The Effects of Finasteride on Parity in Female Drosophila Melanogaster

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Abstract

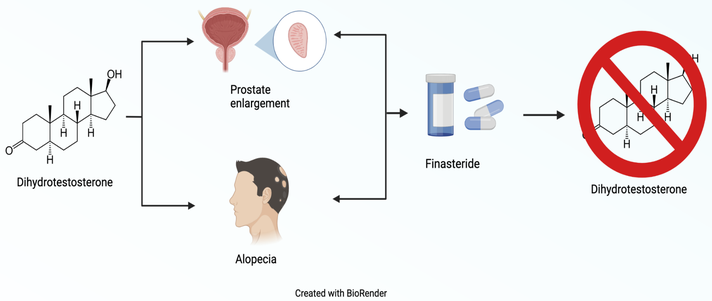
This study was designed to evaluate the impact of finasteride consumption on female reproduction, using drosophila melanogaster as a model. We predict that the finasteride will negatively impact the reproductive ability of the female drosophila melanogaster and its male offspring.

Introduction

Finasteride is a 5-alpha-reductase inhibitor drug typically used to treat prostate enlargement or male pattern baldness (Tacklind et al., 2010). 5-alpha reductase is an enzyme responsible for steroid metabolism and converts testosterone to dihydrotestosterone. This drug therefore works to reduce the level of dihydrotestosterone in the body by inhibiting the 5-alpha reductase enzyme, preventing conversion of testosterone to DHT (Iamsumang et al., 2020). The mechanisms of hormone regulation and its effect on hair growth cycles is not well understood, but it has been shown that in both sexes, hair distribution is determined by testosterone and other androgens. The reduction of DHT in the body results in reduced hair loss, though this mechanism is unknown. (Whiting, 1998). The reduced DHT also results in a reduction of prostate size since this hormone is mainly involved in prostate development. (Steers, 2001). There are also side effects including erectile dysfunction, ejaculation dysfunction, and decreased libido. (Mysore, 2012). Some cases have found that side effects continued after cessation of the drug, known as “Post finasteride Syndrome.” Most studies have focused on the effects of this drug on men rather than women. This drug could potentially help treat polycystic ovary syndrome as well as female pattern hair loss in women, since women have hair distribution resulting from the same hormones and polycystic ovary syndrome has been linked to higher levels of testosterone and DHT, which could be mediated by the finasteride (Munzker et al , 2015).. However, side effects in women and possible birth defects are unknown. A 2007 study found that a higher dosage of finasteride found it beneficial to 5 out of 6 patients taking it for female pattern hair loss (Kohler et al., 2007). While this could be beneficial, the impact of finasteride on embryos is also currently unknown. So far, there has not been a reported successful pregnancy after finasteride consumption. Our study is therefore aimed at assessing the impact of this drug on pregnancy, using drosophila melanogaster as a model.

The study’s hypothesis is that the finasteride will decrease the female drosophila melanogaster's ability to produce offspring and if offspring are reproduced, then the male offspring will have a reduced reproductive ability. This is based on finasteride testing on adult human males, who experienced reproductive reduction and penis reduction (Lee et al., 2019). The drosophila melanogaster was chosen as a model because they have over 75% of clear homologs which means that they will react similarly to how humans react to the finasteride drug (Bier & Reiter, 2002). After all the appropriate materials have been ordered and delivered, the vials will be set up to treat and examine the drosophila. A fixed number of female drosophila will be placed in 12 tubes, three trials for four tests, and one male drosophila will eventually be temporarily placed in each tube. Each test will have an increasing amount of finasteride to test the difference between low and high concentrations (Kohler et al. 2007). When transporting the drosophila from vial to vial, they will be made unconscious by FlyNap. The mass of each vial will be recorded, and the vial will be covered with a breathable lid. The finasteride will then be introduced to the female drosophila’s food in varying amounts using the appropriate conversion equation. After the finasteride has been digested and processed by the female drosophila, the male drosophila will be introduced into the vial with the previously stated method. This process will be repeated three successive times with the female drosophila population. Following each trial, the male offspring will be separated using the FlyNap and then introduced to a control group of female drosophila to determine if the male offspring experience reproductive reduction or inability. Overall, this project aims to contribute to evidence concerning whether or not it is safe for females to take finasteride for various conditions in regard to their reproductive ability and the vitality and reproductive ability of their male offspring.

Theory



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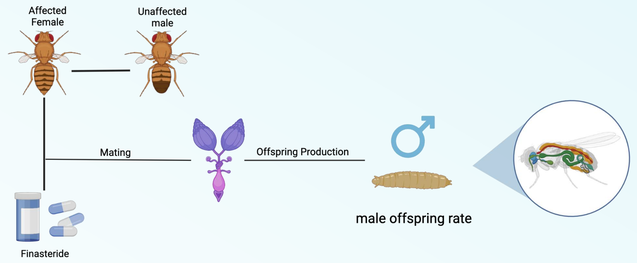

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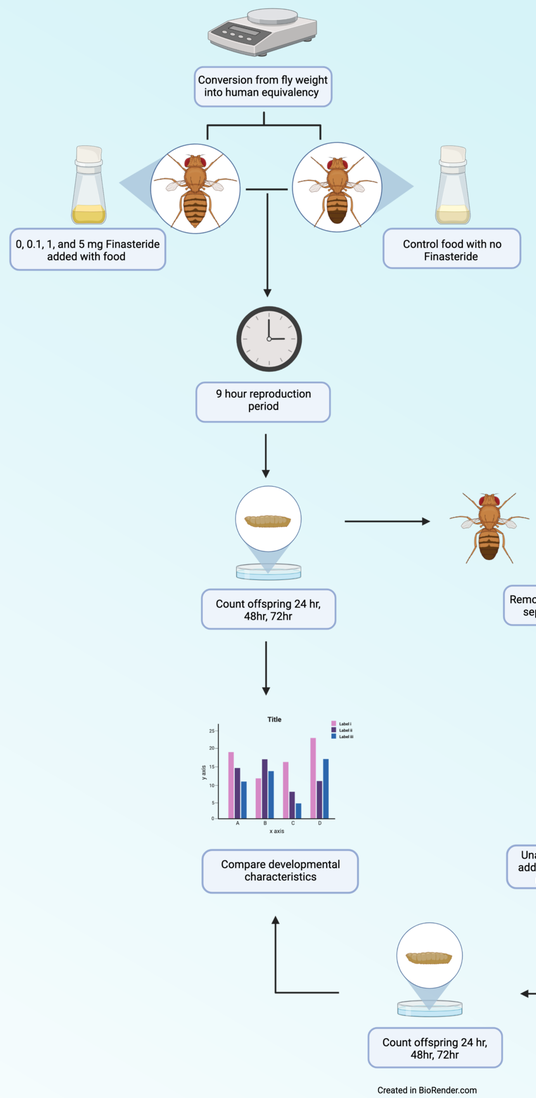
Methodology



Calculations

$$\frac{\text{Finasteride (mg)}}{\text{89.765 (male average kg)}} \times \frac{\text{x (mg)}}{\text{.88 (Fly average mg)}}$$

$$\frac{\text{Finasteride (mg)}}{\text{77.383 (female average kg)}} \times \frac{\text{x (mg)}}{\text{.88 (Fly average mg)}}$$

$$\frac{\text{Fly Finasteride Dose}}{\text{10 mL water}} \times \frac{\text{Volume of Diluted Dose}}{\text{1000 mL water}}$$

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Expected Results

- Parity rate decreased
  - Finasteride negative effect upon reproduction
- No change between control / experimental population

Future Direction

- Identifying finasteride quantitative results
- Understanding the genetic components and defects in male offspring from affected finasteride females
- RNA sequencing to identify hormonal biomarkers between control/experimental