

Introduction

- Parkinson's disease (PD) is a neurodegenerative disorder that causes motor deficits including rigidity and tremors.
- Pain is also a common problem for people with PD that may arise from their dopamine deficit.
- Some PD patients find temporary relief from pain through group singing, which also has been shown to mitigate voice challenges related to PD [1].
- Music related activities upregulate neurohormones involved in the analgesic response such as dopamine, opioids, and oxytocin, as well as downregulate hormones involved in stress response such as cortisol [2-4].
- However, no work has been done in determining a neurochemical mechanism of action on pain threshold.
- Here we examine whether group singing's effects on cortisol and oxytocin contribute to pain relief in PD patients.

Methods

Participants

- Participants (n=14) with PD were recruited from the U-Tunes choir, a singing group for people with PD.
- There were 4 females.
- Mean age of participants was 73.8 years.
- Exclusionary criteria included persons at risk for mild cognitive impairment (Montreal Cognitive Assessment score > 21)

Experimental Procedure

- Choir members participated in a 12-week singing program involving weekly 45-minute sessions with a certified music therapist.
- Data collection on cortisol, oxytocin and pain threshold occurred in 2nd (session #1), seventh (session #2) and 12th (session #3) week of the study.
- Cortisol, oxytocin and pain threshold were collected before and after each session.

Results

Mixed Linear Model Analyses

- Two mixed linear model analyses were conducted: one for cortisol and another for oxytocin.
- Decreases in cortisol were found to significantly contribute to increases in pain tolerance ($p < 0.05$).
- Oxytocin was not found to significantly contribute to increases in pain tolerance.

Pain Tolerance

Pain Tolerance Pre and Post Session

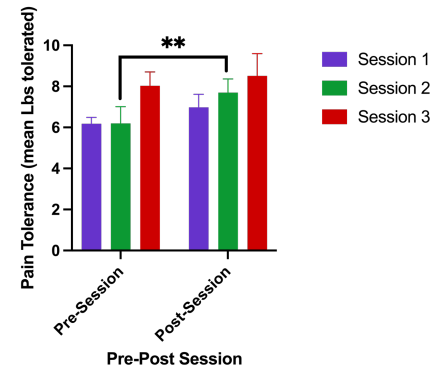


Figure 1: Pain threshold over 3 sessions (** denotes $p < 0.01$ by Fisher Randomization, 5000 iterations). Error bars are standard error of means.

- Pain tolerance significantly increases after session 2 (Figure 1).
- There is a general trend of increasing pain tolerance after each singing session (Figure 1).

Cortisol Pre and Post Session

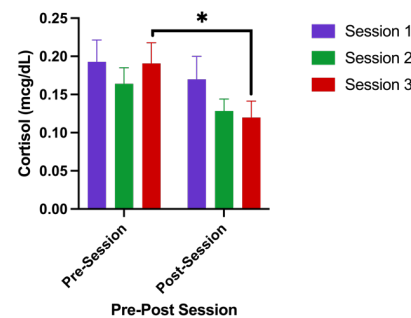


Figure 2: Cortisol over 3 sessions (* denotes $p < 0.05$ by Fisher Randomization, 5000 iterations).

Results

Oxytocin

Oxytocin Pre and Post Session

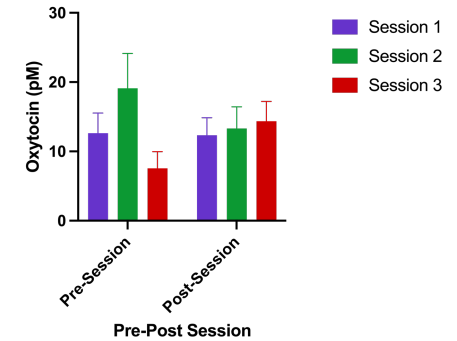


Figure 3: Oxytocin over 3 sessions.

- Cortisol significantly decreases after session 3 (Figure 2).
- There is a general trend of decreasing cortisol after each session (Figure 2).
- There were no significant differences in oxytocin after any of the sessions (Figure 3).

Discussion & Conclusion

- Pain tolerance significantly increases after session 2 and shows a general trend of increasing after each session (Figure 1).
- This validates previous work which indicated performance of music elevates pain threshold [5].
- Cortisol significantly decreased after session 3 (Figure 2) and significantly contributes to increases in pain tolerance.
- Elevated cortisol activates the sympathetic nervous system and stress response [6].
- Singing reduces cortisol [4].
- No significant increases in oxytocin after singing sessions.
- Medications of PD participants (dopamine agonists) interfere with oxytocin signaling [7].
- Increased sample size (higher statistical power) in future studies may be needed to determine if oxytocin plays a role in pain tolerance.

References

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