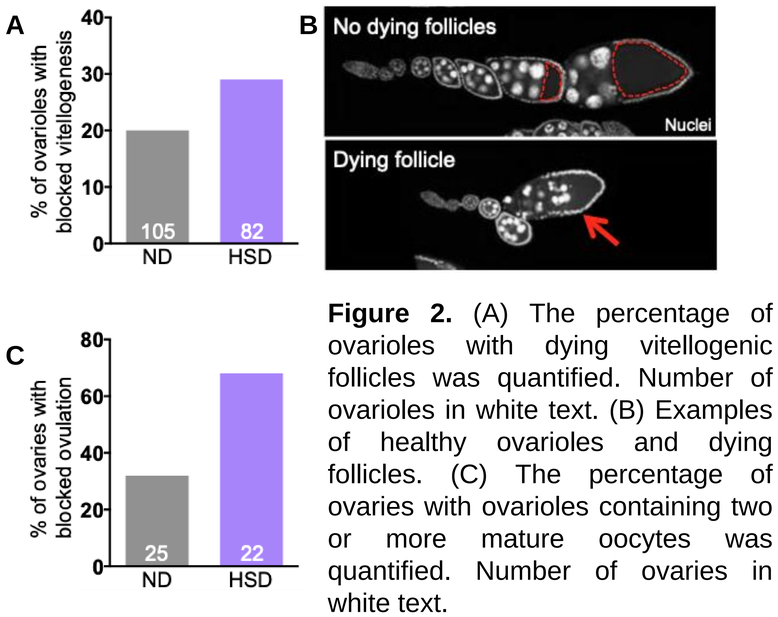


Figure 2. (A) The percentage of ovarioles with dying vitellogenic follicles was quantified. Number of ovarioles in white text. (B) Examples of healthy ovarioles and dying follicles. (C) The percentage of ovaries with ovarioles containing two or more mature oocytes was quantified. Number of ovaries in white text.

Conclusions & Future Directions

- High-sugar diet…
  - does not impact cap cell or germline stem cell number
  - blocks progression through vitellogenesis
  - blocks ovulation of mature oocytes
- Future research will…
  - analyze ovarian tissue in older females
  - assess other stages of oogenesis like GSC proliferation, germ cell survival and growth
  - examine tissues like the fat body

Acknowledgments

➢ ***Research supported by NIA-funded South Carolina Advancing Diversity in Aging Research (SC-ADAR) Program (R25AG050484).***

➢ ***Armstrong Lab Members: Tancia Bradshaw and Chad Simmons***