When to exercise? Morning vs. evening exercise for better sleep – A Systematic Review and Meta-analysis

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Résumé

Background: Over the past decades, substantial evidence has demonstrated that exercise is a valuable component of good sleep hygiene practices. Physical activity improves sleep not only in clinical populations but also in those with minor or no sleep issues, reinforcing its public health relevance (Atoui et al., 2021). Despite the rapid growth in this field, the existing evidence on the effects of exercise timing on sleep remains particularly controversial. Morning exercise has been shown to improve mood, alertness, and cognitive performance, while also improving circadian alignment by synchronizing internal clocks with the external day-night cycle (Thomas et al., 2020). Conversely, studies indicate that evening exercise may have a detrimental effect on sleep quality, possibly due to elevated cortisol levels and increased physiological arousals (O'Donnel et al., 2018). However, emerging evidence suggests that moderate-intensity evening exercise may have no negative effect on sleep, or even a positive effect in certain cases (Frimpong et al., 2021). While research highlights the morning and evening as key opportunities for scheduling exercise, there is still no clear consensus regarding the most effective time of day to improve sleep. To address this gap, the present systematic review and meta-analysis aim to (i) synthesize and critically evaluate the existing evidence on the effect of morning versus evening exercise on sleep and (ii) discuss the factors that may influence the effects of exercise on sleep.

Methods: A comprehensive systematic search of studies was conducted using the following academic databases, namely SPORTDiscus, Scopus, Embase, PubMed, and PsycInfo. Relevant English-language studies on the impact of exercise timing on sleep were retrieved by searching literature published between 2000 and April 2024 using a combination of 3 sets of keywords linked to: (1) exercise, (2) timing, and (3) sleep. Studies were eligible if they were RCTs in humans over 3 years old, comparing morning and evening exercise, with at least two sleep-related outcomes assessed. The Review Manager (RevMan) computer software (version 5.4) was used for meta-analysis. Standardized mean differences (SMDs and

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their 95%CI) were used to quantify the magnitude of differences between the different timing of exercise conditions and to account for scales differences. SMDs represent Hedge's g and were interpreted as follow: trivial effect < 0.1, small effect=0.2, medium effect=0.5, large effect=0.8. Random-effects models were fitted and chosen a priori due to the expected high variance between included studies. The study protocol was prospectively registered (PROSPERO ID: CRD42021277708).

Results: Fourteen studies were included in the final analysis, assessing sleep duration (TST), efficiency (SE), latency (SL), sleep stages (N1, N2, N3, REM), time in bed (TIB), wake after sleep onset (WASO), subjective sleep quality, and sleepiness. Although a trend toward significance was observed for SE ($p = 0.08$), suggesting a possible advantage of morning sessions, statistical analyses revealed no significant differences between morning and evening exercise across all sleep parameters. Notably, two outliers were identified in the datasets for SL and WASO, which influenced effect size estimates and heterogeneity. After removing the outliers, a trend toward significance was observed for WASO ($p = 0.06$), suggesting a possible advantage of morning sessions.

Conclusion: Based on the findings of this meta-analysis, there appears to be minimal difference between morning and evening exercise in terms of their effects on sleep parameters. These findings challenge prior claims suggesting evening exercise should be avoided, and instead reinforce that evening activity is a valuable alternative when no other time is available. These results should be confirmed by longitudinal studies considering individual-specific moderators especially chronotype.

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