

The Neuro-Theological Nexus: Quantifying the Impact of Islamic Prayer (Salah) on Brainwave Coherence and Stress Biomarkers

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Abstract

This study investigates the psychophysiological effects of Islamic prayer (Salah) on human neurobiology and stress response systems. The research employed a quantitative methodology measuring electroencephalography (EEG) coherence patterns and salivary cortisol levels in 35 adult participants before, during, and after performing obligatory prayers. Data collection spanned six weeks using standardized laboratory conditions. Results demonstrated statistically significant increases in alpha and theta wave coherence ($p < 0.01$) in prefrontal and parietal regions, alongside a 27.3% mean reduction in cortisol levels post-prayer. These findings indicate Salah induces measurable neurophysiological changes associated with meditative states and stress reduction. This research provides empirical evidence for the therapeutic potential of ritual prayer in stress management protocols and contributes to interdisciplinary understanding of religious practices' impact on human physiology.

Keywords: Islamic Prayer, Neurotheology, EEG Coherence, Cortisol, Stress Physiology, Religious Neuroscience

1. Introduction

The intersection of religious practice and neurophysiology represents an emerging frontier in understanding mind-body relationships. Islamic prayer (Salah) constitutes a structured ritual combining physical movements, Arabic recitation, and focused intention, performed five times daily by approximately 1.8 billion Muslims worldwide. Despite its global prevalence and regular practice, limited empirical research exists examining its psychophysiological effects using modern biomedical measures. Previous studies on meditation and contemplative practices have demonstrated significant effects on autonomic nervous system regulation and neurocognitive function. However, these investigations have predominantly focused Eastern practices, with comparatively minimal attention given to Islamic devotions. This research gap is particularly notable given Salah's unique combination of physical postures, linguistic recitation, and temporal structure. This study addresses this research void by employing electroenceph-

alography and biochemical analysis to quantify Salah's impact on brainwave synchronization and hypothalamic-pituitary-adrenal axis activity. The investigation aims to provide objective data regarding the neurophysiological correlates of this fundamental Islamic practice, potentially informing both clinical applications and theological understandings.

2. Methodology

2.1. Participants

Thirty-five healthy adult participants (20 male, 15 female) aged 22-45 years ($M = 31.4$, $SD = 6.7$) were recruited through university networks. All participants reported regular prayer practice since adolescence (minimum 5 years continuous practice), absence of neurological or psychiatric conditions, and abstinence from psychotropic medications. Ethical approval was obtained from the University of Amran Institutional Review Board (REF: UAM-MED-2023-041).

2.2. Equipment and Measures

EEG data was collected using a 32-channel BioSemi ActiveTwo system sampled at 2048 Hz. Salivary cortisol levels were quantified using Salimetrics high-sensitivity enzyme immunoassay kits (1 – 0.007 $\mu\text{g/dL}$ detection range). Subjective stress measures were obtained using the Perceived Stress Scale (PSS-10) administered pre and post intervention.

2.3. Procedure

Testing sessions occurred in a sound-attenuated laboratory maintained at 22–24°C. Participants underwent baseline measurements followed by performance of Zuhr (noon) prayer consisting of 4 rak'ahs. EEG recordings were continuous throughout pre-prayer (10 min resting), prayer, and post-prayer (15 min resting) periods. Saliva samples were collected at T (pre-prayer), T (immediately post-prayer), and T (30 minutes post-prayer).

2.4. Data Analysis

EEG data was processed using MATLAB-based EEGLAB toolbox implementing ICA for artifact removal. Spectral analysis used Welch's method (2-second Hanning windows). Statistical analyses employed repeated measures ANOVA with Bonferroni correction for multiple comparisons ($\alpha = 0.05$).

3. Results and Discussion

3.1. EEG Findings

Significant increases in coherence were observed in alpha (8-13 Hz) and theta (4-7 Hz) frequency bands during and post-prayer periods. Maximum coherence increases occurred between prefrontal and parietal electrodes (F3-P3: $t(34) = 4.27, p < 0.001$; F4-P4: $t(34) = 3.89, p < 0.001$). These patterns indicate enhanced functional connectivity between brain regions associated with attention regulation and emotional processing.

3.2. Biochemical Markers

Salivary cortisol levels showed significant reduction from pre-prayer ($M = 0.47 \mu\text{g/dL}, SD = 0.21$) to post-prayer measurements ($M = 0.34 \mu\text{g/dL}, SD = 0.18$), representing a 27.3% mean decrease ($F(2, 68) = 9.34, p < 0.001$). This reduction persisted at 30-minute

follow-up ($M = 0.32 \mu\text{g/dL}, SD = 0.17$), suggesting sustained physiological relaxation response.

3.3. Subjective Measures

PSS-10 scores showed significant improvement from pre-prayer ($M = 18.7, SD = 4.3$) to post-prayer ($M = 12.1, SD = 3.8$) assessments ($t(34) = 5.92, p < 0.001$), correlating with objective physiological measures ($r = -0.67, p < 0.01$).

4. Conclusion

This study provides empirical evidence that Islamic prayer produces significant psychophysiological changes associated with relaxation and stress reduction. The observed patterns of increased EEG coherence and decreased cortisol secretion suggest Salah activates neurobiological mechanisms similar to those documented in meditation practices, while incorporating unique elements of physical movement and linguistic recitation. These findings have implications for integrating religious practices into stress management protocols and contribute to the growing literature on neuroscientific investigations of spiritual activities. Future research should examine long-term practitioners, compare different prayer forms, and investigate potential clinical applications for anxiety disorders [1-5].

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