Effect of Pre and Postnatal Exposure to Soy Phytoestrogen on Male Fertility of Albino Mice

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For the fulfilment of the MSc in Zoology (Embryology & Comparative Anatomy)

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Summary

Phytoestrogens are plant-derived, 17β-estradiol-structurally similar compounds, acting either by direct action or by inhibition of this compound in humans. The major dietary isoflavones are formononetin and GEN; daidzein, glycitein, and biochanin A are the other components. The principal foods found to be rich in isoflavones in the human diet are derived from soybeans and products of soybeans. High amounts of daidzein and GEN were found in dried soybeans. Soybean is extensively utilised globally as both animal feed and human nourishment. Nevertheless, soybeans have been demonstrated to be a significant contributor to various health issues, including male infertility. Later, the current study was carried out to assess the male reproductive toxicity of two dosages of soybean-based diets in male albino mice. 40 male albino mice weighing 25-30g each were used, kept in a stainless-steel cage in the animal house of the Zoology Department, Faculty of Science, Fayoum University. The animals were maintained under conventional laboratory conditions for a 12 h photoperiod at a temperature of 25 ± 2 ºC. The mice were partitioned into three groups, each consisting of 10 mice, and subjected to the experimental treatments for a duration of 64 days.

Group 1: **Control group (CON group)**: male mice from PND21 fed on a casein-based diet free of soybeans till the PND56.

Group 2: **Low-soybean group (LS group)**: male mice from PND21 fed on a 20 % Soybean diet till the PND56.

Group 3: **High-soybean group (HS group)**: male mice from PND21 fed on a 30 % Soybean diet till the PND56.

In order to assess the impact of different doses of soybean on the ability of adult albino mice to reproduce, various factors were examined. These factors included the amount of food consumed, reproductive performance,

measurements of body and testicular size, analysis of sperm, levels of hormones, overall antioxidant capacity, assessment of DNA damage using the comet assay, examination of histopathological changes, and measurement of morphometric parameters. The statistical analysis utilized one-way and mixed analysis of variance (ANOVA), with Tukey's test employed to assess group changes. The programmed used for conducting the analysis was SPSS, whereas Office (2019) was utilized for curve fitting. This study investigated the effects of low- and high-soybean diets on reproductive parameters in mice from gestational day (GD) 12 to postnatal day (PND) 56. Mice fed soybean diets exhibited decreased food intake, weight loss, hyperactivity, and increased aggression. Mortality rates were higher in soybean groups compared to controls. Food consumption was significantly lower in soybean groups during pregnancy, lactation, and post-weaning periods. Body and testicular weights were also reduced in soybean mice. Reproductive performance measures like mating and fertility indexes declined for the low soybean group. Sperm analysis found motility, viability, and count decreased in soybean mice relative to controls. Abnormal sperm morphology and various head, mid-piece, and tail abnormalities increased substantially. Hormonal analysis revealed reduced testosterone and increased FSH and LH levels in soybean groups versus controls. Total antioxidant capacity decreased while DNA damage as measured by comet assay increased in soybean mice. Morphometric analysis showed tubular diameter, epithelial height, lumen thickness, and blood vessel diameter were significantly altered in soybean groups compared to controls. The study results align with several previous findings. Decreased food intake could relate to isoflavones influencing appetite hormones. Increased aggressiveness and urine odor may involve isoflavone metabolism issues. Weight loss at low soybean doses agrees with shorter supplementation durations being more effective. Reproductive performance declines agree with phytoestrogens reducing male capacity. Increased abnormal sperm morphology and reduced

motility/viability support soy's testicular toxicity impacting sperm production. Decreased testosterone and altered FSH/LH levels could involve isoflavonoids' phytoestrogenic effects on the pituitary-testicular axis. Elevated DNA damage may originate from toxic bile acid or protein fermentation compounds. Reduced antioxidant capacity is consistent with impaired capacity reported elsewhere, though some studies conflict with or found improvement. Overall variations may stem from differences in study design or concentration