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

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Abstract
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 Arithmetic 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 control). All groups were brought in for testing before and after their intervention. At each visit, the PAST was administered, and an ERP recorded changes in feedback-related negativity (FRN) timeframes during a stressful event. While the two closely related, ERP curves are specific to “incorrect responses,” as demonstrated in the Portland Arithmetic Stress Task, which uses complicated mathematics under a time constraint to measure ERP’s. The current psychological literature supports that ERP’s are used to measure changes in the brain in response to stress. The primary goal of this study was to determine whether or not MM will have a measurable effect on the ERP’s. If it is inferred that ERP’s correlate to the stress response, then connections can also be made between the FRN curve and disorder associated with disturbance in normal metabolism. While the FRN is thought to represent a physiological stress response, 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 should be a decrease in physiological and ERP stress reactivity measures during the test, as well as a further rebase to baseline after the test was administered.

Methods & Materials

Intervention Programs
- 1 week
- MM and H/W groups receiving weekly, 1-hour training exercises including health podcasts

The PAST Task¹
- ECG monitors heart rate before, during, and after task
- Participants can quickly answer arithmetic problems using 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 studied and supported by both the event-related potential (ERP) literature and cognitive-laboratory studies. ERP’s are a useful tool in analyzing changes in the brain during the event-related potential (ERP) literature and cognitive-laboratory studies. ERP’s are a useful tool in analyzing changes in the brain during the stressful event. While the two closely related, ERP curves are specific to “incorrect responses,” as demonstrated in the Portland Arithmetic Stress Task, which uses complicated mathematics under a time constraint to measure ERP’s. The current psychological literature supports that ERP’s are used to measure changes in the brain in response to stress. The primary goal of this study was to determine whether or not MM will have a measurable effect on the ERP’s. If it is inferred that ERP’s correlate to the stress response, then connections can also be made between the FRN curve and disorder associated with disturbance in normal metabolism. While the FRN is thought to represent a physiological stress response, 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 should be a decrease in physiological and ERP stress reactivity measures during the test, as well as a further rebase 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

Implications
1. MM could show considerable improvement in lessening stress reactivity compared to H/W or no training control
2. Would add to the scientific data to support MM as an effective treatment protocol/medicine technique to reduce the physiological effects of chronic stress
3. Reduction in stress reactivity controls symptoms of PTSD, anxiety, depression, and other disorders associated with these mental processes

Literature Citations
3. Reduction in stress reactivity controls symptoms of PTSD, anxiety, depression, and other disorders associated with these mental processes
4. Adoption of MM could reduce the use of pharmaceutical treatment in patients when medication is contraindicated or not desired

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