

The effect of music on stress and anxiety behaviors in male and female rats

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Abstract

Research on the neurobiology of stress disorders has gained momentum in recent years. However, while women are more likely to suffer from stress disorders than men, little research has been conducted to understand these sex differences. Researchers are always looking for new and non-invasive treatments such as music therapy that could potentially help treat stress disorders. Examining both male and female Sprague Dawley rats, we considered whether a classical music condition would help alleviate stress responses in the rodents compared to no music. Struggle behavior in a restraint stress model was coded to analyze stress levels in the rodents. Furthermore, an elevated plus maze was used to analyze anxiety behaviors after their conditions.

Introduction

Stress causes many negative effects on the body and brain, and research shows that women are more susceptible to developing psychiatric disorders related to stress than men. The neurobiology underlying these sex differences is still unknown and not enough research has been conducted to fully understand these differences. To try to fill in some gaps, our study uses an animal model to better understand sex differences in response to stress and how music can ameliorate some of the stress and anxiety behaviors we observe.

Methods

Restraint Stress: All rats were placed under restraint stress for 10 minutes, in sets of two. Rats in the control group (n=8) underwent the restraint stress in silence while Rats in the experimental group (n=8) were played Mozart's Piano Concerto N.28 in A major would be played while in the restraint. Struggle behavior, time it took to restrain (both in seconds) and fecal boli count were all measured to determine anxiety level in each rat.

Elevated Plus Maze: Rats from both groups were then transferred to a separate room and placed individually in the elevated plus maze for five minutes each. In order to analyze anxiety characteristics (Pellow et. Al., 1985) the following factors were measured: number of seconds rodents stayed in open and closed arms, entries into each arm, freezing behavior, and number of fecal boli.

Restraint Stress: Sex has a significant effect on restraint timing. Specifically, the time it took for the female rats to be restrained in the device before recording struggle behavior was significantly longer compared with males (Figure 1). There was also a trend for the interaction between sex and music on struggle behavior duration (Figure 2). Namely, males undergoing the classical music condition recorded a slightly longer struggle duration than males undergoing the no music condition.

Figures:

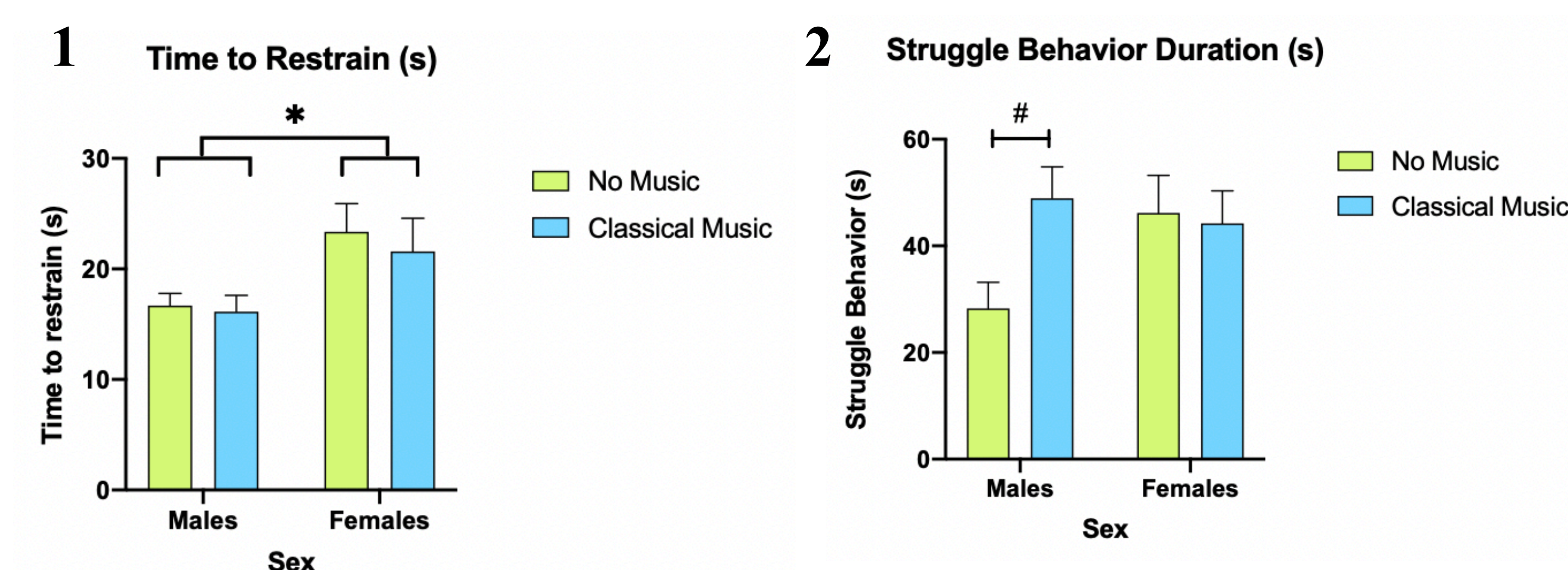


Fig 1. Time to Restrain (s): Amount of time it took rats to be fully restrained within the restraint apparatus. Females took a significantly longer time to be restrained than male rats. **Fig 2. Struggle Behavior Duration (s):** Amount of time spent struggling within the restrainer was measured. Males in the classical music condition had a longer struggle duration than males in the no music condition.

Discussion

Main findings of this study were: female rats entered the Open Arms of the EPM significantly more times than male rats; male rats spent significantly more time in the closed arms compared to female rats while the female rats spent significantly more time in the open arms compared to male rats. These findings support previous research and are usually characteristics of lessened anxiety (Pellow et. Al., 1985). There was also a trend of male rats struggling for a longer time while under the classical music condition compared to the no music condition. Finally, there were no significant findings between Conditions (No Music/Classical Music). In the future studies could analyze different genres of music or other pieces of classical music.

Results

Elevated Plus Maze: Analysis showed that female rats entered the open arms of the EPM and spent significantly more time in the open arms compared to the males (Figures 3 and 4). Consistently, male rats spent significantly more time in the closed arms of the EPM which is a characteristic of heightened anxiety in rats (Figure 5).

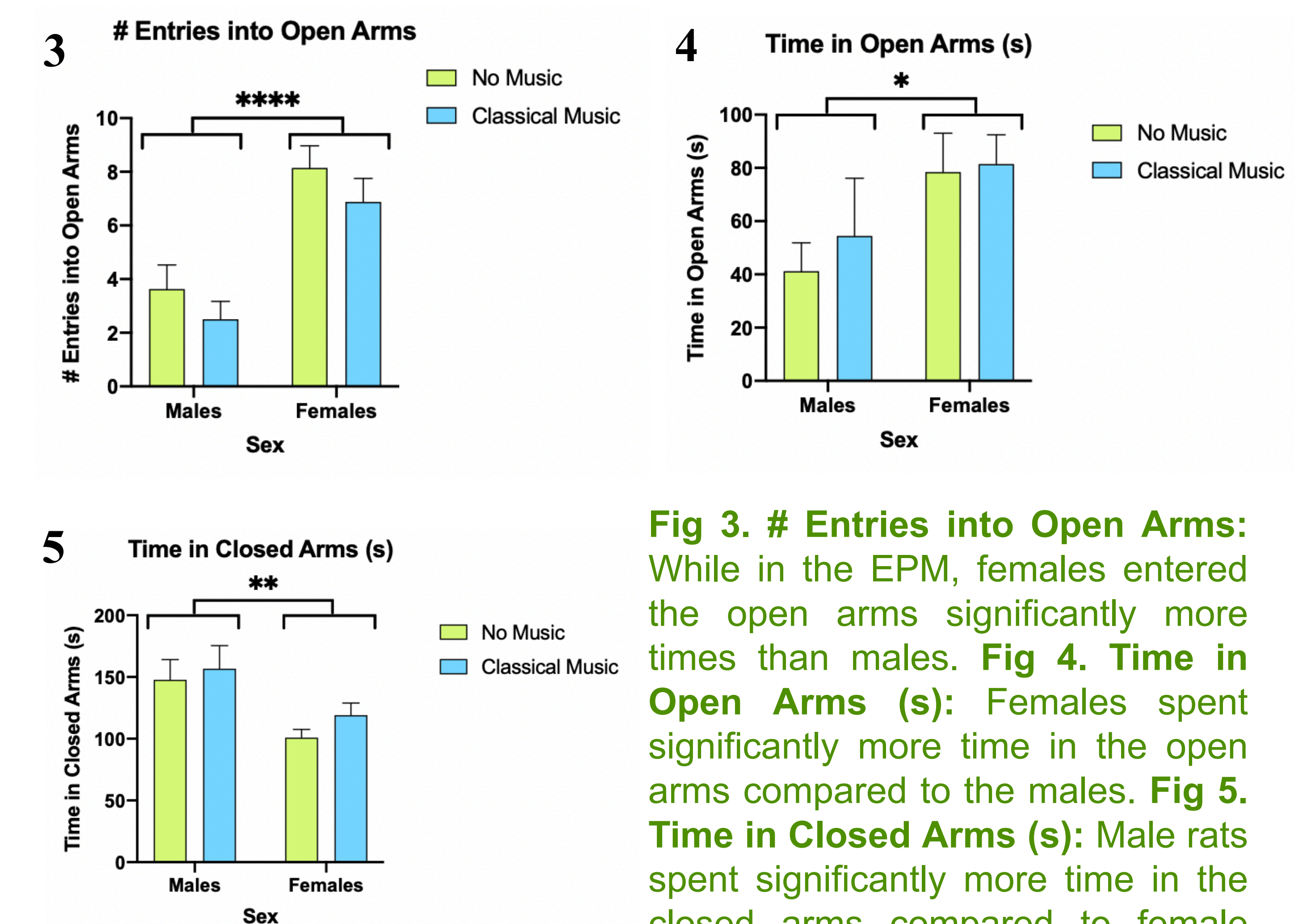


Fig 3. # Entries into Open Arms: While in the EPM, females entered the open arms significantly more times than males. **Fig 4. Time in Open Arms (s):** Females spent significantly more time in the open arms compared to the males. **Fig 5. Time in Closed Arms (s):** Male rats spent significantly more time in the closed arms compared to female rats.

Conclusion

Female rats showed fewer anxiety characteristics regardless of condition compared to males overall by entering the Open Arms of the EPM significantly more times than males, and males spent significantly more time in the closed arms compared to the female rats. No significant findings between the No Music/Classical Music conditions were found.

References

1. Pellow, S., Chopin, P., File, S.E., & Briley, M. (1985) Validation of open : closed arm entries in an elevated plus-maze as a measure of anxiety in the rat. *Journal of Neuroscience Methods*, 14(3): 149-167.