

SUGAR, STRESS, AND SEX: Impact of stress on reward-related behaviors and pathways in female rats

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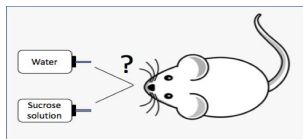


Introduction

Women are twice as likely to develop stress-related disorders such as depression and post-traumatic stress disorder; however, it's still unclear as to why this sex difference in prevalence exists.

In this pilot study, we investigated the effects of stress on reward-related behavior (as measured by sucrose preference, see Liu et al., 2018) in female rats across the phases of the estrous cycle. The estrous cycle in rodents is similar to the human menstrual cycle. The estrous cycle has four phases (proestrus, estrus, metestrus and diestrus) with proestrus associated with increasing levels of estrogen (Ajayi et al., 2020, p. 3). We hypothesized that stress exposure would decrease sucrose preference and differ based on estrous phase based on previous studies (Duncko et al., 2001).

Methods



-Subjects: 4 Sprague Dawley rats, two males and two females. One male and one female were exposed to stress.

-Stress exposure took place on the last day of the baseline measurement week (Week 1).

-Sucrose preference test: Rats were presented with two bottles to drink from daily for two weeks; one contained water and the other a solution of 1.5% sucrose in water. Bottle weights were recorded for the 2 weeks. Percent sucrose preference was calculated with the following formula: $\text{sucrose preference (\%)} = \frac{\text{sucrose intake(g)}}{\text{sucrose intake} + \text{water intake(g)}} \times 100$.

Results

Preliminary review of data suggests that stress may reduce % sucrose preference in female rats.

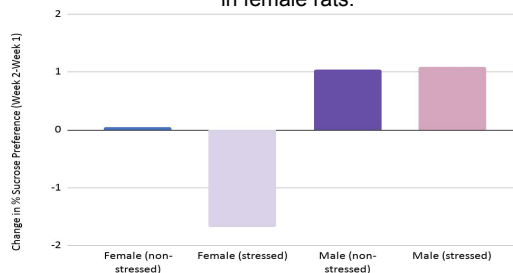


Figure 1. The stressed female showed a reduction in the % sucrose preference between weeks 1 and 2 compared to the non-stressed female. Stress did not appear to affect % sucrose preference in the male rats.

Preliminary observations changes in % sucrose preference after stress may depend on estrous phase.

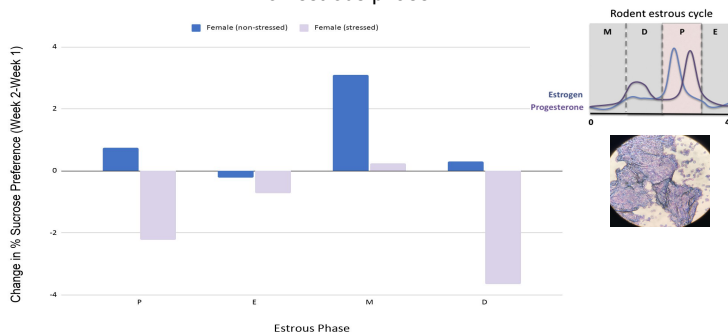


Figure 2. A decrease in % sucrose preference was observed in the stressed female rat during the diestrus and proestrus phases between weeks 1 and 2. The inset image on the right illustrate the level of ovarian hormones (estrogen and progesterone) as they fluctuate across the phases of the estrous cycle. The image below this is a photograph of estrus cells that characterize this phase. P=Proestrus, E=Estrus, M=Metestrus, D=Diestrus.

Conclusions

We hypothesized that stress exposure would reduce the preference for sucrose, indicating the presence of anhedonia which is "a core symptom of depression that can be assessed in rodents" (Scheggi et al., 2018, p. 3). Our initial observations supported our hypothesis. We found reduced sucrose preference in stressed females compared to the unstressed rats and stressed males, and this effect was more pronounced during the diestrus and proestrus phases of the estrous cycle. This is consistent with previous findings in which chronic mild stress reduced sucrose preference in control, but not ovariectomized rats (Duncko et al., 2001).

Given that we observed differences in sucrose preference. It is possible that in the female rats, the estrous phase contributed to the stress-induced changes in percent sucrose preference, but this effect should be further investigated with a larger sample size. Ongoing analyses will examine the dopaminergic pathways that might be involved.

References

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Acknowledgements

This project facilitated by departmental funds from the Department of Psychology and Neuroscience at Wheaton College, Massachusetts. We would also like to thank Professor Lisa Maeng, Amanda Bettie, and our rats.