A Neurophysiological Correlate of Anxiety and Depression in Healthy Middle-Aged Adults

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INTRODUCTION

- Depression is the feeling of being sad or blue and the feelings interfering with everyday life and average functioning.7
- Anxiety is a reaction to stress. Anxiety becomes a disorder when it becomes excessive and irrational.8
- Stress is a continuous term. For the purpose of this study, stress will be defined by the Perceived Stress Survey’s metric.
- There are many ways to assess, describe, and predict depression, anxiety, and stress. The most common way is by surveys. Another way is by neuroimaging, in particular, looking at hemispheric asymmetry in the alpha frequency band (8–13 Hz).
- Alpha activity is associated with being in a relaxed, alert state. Low levels of right frontal alpha power are related to negative and withdrawal emotion. High levels of left frontal alpha power are related to positive and approach emotion.
- High levels of right parietal alpha power are associated with increased stress and anxiety. High levels of left parietal alpha power are associated with decreased stress and anxiety.
- While there have been studies using EEG to measure frontal and parietal asymmetry, there is little or no information using MEG data.

Based on EEG literature, predictions for this project are:

- The Beck Depression Inventory scores and the frontal asymmetry difference score (FADS) will be negatively correlated.
- The State-Trait Anxiety Inventory Scores will be negatively correlated with parietal asymmetry difference score (PADS).
- Because anxiety is directly related to stress, the Perceived Stress Survey (PSS) and the PADS will be negatively correlated.

MATERIALS AND METHODS

- Participants (n=51) between the ages of 50 and 70 were recruited for the study through posted flyers, running events, and from campus faculty and staff. All participants gave informed consent.
- Depression was assessed by using the Beck Depression Inventory (BDI). The BDI evaluates depression on a scale from 0 to 63. There are 21 questions to evaluate how depressed an individual is. If an individual receives a score between 0 and 13 they are in minimal risk range, a score of 14 to 19 is mild risk range, 20 to 28 is moderate risk range, and 29 to 63 is severe risk range.
- Anxiety was assessed by the State-Trait Anxiety Inventory (STAI). The STAI is a self-report measurement of both state anxiety which can vary from moment to moment, and trait anxiety which is how a person responds to potentially anxiety inducing situations and is different among individuals. The STAI uses a Likert scale that ranges from “not at all” to “very much so”.
- Stress was assessed by the Perceived Stress Survey (PSS).
- MEG (Magnetoencephalography) data: Subject was supine, with their head placed in MEG, alone in a magnetically shielded room.
- Resting eyes open and resting eyes closed were recorded prior to cognitive tasks as part of another study.
- Used whole head MEG system with 157 channels (squids).
- Data were recorded at 500 samples per second.
- Previous EEG research used P3 and P4 electrodes for parietal analysis and F3 and F4 for frontal analysis. The corresponding squids for MEG were determined to be 58 and 154 (F3 and F4) and 91 and 93 (P3 and P4).
- MEG 160 software was used to clean data.
- Continuously Adjusted Least Square Method (CALM) was used as a noise reduction mechanism.
- Signal processing computations were done in MATLAB version 7.4 (Mathworks, Natick, MA).
- Extracted the alpha band (8–13 Hz) from MEG signal.
- Eyes open / eyes closed - epoched into 1-second sweeps.
- Baseline corrected using the entire sweep intervals.
- Did the computations using the following calculations:
  - In (Right Frontal) - In (Left Frontal)
  - In (Right Parietal) - In (Left Parietal)

RESULTS

- The purpose of this investigation was to try to replicate the EEG neurophysiological correlate of depression, anxiety, and stress with MEG.

DISCUSSION

- With this high functioning, middle aged sample, there was no statistically significant correlations between the FADS and the BDI scores.
- There was also no statistically significant findings between the PADS and the STAI scores.
- However, there was a statistically significant correlation between the PSS scores and the PADS.
- This suggests that PADS may be used as a neurophysiological correlate of perceived stress.
- Pending replication of these results, PADS could be used as a diagnostic tool with different populations of people who are susceptible to stress.
- Examples include soldiers returning from deployment or older individuals suffering from the loss of a spouse.
- Future research should attempt to replicate these results using EEG and with a clinical population.
- Another possibility for future research is to do a longitudinal study looking at whether PADS scores can predict future clinical diagnosis of stress, anxiety, and depression disorders.

REFERENCES

10. NIH # R25 HD02644, NIH # AG025505