Effects of Stress on Behavioral Inhibition in Male and Female Rats Tested via Operant Touchscreen Chambers

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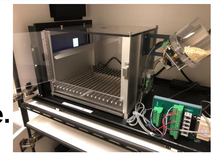
INTRODUCTION

- Addiction negatively impacts behavior and neuronal function, and defeating addiction requires an individual to inhibit reward-seeking behaviors (NIDA, 2014).
- Sex differences in addiction relapse may be stress-dependent (Lynch et al. 2002; McKay et al, 1996).
- The purpose of the present study was to examine the effects of acute stress on inhibition of an appetitively conditioned touchscreen response in male and female rats.
- Extinction training was used because it is known to produce inhibition of a reward-seeking responding (Todd et al, 2014).
- A spontaneous recovery test was used to measure behavioral inhibition (Brooks & Bouton, 1993).

METHODS



Subjects & Apparatus
Sprague Dawley rats (16 male; 16 female) were trained and tested in Layfette Touchscreen Chambers using ABET II software.

Pre-training
During a 60 min pre-training session, rats were presented with a conditioned stimulus (CS; i.e., a white square) every 30 secs followed by one 45 mg sucrose pellet. However, if the rat touched the CS it received three sucrose pellets.

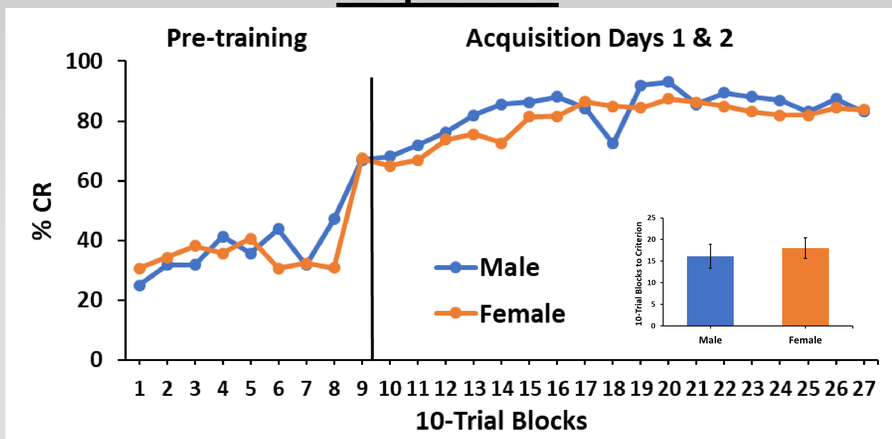
Acquisition
During acquisition, rats were given 100 presentations of the CS per daily session. If the rat touched the CS it received a sucrose pellet. Incorrect responses were followed by the house-light turning on for 10 secs and no reward was given. The acquisition criterion was 80% correct conditioned touch responses (CR) within a single session.

Extinction & Spontaneous Recovery
During extinction, the rats were not reinforced (i.e., no food was given) for a touching the CS. Extinction consisted of 60 trials per session. The criterion was 77% no-CRs within a single session. Spontaneous recovery was tested two weeks after the rat reached extinction criterion.

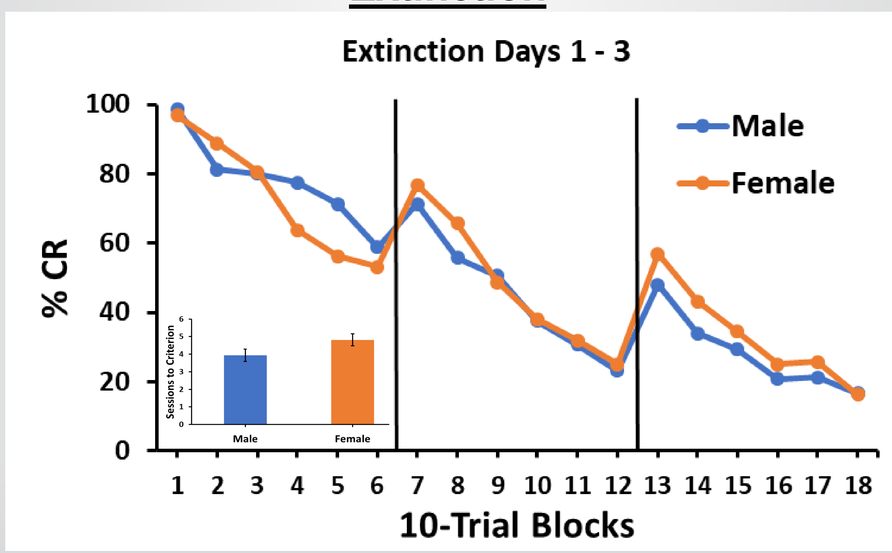
Acute stress administration
Half of the male and half of the female rats received a 30 min acute restraint stress (outside of the training chambers) immediately prior to the spontaneous recovery test.

RESULTS

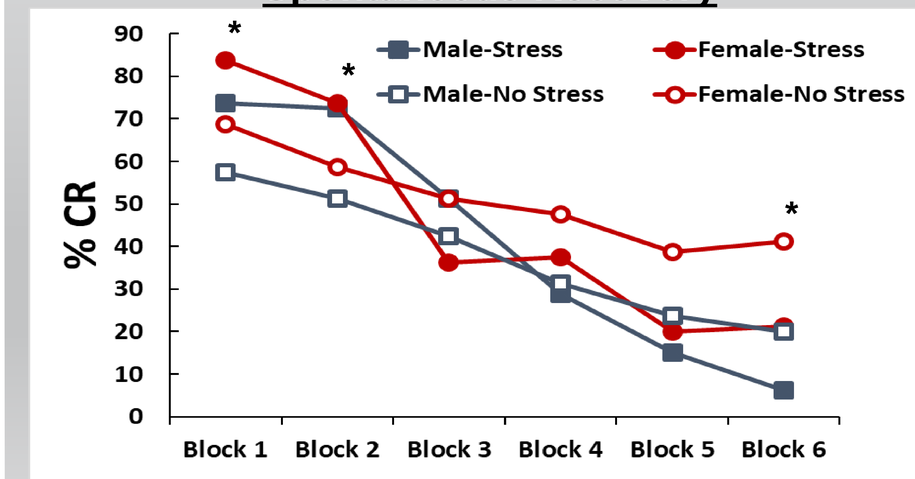
Acquisition

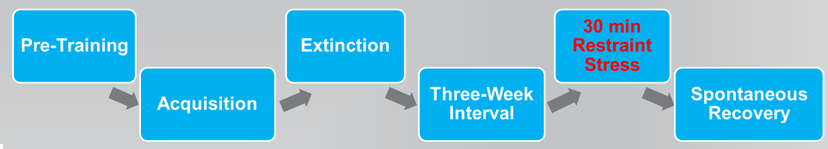


Extinction



Spontaneous Recovery





RESULTS AND DISCUSSION

- All rats successfully acquired and extinguished a conditioned touch response to the CS that was presented on a touchscreen.
- There were no sex differences in the rate of acquisition or extinction.
- Stressed rats showed greater spontaneous recovery than non-stressed controls.
  - A repeated measures mixed ANOVA revealed a significant Block X Stress interaction [$F(5, 140) = 5.1$, $p < 0.01$].
  - 2 x 2 ANOVAs revealed significant main effects of stress on Block 1 [$F(1, 28) = 5.25$, $p = 0.03$] and Block 2 [$F(1, 28) = 5.98$, $p = 0.02$].
- Stressed female rats showed the greatest spontaneous recovery overall, however their performance was highly variable.
- Our results show that stress decreases inhibition, which may be a possible mechanism that contributes to stress-induced drug relapse.

Future Studies

We plan to use a similar experimental approach to determine if fluctuations in estrogen levels differentially affect the magnitude of spontaneous recovery in stressed and non-stressed female rats.

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