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Impact of Aerobic Fitness on Cognitive Performance During Simulated Military Operational Stress

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Low aerobic fitness, associated with cognitive impairment, may exacerbate the negative impact of military operational stress on vigilance and working memory compromising performance and safety. **PURPOSE:** To determine the effects of aerobic fitness on cognitive function during simulated military operational stress (SMOS). **METHODS:** Fifty-three male Service Members (SMs) (26.2 ± 5.3 yrs, 178.0 ± 6.5 cm, 84.8 ± 13.8 kg, 19.9 ± 6.9 %BF) completed a 5-day/night SMOS protocol consisting of daily physical and cognitive evaluations from 0900-2230. Assessments of psychomotor vigilance (PVT), working memory (2Back), and risk propensity (BART) were completed daily at 0900. 100% of caloric demands and 8 hours of sleep were provided on D1 (familiarization), D2 (baseline), and D5 (recovery). On D3-D4, SMs were allotted 50% of caloric needs and permitted to sleep from 0100-0300 and 0500-0700. SMs were split into aerobic fitness tertiles based on treadmill VO_{2peak} test completed on D1 (LOW: ≤ 45.0; MOD: > 45.0, ≤ 51.54; HIGH: > 51.54 $mL \cdot kg \cdot min^{-1}$). Friedman tests and Bonferroni-corrected pairwise comparisons determined changes in 2Back, BART, and PVT reaction time (RT) and accuracy (ACC) across D2, D4, and D5 for each level of aerobic fitness. **RESULTS:** PVT RT slowed from D2 to D4 in LOW SMs ($p = 0.003$), accompanied by a decrease in ACC ($p = 0.001$). MOD SMs maintained PVT RT across SMOS ($p= 0.069$), but ACC decreased D2 to D4 ($p = 0.015$). HIGH SMs maintained PVT ACC across days ($p = 0.062$) despite a slower RT from D2 to D4 ($p = 0.011$). No difference was observed between D2 and D5 PVT RT or ACC across groups ($p > 0.05$). 2Back ACC declined from D2 to D4 in MOD SMs ($p = 0.003$). No other significant changes in 2Back were observed. BART ACC increased across SMOS at each level of fitness (LOW $p = 0.045$; MOD $p = 0.030$; HIGH $p = 0.037$) despite no change in RT ($ps > 0.05$). Risk propensity increased from D2 to D5 in both LOW and HIGH groups ($ps < 0.017$), but did not reach statistical significance in MOD ($p = 0.080$). **CONCLUSION:** SMs with low aerobic fitness were more susceptible to cognitive performance decrements under operational stress. Impaired vigilance and increased risk-taking can reduce operational readiness and effectiveness. Aerobic fitness is likely not only important for physical demands, but also cognitive demands associated with military operations.

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