Effects of estrogen on post-prandial glucose and insulin in cats at risk for diabetes mellitus

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Introduction

Obesity in domestic cats is commonly diagnosed and a growing concern in veterinary medicine because it predisposes individuals to health complications like diabetes mellitus. Feline diabetes mellitus is similar to human type II diabetes with pancreatic β-cell failure and insulin resistance made worse by obesity. Previous studies showed that, in overweight neutered-male cats, estrogen replacement therapy results in decreased food intake and possibly down-regulates insulin production as observed in a glucose tolerance test.

Hypotheses

1) Estrogen replacement will reduce the post-prandial plasma insulin to glucose ratio helping cats maintain euglycemia with less need for insulin
2) Bisphenol-A, an environmentally ubiquitous weak estrogen mimic, will have similar effects as estrogen (decrease food intake, reduce post-prandial insulin:glucose ratio)

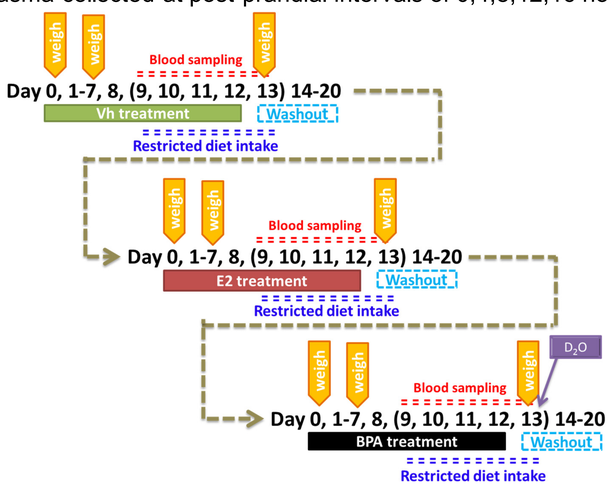
Methods

Animals

- Six male-neutered cats (4-7 years)
- 4.4-8.6kg, variably overweight (body fat= 27-47%)

Study design (Latin-square, 3 treatments)

- Treatments: Oral 17β-estradiol (E2, 1.0 µg/kg/day), bisphenol-A (BPA, 50 µg/kg/day), or vehicle (ethanol, 1.0 µL/kg/day)
- Plasma collected at post-prandial intervals of 0,4,8,12,16 hours



Results

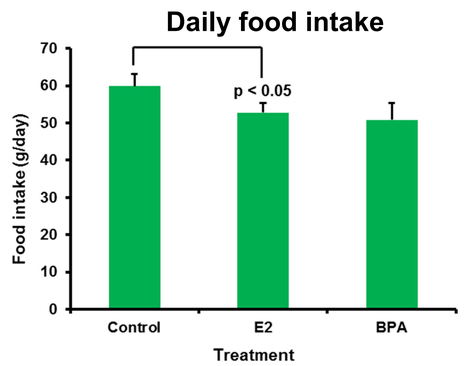


Figure 1. Mean of food consumed ad libitum for days 0 to 9 from ~9:00 to 17:00 hrs. There was a significant decrease (12%) in food intake with estradiol treatment.

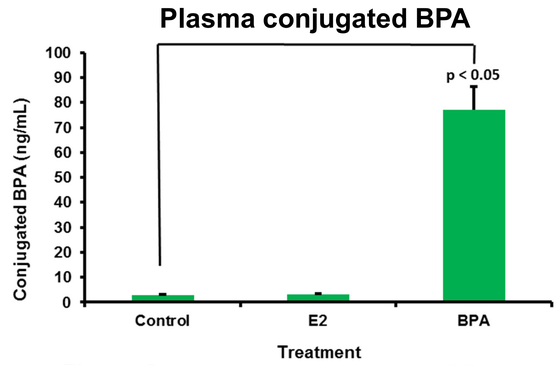


Figure 2. Mean plasma conjugated BPA on day 13 (24 hrs after last oral treatment.) Plasma levels of BPA were significantly higher in cats treated with oral BPA.

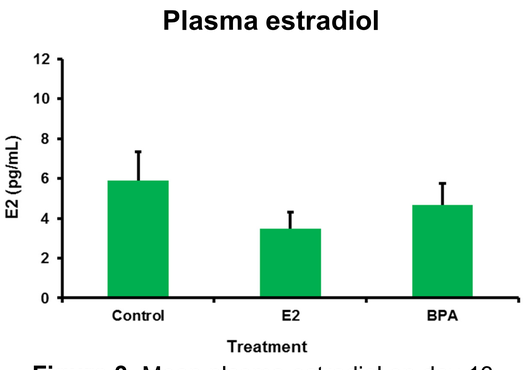
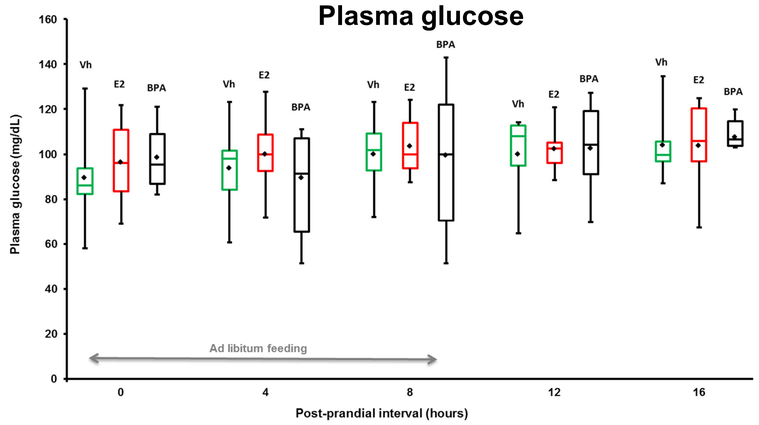
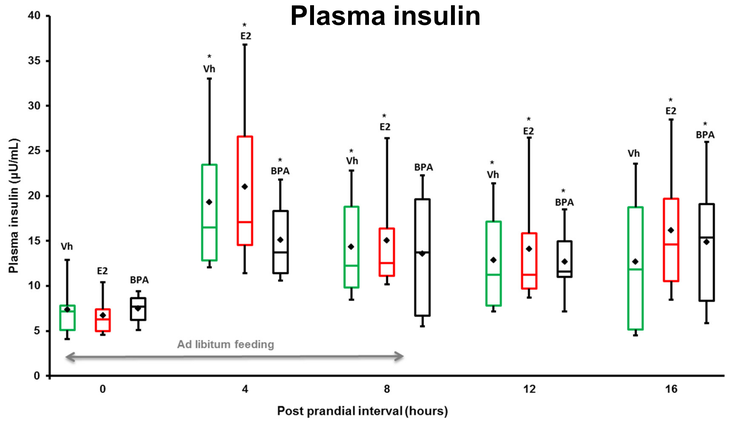


Figure 3. Mean plasma estradiol on day 13 (24 hrs after last oral treatment.) There was no significant difference in plasma levels of estradiol among treatment group.





Figures 4 & 5. Box-whisker plots of plasma glucose and insulin concentrations. There was no post-prandial rise in glucose and no significant difference in levels with treatment. (*) > t=0 insulin concentration ($p < 0.05$). There was no significant treatment difference in insulin levels and insulin:glucose ratio.

Conclusions/on-going research

- Dose of E2 given appears physiologic and appropriate for replacement therapy to decrease ad libitum food intake toward pre-neuter amounts.
- Oral BPA is absorbed and accumulated, but not eliminated within 24 hrs.
- Post-prandial glucose and insulin concentration and insulin:glucose ratio are not negatively impacted by E2 replacement and allowable limits of BPA contamination of pet foods.
- Unconjugated (free) BPA analysis to be done.

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