Weak Shock Exposure Is Behaviorally Different From Extinction In Reducing Stress-Enhanced Fear

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BACKGROUND

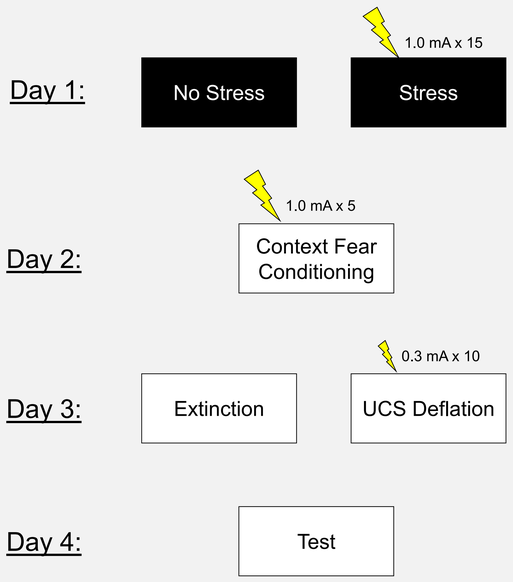
Exposure to an extreme stress can lead to prolonged fear sensitization and exacerbate learned fear behaviors, including freezing. These processes can be studied using **stress-enhanced fear learning (SEFL),** a behavioral paradigm in which prior exposure to an extreme stressor renders later contextual conditioning resistant to extinction (Long et al., 2012)**.**

Our lab has recently characterized a way to reduce fear behaviors through presentations of a weaker version of the unconditional stimulus (termed **'UCS deflation'**) that is behaviorally and neurobiologically distinct from extinction (Bonanno et al., 2023). **Here, we tested the prediction that UCS deflation, but not extinction, will weaken a stress-enhanced fear memory.**

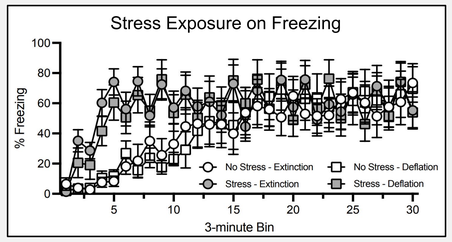
METHODS

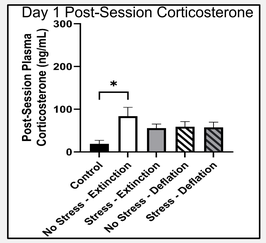
Male and female Long Evans rats were used and split into four groups: No Stress - Extinction, No Stress – Deflation, Stress– Extinction, No Stress – Deflation.

Blood plasma was collected before and after each day's behavioral session. FreezeFrame was used to measure freezing, defined as the absence of movement except for which was necessary for respiration (Rajbhandari et al., 2018).

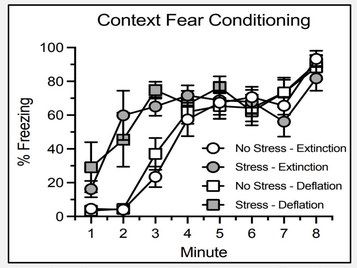


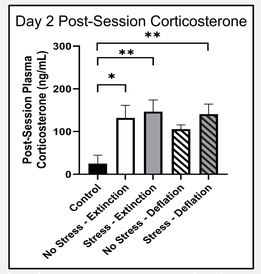
RESULTS



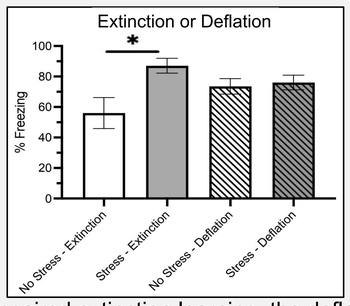


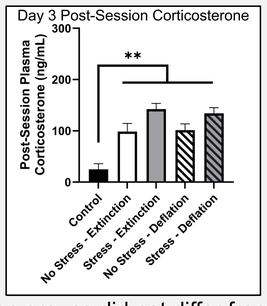
Day 1: Stress groups increased their freezing over time. No Stress groups received no stimulus and fell asleep, depicted as an increase in freezing. In general all groups increased cort, but this was only significant in the No Stress– Extinction group.



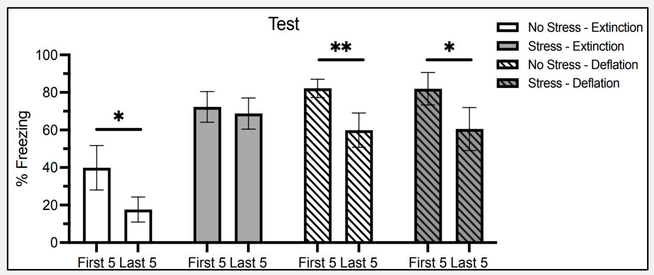


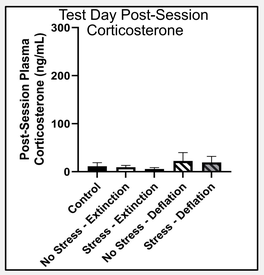
Day 2: Stressed animals show context generalization within the new context before the shock. All groups increased their freezing once shocks began, and all groups except for the No Stress Deflation group had higher corticosterone levels than the Control group.





Day 3: While stress impaired extinction learning, the deflation groups did not differ from each other. All No Stress and Stress groups had higher corticosterone levels than the Control group. Stress groups had higher corticosterone levels than the No Stress groups.





Test Day: All groups decreased their freezing to the context during the test except for the Stress-Extinction group. No groups displayed an increase in corticosterone, however, blood collection did not begin until 1 hour after the session.

SUMMARY

- While prior stress impacted extinction performance, UCS deflation was not affected by prior stress in that the stress and no stress deflation groups maintained similar levels of freezing. There was a large disparity in the freezing between the stress and no stress extinction groups. This indicates that **prior stress makes CFC more resistant to extinction**, thus demonstrating a **strong SEFL effect.**
- The high levels of freezing in the no stress deflation group are possibly due to the stress of blood collection before testing, making the weak shock appear more aversive.

FUTURE DIRECTIONS

- Future experiments may eliminate blood collection before and after each behavioral session to focus on behavior
- A sub-threshold context fear conditioning design may be implemented to eliminate the ceiling effect in the deflation groups, allowing for additional analysis within the stress and no stress deflation groups.

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