



HUMOR- ASSOCIATED MIRTHFUL LAUGHTER COMPARED TO STRESS MODULATES BRAIN FREQUENCIES 1– 40 HZ EEG POWER SPECTRAL DENSITY: INCREASES BENEFICIAL GAMMA FREQUENCY 30– 40 HZ FOR BRAIN HEALTH



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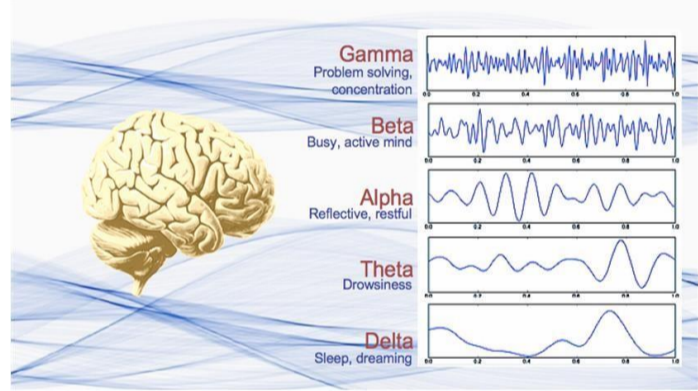
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INTRODUCTION

Happiness and stress, are complex emotional states that can modulate different aspects of psychoneuroimmunological (PNI) mechanisms. Humor-associated mirthful laughter is considered to be a metaphoric representation of happiness in positive psychology, which are fundamental aspects of human behavior in most all cultures. Depending on the type of emotional experience, PNI mechanisms can be modulated to result in either negative or positive health benefits. The focus of our research is to investigate the role of neural electrical activity and the possible modulation of brainwaves frequencies, particularly Gamma frequency, which has been associated with higher levels of cognitive processing enhanced memory and recall. Currently, no known study has been conducted comparing positive affect induced from Humor-Associated Mirthful Laughter (HAML) versus a stress experience using electroencephalograph (EEG) to differentiate Power Spectral Density μV^2 (PSD) correlates across EEG frequency bins 1-40Hz.



Bandwidth	Hz
Delta	1-3
Theta	3-7
Alpha	8-13
Beta	13-30
Gamma	31-40

PURPOSE

This study assessed EEG PSD in healthy university graduate students (N=31) during a HAML and a stress experience.

METHODS

- In a crossover research design, each subject was randomly administered (watched) two 10 minute videos segments: HAML (America's Funniest Home Videos) and Stress (Movie - Saving Private Ryan- first part).
- EEG wave band activity was recorded from 9 cerebral cortical scalp locations following the standardized 10-20 System F3, Fz, F4, C3, Cz, C4, P3, Pz, and P4 using the EEG B-Alert 10X System™, Advanced Brain Monitoring, Carlsbad, CA.

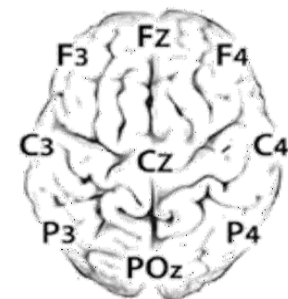


Fig 1: Brain map of 9-electrode strip.

RESULTS

- Humor-associated mirthful laughter compared to stress showed that **Beta (13-30Hz)** ($p=0.01$) and **Gamma (30-40Hz)** ($p=0.001$) frequencies had the greatest PSD (μV^2) across all 9 EEG cerebral cortical regions.
- Further, during the humor task, **Gamma PSD** was significantly greater than **Beta PSD** ($p=0.01$) for all 9 EEG cerebral cortical regions.
- During the humor task, **Theta (3-7 Hz)** and **Alpha (8-12 Hz)** frequencies had greater PSD (μV^2) in the P3 region than P4 ($p<0.01$).
- When comparing Frontal, Central, and Parietal cerebral cortical regions:
 - In the Frontal Region, **Gamma** and **Beta PSD** (μV^2) was significantly different from Theta and Alpha during Humor-associated mirthful laughter ($p<0.05$).
 - In the Central region, **Gamma** and **Beta PSD** (μV^2) stress was different from HAML ($p<0.0001$).
 - In the Parietal Region, **Alpha, Beta, and Gamma**, stress was different from HAML ($p<0.05$).

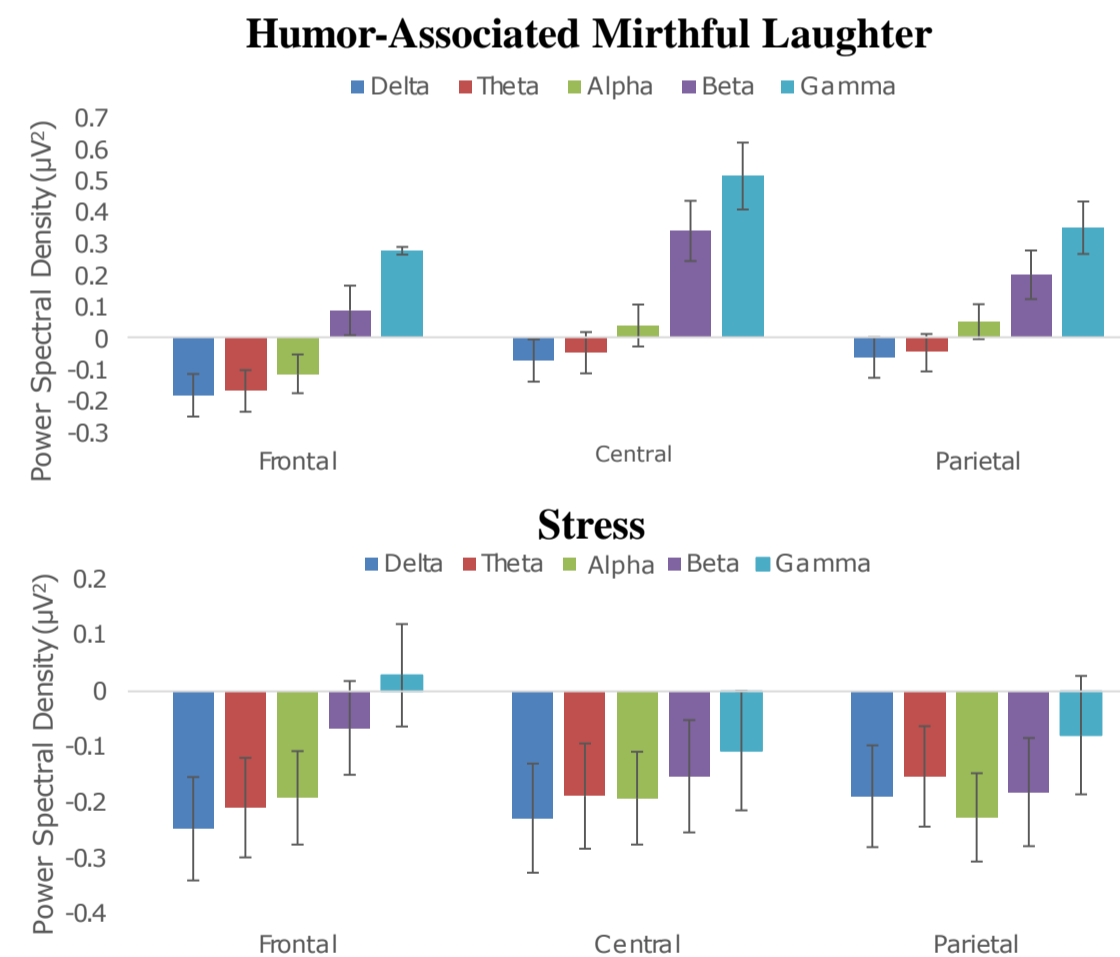


Figure 1. Brain Frequency PSD During Humor-Associated Mirthful Laughter vs. Stress in the Frontal, Central and Parietal Regions (N=31)

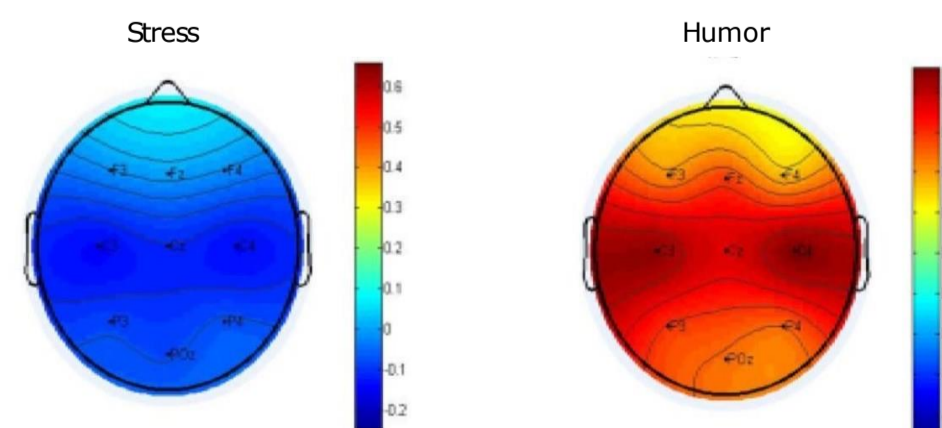


Figure 2. Stress VS HAML- Gamma Brain Frequency (31-40Hz) (N=31)

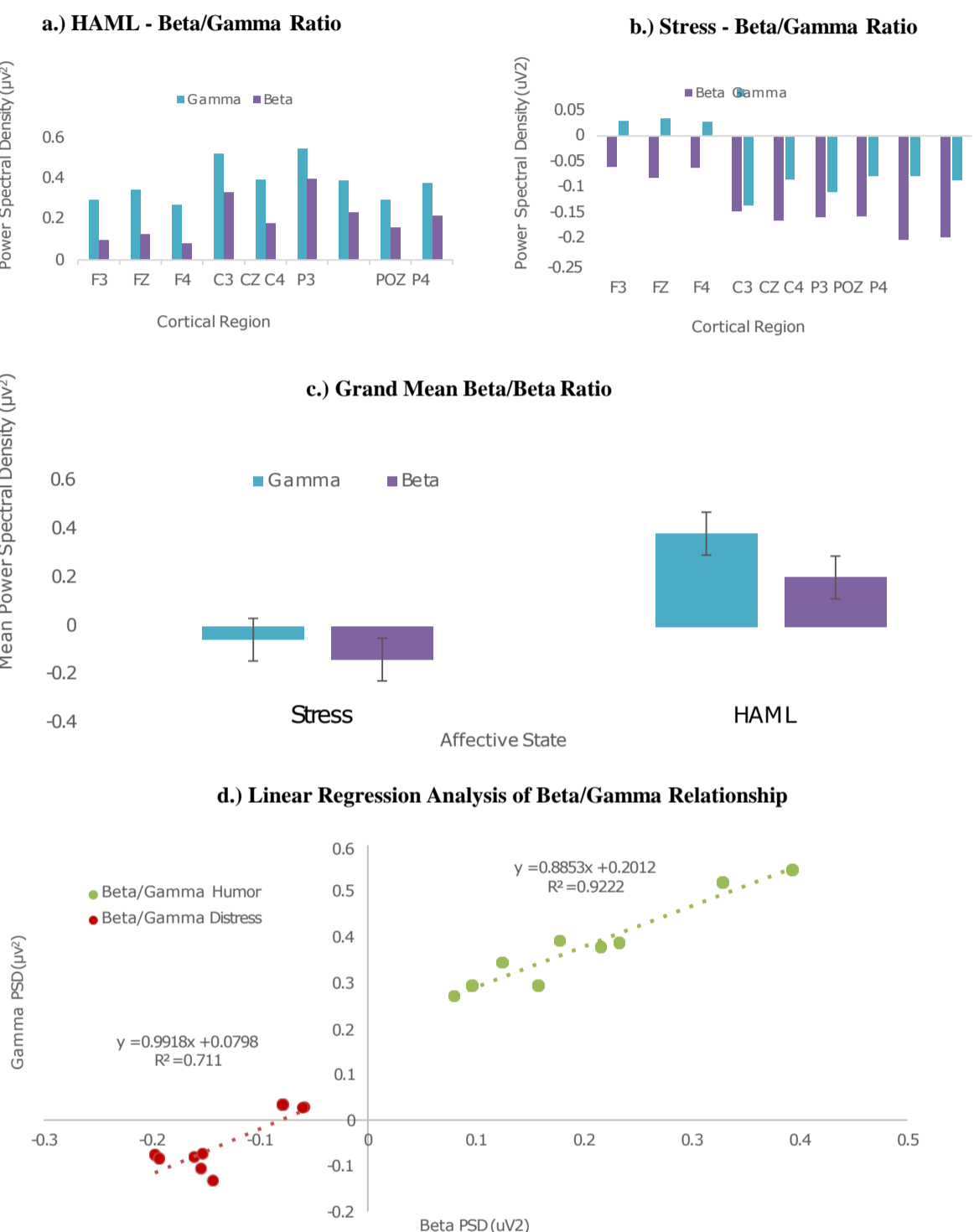


Figure 3a-d. Beta/Gamma Relationship Across 9 Cortical Regions (N=31)

CONCLUSION

- Our findings show that the “positive mood state” generated from HAML modulates brain frequencies, with the greatest increases seen in Gamma frequency activity in the cerebral cortex.
- This provides supportive evidence that increased Gamma frequency from the resultant behavior of HAML can be further associated with the enhancement of memory and recall, cognition processing, sensory perception, positive mood state, and other brain benefits.
- Our findings suggest that Indeed, “A merry heart doeth good like a medicine.....” Proverbs 17:22

References available upon request