Whole-body cryostimulation enhances sleep quality and reduces fatigue in female athletes during the mid-luteal phase of the menstrual cycle

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Résumé

Athletes are more prone to sleep disturbances than the general population, with 26% to 50% experiencing disrupted sleep (Schaal et al., 2011). Many get less than the recommended 7 hours per night, which can impair recovery and performance. Female athletes, in particular, appear to be at greater risk for poor sleep, a vulnerability likely linked to hormonal fluctuations during the menstrual cycle (MC), especially during the early follicular phase (EFP) and the mid-luteal phase (MLP) (Miles et al., 2022). Recently, Whole-Body Cryostimulation (WBC), involving brief exposure to extremely cold air (between -50∘C and -150∘C), has emerged as a potential strategy to enhance recovery and improve sleep quality (Douzi et al., 2019). Its mechanisms are thought to involve modulation of core temperature (CT) and autonomic nervous system activity.
This randomized, controlled crossover study investigated the effects of WBC on sleep and well-being in 17 physically active women (mean age: 24 ± 3.3 years) with regular menstrual cycles. Each participant underwent both a control and WBC condition (three sessions of 3 minutes at –110∘C) during the EFP and MLP. Sleep quality was assessed using both objective (triaxial accelerometry) and subjective (Spiegel Sleep Inventory) measures. Additional measures included CT (radiotelemetry), heart rate variability, and well-being indices (Hooper Index and Profile of Mood States).

The menstrual cycle phase significantly influenced physiological and psychological parameters. The MLP was associated with elevated CT, reduced objective SQ (e.g., lower sleep efficiency, increased wake after sleep onset), greater fatigue, and higher sympathetic nervous

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system (SNS) activity compared to the EFP. Notably, subjective assessments did not always align with objective data. WBC improved objective SQ and perceived fatigue during the MLP and appeared to help restore thermoregulatory function, although SNS activity remained elevated.

These findings confirm that sleep and recovery parameters are negatively affected during the MLP, likely due to thermoregulatory and hormonal changes, as previously documented (Tada et al., 2017). The observed improvements in sleep metrics and fatigue following WBC suggest that this intervention may counteract the MLP-related decline in recovery quality, possibly by restoring nocturnal thermoregulation. Interestingly, the elevated SNS activity post-WBC contrasts with earlier studies conducted in male populations (Douzi et al., 2019), indicating a potential sex-specific response to cryostimulation. This divergence highlights the need for more tailored, sex-specific investigations to optimize athlete care.

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