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Slow Wave Activity Sleep is Significantly Associated with Decision-Making During Simulated Military Operational Stress

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Modern warfare exposes Service members (SMs) to volatile and complex environments. Adaptability in responding to these challenges and maintaining resiliency for sustained optimal cognitive and physical functionality is essential to operational readiness. Therefore, associations between neurocognitive measures, heart rate variability, physical fitness, and slow wave activity during sleep, may provide valuable information for operational success. **PURPOSE:** To determine if performance in a laboratory-based, militarily relevant decision-making assessment called the Soldier Performance and Effective, Adaptable Response (SPEAR) task is influenced by physiological, neurocognitive, sleep, and aerobic fitness batteries during simulated military operational stress. **METHODS**: Thirty-six male (n=30) and female (n=6) SMs (age: 26 ±5.3 years) participated in a 5 day/night protocol, including familiarization day (D0), baseline testing (D1), and two days of sleep and caloric restriction (D2 and D3), with D3 considered the peak stress period. Baseline testing included a treadmill VO_{2peak} test. Neurocognitive test known as MATCH and the SPEAR task were performed on D1 and D3. Respiratory sinus arrythmia (RSA) were acquired concurrently just prior to the SPEAR task. Sleep was monitored each night with baseline absolute slow wave activity (SWA) as the outcome of interest. Multiple linear regression was used to predict change in SPEAR performance from D1 to D3 using the following predictors: baseline RSA, baseline MATCH score, VO_{2peak} test score, and SWA. **RESULTS:** On average, SPEAR score decreased -1.22 ± 8.64 from D1 to D3 with change scores demonstrating variability among SMs. Overall, the model predicted 27% of the variation in performance from D1 to D3, $F(4,35)=2.88$, $p=.039$), $R^2=.271$. Only SWA had a significant slope coefficient ($p=.034$) such that higher baseline SWA, which may reflect greater sleep propensity, while all other independent variables are held constant, predicted decreased SPEAR performance from D1 to D3 ($\beta = -15.94$). **CONCLUSION:** Only baseline SWA was a significant contributing factor to the predictive model, suggesting that higher SWA, in the context of physiological, neurocognitive, and aerobic fitness testing batteries, may influence change in military-specific adaptive decision making.

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