Mindfulness Meditation as a Stress Reactivity Intervention: An Event-Related Potential Study

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Chronic stress has been shown to adversely affect cardiovascular, neurological, and mental health, especially in older populations. The success of alternative therapies in combating stress has been well-supported in neuroscience thus far. In this experiment, the Portland Arithmetico Stress Task (PAST) was used to examine stress reactivity in older adults who received Mindfulness Meditation (MM) training. This was done in order to determine whether event-related potentials (ERP) and autonomic biomarkers may be impacted by this MM intervention. Thirty-one older adults were enrolled and randomized into three, six-week program groups: MM, Health/Wellness Education (H/W), and no program (no training). All groups were brought in for testing before and after their intervention. At each visit, the PAST was administered, and an EEG recorded changes in feedback-related negativity (FRN), while an ECG recorded heart rate before, during, and after the PAST. While a previous study suggested that the PAST test was effective in eliciting a significant stress response, the changes in physiological measures and ERP’s were modest, leaving a small range to work with in future studies. It is unclear if MM will be effective enough, in such a short time, to create a measurable difference in stress reactivity via this EEG measure. We expect, given previous literature on MM and stress, that in the MM group there would be a decrease in physiological and ERP stress reactivity measures during the test, as well as a faster rebound to baseline after the test was administered. This was done in order to determine whether event-related potentials (ERP) and autonomic biomarkers may be impacted by this MM intervention. Thirty-one older adults were enrolled and randomized into three, six-week program groups: MM, Health/Wellness Education (H/W), and no program (no training). All groups were brought in for testing before and after their intervention. At each visit, the PAST was administered, and an EEG recorded changes in feedback-related negativity (FRN), while an ECG recorded heart rate before, during, and after the PAST. While a previous study suggested that the PAST test was effective in eliciting a significant stress response, the changes in physiological measures and ERP’s were modest, leaving a small range to work with in future studies. It is unclear if MM will be effective enough, in such a short time, to create a measurable difference in stress reactivity via this EEG measure. We expect, given previous literature on MM and stress, that in the MM group there would be a decrease in physiological and ERP stress reactivity measures during the test, as well as a faster rebound to baseline after the test was administered.

Methods & Materials

Intervention Programs
- MM
- H/W
- Control

Methods
- MM and H/W groups receiving weekly, 1-hour training videos, as well as Intervention Programs
- Control group did not receive any training and was assigned to a waiting list

The PAST Task
- ECG monitors heart rate before, during, and after task
- Participants were asked to perform 47 arithmetico problems on a keyboard
- Color, sound, and visual feedback according to correct/incorrect answers
- EEG records FRN responses to incorrect answers

Literature Review

The biological and neural mechanisms, as well as the psychological processes involved in stress have been relatively understudied and supported by the empirical literature. The event-related potentials (ERP) on the other hand have been a popular foci in the scientific community for the past several decades. ERP’s have been shown to be susceptible to performance-related signals, emitted by neurons in the brain during the stress response. ERP’s are a useful tool in measuring how the brain is processing information, as they provide a physiological basis for understanding stress or anxiety. While ERP’s have been studied in previous research, it is unknown if MM will be effective in reducing stress and anxiety reactivity, as well as if it will improve the physiological markers to a faster rebound to baseline after the stress response. While a previous study suggested that the PAST test was effective in eliciting a significant stress response, the changes in physiological measures and ERP’s were modest, leaving a small range to work with in future studies. It is unclear if MM will be effective enough, in such a short time, to create a measurable difference in stress reactivity via this EEG measure. We expect, given previous literature on MM and stress, that in the MM group there would be a decrease in physiological and ERP stress reactivity measures during the test, as well as a faster rebound to baseline after the test was administered.

Experiment Predictions

1. Noticeable FRN curve is generated from stress event (incorrect answer)
2. With MM training: smaller amplitude of FRN curve, returns to baseline in a shorter amount of time
3. An analysis of average reactivity over time may be better suited for this study

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