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Impact of Operational Stress on Motor Evoked Potentials in Military Personnel

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Sleep deprivation is a prevalent operational stressor that may degrade neurophysiological performance in military personnel. Transcranial magnetic stimulation (TMS) is an established non-invasive brain stimulation technique capable of assessing corticospinal excitability that is not extensively investigated in military populations. **PURPOSE:** To examine the influence of operational stress (i.e., sleep deprivation) on corticospinal excitability in military personnel. **METHODS:** Thirty-two male and seven female service members (25.1 ± 4.9 yr) performed two series of stimulus response curves (SRCs) at 15% maximum voluntary muscle contraction for five consecutive days (D0-D4) using single-pulse TMS and a figure-of-eight coil. A familiarization day served as D0 with baseline testing on D1. Participants were allowed eight hours to sleep on D0, D1 and D4. On D2 and D3, participants had their sleep restricted for two 2-hour segments. For the SRC, stimulator outputs were randomly administered from 5-100% in 5% increments. Motor evoked potentials of the first dorsal interosseous muscle were quantified as the peak-to-peak electromyography amplitude of the 50ms post TMS stimulus. Corticospinal excitability was assessed by fitting MEP responses to a Boltzmann sigmoidal curve (BSC) via nonlinear regression and determining BSC_{MAX} and BSC_{V50} (i.e., stimulator output at the mid-point between BSC_{MIN} and BSC_{MAX}). Repeated-measures one-way ANOVAs with Tukey post-hoc tests were used to compare BSC properties over time. **RESULTS:** ANOVAs revealed a main effect of time for both BSC_{MAX} and BSC_{V50} ($F(3.31, 122.40)=2.71, p=0.04$ and $F(2.96, 109.50)=3.26, p=0.02$, respectively). No significant pairwise comparisons were detected for BSC_{V50} . BSC_{MAX} revealed to be significantly greater on D3 compared to D0 (5.21 vs 4.56 mV, $p=0.02$) and D1 (5.21 vs 4.44 mV, $p=0.02$) but similar to D2 and D4 ($p>0.05$). **CONCLUSION:** Our findings highlight the ability of TMS to capture subtle but significant increases in corticospinal excitability after exposure to simulated operational stress. Furthermore, BSC_{MAX} remained elevated on D4, suggesting one day is inadequate recovery time after operational stress.

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