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Mapping smart technologies and nutritional strategies for monitoring cognitive resilience in military personnel under extreme operational conditions: a scoping review

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In extreme operational environments, cognitive performance is critical for mission safety and decision accuracy; however, it is vulnerable to sleep deprivation, energy deficits, and multiple stressors. This scoping review aimed to map and synthesize evidence on nutritional strategies and smart technologies designed to monitor and support cognitive resilience in military personnel. Following the Joanna Briggs Institute (JBI) methodology and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guideline, studies published between 2010 and 2024 were identified through Web of Science, PubMed, and eLibrary.ru databases. Eligible records included interventions addressing nutrition, physiological monitoring, and cognitive outcomes in extreme settings. Nearly 79 studies met the inclusion criteria. A majority of the studies focused on metabolic or physiological markers, while direct cognitive endpoints were underrepresented. Nutritional supplements (42%) and personalized diets (31%) were predominant, whereas operational rations were rarely tested. Caffeine was consistently associated with improvements in vigilance and reaction time but showed limited effects on sustained attention. Smart technologies were applied inconsistently, with ecological validation reported in only 25% of cases. Superior standardization in reporting and field validation are needed to enhance comparability. Integrating nutritional countermeasures with wearable analytics emerges as a promising approach to sustain behavioral resilience and cognitive readiness under operational stress.
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KEYWORDS
adaptive behavior, biomarker monitoring, field assessment, human performance optimization, neurocognitive performance, operational stress, wearable analytics

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