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(REVIEW ARTICLE)

A literature review: Understanding the effects of high and moderate intensity aerobic exercise on sleep quality in adults

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Abstract

Background: One of the essential aspects in maintaining physical and mental health is sleeping, yet many adults experience sleep disturbances that can further impact their well-being. Exercise, which includes physical activities such as running, cycling, and swimming, is known to offer numerous health benefits, including cardiovascular improvement and weight management. This literature review aims to thoroughly examine the effects found in a number of previous researches of aerobic exercise in both high and moderate intensity on sleep quality of adults.

Methods: A systematic literature search was conducted across PubMed, Google Scholar, and JSTOR using specific terms of "exercise AND intensity," "aerobic exercise AND sleep quality," and "sleep quality in adult" as keywords by using the Boolean operator. The result shows a total of 20 studies were deemed relevant for a full-text review, and, upon applying inclusion and exclusion criteria, 7 studies were included in the final review. These findings consistently indicate that regular exercise positively influences sleep quality with the intensity of exercise emerges as a significant factor to the outcomes.

Conclusions: This review emphasizes how the correlation between exercise and sleep quality has a complex and multifarious nature, underlining the potential for exercise to serve as a non-pharmacological intervention to enhance sleep quality and overall well-being

Keywords: Exercise; Intensity; Aerobic; Sleep Quality; Adult

1. Introduction

To maintain both physical and mental health, adequate sleep is one of the considerable essential factors that needs to be fulfilled. Yet there are still many adults experiencing disturbances during their sleep. These disturbances can further impact their well-being. In recent years, research has increasingly explored the potential role of physical activity, particularly aerobic exercise, in improving sleep quality [2]. Aerobic exercise, which includes physical activities such as running, cycling, and swimming, is known to offer numerous health benefits, including cardiovascular improvement and weight management. However, the effects of different exercise intensities–specifically high versus moderate intensity–on sleep quality remain a subject of ongoing examination.

While a number of studies have suggestively shown that aerobic exercise done in moderate intensity can reduce sleep onset latency and increase sleep efficiency which result in a significant enhancement of sleep quality [1], others indicate

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that higher intensity exercise may have even more pronounced effects, potentially improving deep sleep and overall restorative sleep. However, this interaction between the intensity of exercise and sleep outcomes is complicated, with various factors including the timing of exercise, individual fitness levels, and the presence of sleeping disorders influencing the results [10].

This literature review aims to further examine a number of previously done researches on the effects of aerobic exercise in both high and moderate intensity on adults' sleep quality. By synthesizing findings from relevant studies, this study seeks to clarify the extent to which various intensity of exercise influencing sleeping patterns, including sleeping duration, onset, and disturbances. Additionally, this review will explore potential mechanisms through which exercise may improve sleep, such as the regulation of circadian rhythms and the reduction of anxiety and stress. The main purpose of this research is to provide an extensive comprehension of exercise and its role in promoting better sleep health among adults and to identify areas for future research

2. Material and methods

Investigation from several studies have conducted to determine the connection between exercise and the quality of sleep. Epidemiological evidence suggests a positive interaction between exercise and better sleep from self-reports. However, these studies have limitations, as the direction of the relationship is unclear, with better sleep potentially leading to a greater ability and willingness to exercise [11].

Experimental studies have provided a more direct evidence of how exercises classified as acute and chronic both have sleep-promoting effects. They have also found that aerobic exercise in high and moderate intensity can both lead to improvements in sleeping quality, such as shorter time to fall asleep, fewer awakenings, and less time spent awake during the night. The mechanisms underlying these effects are partially unclear, but may relate to the physiological and psychological benefits of exercise, such as reduced stress, improved mood, and changes in circadian rhythms.

2.1. Search Strategy

A literature search was comprehensively conducted across a variant of databases which are Google Scholar, PubMed, and JSTOR. The specific terms used in searching included "mental health interventions AND adolescents," "youth depression prevention," and "psychosocial factors in adolescent mental health." Boolean operators such as "AND" and "OR" were employed to refine the results.

2.2. Inclusion and Exclusion Criteria

Studies were included if they: focused on exercise intervention on sleeping quality in adults, were published in between 2010 and 2024, and were available in English. Studies were excluded if they: were not empirical (e.g., editorials or opinion pieces) and focused on non-adult populations.

2.3. Data Extraction and Organization

From each study, the following data were extracted: study aims, sample size, research design, key findings, and limitations. Studies were sorted according to the date of publication.

2.4. Analysis and Synthesis

The findings were synthesized thematically. Two major themes emerged: (1) effects of exercise in sleeping quality and (2) roles of exercise intensity in sleeping quality. Each theme was examined thoroughly by comparing findings across studies.

2.5. Limitations

The review is limited by the lack of diversity in studies included, as most were conducted in Western countries. Additionally, the subjective nature of the technique in sorting the referred studies for inclusion may have introduced bias.

2.6. Quality of the Studies

Most studies were well-conducted peer-reviewed articles, though several small-scale studies were also included. These smaller studies may limit the ability to generalize findings across larger populations.

3. Results and discussion

A literature search was comprehensively conducted across Google Scholar, PubMed, and JSTOR using terms such as "exercise AND intensity," "aerobic exercise AND sleep quality," and "sleep quality in adults," with Boolean operators, initially identified 50 articles. Through titles and abstracts screening, 20 studies were considered deemed relevant for full-text review, and, upon applying the criteria for inclusion and exclusion, 7 studies were included in the final review.

Some of the articles retrieved for this research focused specifically on how exercise affects sleep, while others examined its impact on broader aspects such as quality of life and mental health. This review, however, will primarily focus on the reciprocal effects of exercise and sleep on each other.

3.1. Effects of Exercise on Sleep Quality

The findings consistently indicate that regular exercise positively influences sleep quality. Across the studies, exercise was associated with improvements in sleep duration, sleep efficiency, and reductions in sleep disturbances. For instance, moderate aerobic exercise was found to enhance the duration of deep sleep stages, which are critical for physical restoration and cognitive functioning [3]. Additionally, exercise appeared to alleviate insomnia symptoms and improve sleep quality subjectively among participants with sleep disorders [6]. These findings align with the theory that exercise promotes thermoregulation and hormonal changes conducive to better sleep.

However, there were some variations in the magnitude of these effects that were observed. Some studies suggested that the frequency of exercise plays a more significant role rather than intensity [6], while others found negligible roles of exercise frequency [4]. While even some, accounts for both [9]. These discrepancies point to the need for further exploration into individual and contextual factors, baseline fitness level, and pre-existing sleep conditions. For instance, individuals with higher baseline fitness levels may experience different sleep quality improvements compared to those who are sedentary, suggesting that personalized exercise prescriptions could enhance outcomes.

3.2. Role of Exercise Intensity in Sleep Quality Outcomes

The intensity of exercise emerged as a significant factor influencing sleep outcomes. Low-to-moderate intensity exercise generally had the most consistent benefits to sleep quality [7,8]. Several studies also reported that high-intensity exercise yielded a more significant improvement [5], with some studies reporting improvements in sleeping efficiency and at the same time noting decreased in physical quality of life [3]. The latter findings may be attributed to the arousing effects of vigorous physical activity, such as elevated cortisol levels and increased heart rate, which could notably interfere with relaxation of the muscles.

Interestingly, some studies highlighted the potential for adaptation to high-intensity exercise over time, with long-term participants reporting improved sleep quality compared to their sedentary counterparts [4]. This suggests that the body may adjust to the physiological demands of high-intensity exercise, mitigating its initially disruptive effects on sleep. It raises the question of whether a threshold exists for exercising intensity that optimally balances the positive impacts of physical activity with the possibility for sleep disruption.

3.3. Comparative Insights and Implications

Comparing findings across studies reveals a nuanced relationship between exercise and sleep quality. While exercise broadly supports better sleep, factors such as intensity, timing, and individual differences significantly modulate these outcomes. For example, the timing of exercise, whether performed in the morning, afternoon, or evening, has been shown to influence sleep patterns, with some studies indicating that evening exercise may lead to sleep disturbances in certain individuals [8]. These revelations highlight the significance of tailoring exercise interventions to promote sleep benefits, particularly for individuals with specific needs or conditions, such as insomnia or chronic fatigue. Moreover, the psychological aspects of exercise should not be overlooked. The benefits of exercise on mood and anxiety may further contribute to improved sleep quality. Regular physical activity is associated with reductions in anxiety levels, which can be particularly beneficial for individuals whose sleep quality is compromised by stress or anxiety [6].

Future research suggested to explore the long-term outcomes of different exercise regimens on sleep quality by focusing on longitudinal studies. Additionally, investigating the fundamental mechanisms of the interaction between exercise and sleep such as neurochemical and circadian rhythm changes could provide deeper insights. Understanding how different types of exercise impact the sleep-wake cycle may help in developing targeted interventions to enhance sleep quality.

4. Conclusion

In summary, this review emphasizes the complex and multifarious nature of the correlation between exercise and sleep, underlining the potential for exercise to serve as a non-pharmacological intervention to promote quality of sleep and overall well-being. The integration of exercise into daily routines, particularly in a manner that considers individual preferences and physiological responses, may offer a viable strategy for improving sleep health in diverse populations.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed

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