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Effectiveness of Aerobic and Load Exercise on Insomnia

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Abstract

Insomnia is a sleep disorder that affects approximately 10-30% of the adult population worldwide and is often underestimated despite its significant impact on quality of life, physical health, and psychological well-being. Insomnia management faces various challenges, including varying response to therapy, limited access to evidence-based therapies, and diagnostic complexity. Physical exercise has emerged as a promising non-pharmacological intervention, but inconsistent findings remain regarding the most effective types of exercise. This study aimed to analyze the effectiveness of aerobic exercise and resistance training on improving sleep quality and reducing insomnia symptoms based on a systematic literature review. The method used was a Systematic Literature Review with PRISMA 2020 guidelines. The search was conducted in four databases (SCOPUS, PubMed, Web of Science, Cochrane Library) with a publication limit of the last five years (2022-2026). Of the 985 documents identified, 28 articles met the inclusion criteria. The results of this study indicate that moderate-intensity aerobic exercise (60-75% of maximum heart rate) for 30-60 minutes per session, 3-5 times per week, for a minimum of 8-12 weeks is consistently effective in improving sleep quality in various populations. Strength training is also effective, especially in the elderly. Combining exercise with CBT-I, music therapy, or a circuit program provides more optimal results. The conclusion of this study is that both aerobic and strength training are effective as non-pharmacological therapies for insomnia, with the selection of exercise types tailored to population characteristics. A multimodal approach is recommended for optimal results.

Keywords: Aerobic exercise; weight training; insomnia; sleep quality

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Introduction

Insomnia is a sleep disorder that affects approximately 10-30% of the adult population worldwide, with chronic insomnia affecting 5-10% of individuals globally (Royant-Parola et al., 2025). Despite its high prevalence, insomnia is often considered a minor complaint, yet it has profound consequences for quality of life, physical health, and psychological well-being (De las Cuevas, 2026). This disorder is characterized by persistent difficulty initiating or maintaining sleep, early morning awakenings, and non-restorative sleep, resulting in significant impairment of daytime functioning (Poon et al., 2021).

Beyond its direct effects, chronic insomnia substantially increases the risk of developing mental disorders, particularly depression and anxiety, with a bidirectional relationship complicating diagnosis and treatment (Chen et al., 2025; Xu et al., 2022). Furthermore, growing evidence suggests that insomnia is associated with systemic inflammation, cardiovascular disease, metabolic dysfunction, and neurodegenerative conditions including dementia (Irwin, 2025; Kim et al., 2025; Meng et al., 2025). The treatment of insomnia continues to face challenges despite advances in understanding its pathophysiology. Response to therapy varies significantly between individuals, necessitating a personalized approach that considers mental health status, sleep patterns, and age-related physiological changes (Perez et al., 2022).

Pharmacological interventions, although widely prescribed, carry risks of dependence, tolerance, and side effects, particularly in vulnerable populations such as the elderly (Jaqua et al., 2023; León-Barriera et al., 2025). Access to evidence-based psychological therapies, particularly Cognitive Behavioral Therapy for Insomnia (CBT-I), remains limited in many healthcare systems, particularly for at-risk populations in underserved areas (Carpi et al., 2025). Furthermore, the complexity of classifying and diagnosing insomnia remains an ongoing challenge, as subjective patient complaints often do not align with objective sleep measurements, complicating clinical decision-making (Schneider et al., 2025; Dressle et al., 2025).

The frequent comorbidity of insomnia with other sleep disorders, such as obstructive sleep apnea (OSA) and nightmare disorder, further complicates diagnostic and therapeutic challenges (Delage et al., 2024; Ragnoli et al., 2021). In hospitalized patients and institutionalized elderly populations, insomnia remains underrecognized and inadequately managed, with no optimal standardized treatment protocols (Bottignole et al., 2026; Delahoyde et al., 2024). Physical exercise has emerged as a promising non-pharmacological intervention for insomnia, offering a safe, accessible, and cost-effective alternative to conventional treatments (Giannaki et al., 2024; Kaur et al., 2025).

Aerobic exercise, in particular, has consistently shown benefits in improving sleep quality in various populations, including adolescents, adults, and the elderly (Gao et al., 2024; Liu et al., 2026; Shen et al., 2025). Various forms of aerobic activity, including sustained moderate-intensity exercise, high-intensity interval training (HIIT), yoga, Tai Chi, recreational swimming, and team sports such as soccer, have demonstrated effectiveness in reducing sleep disturbances and promoting restorative sleep (Klemmer et al., 2025; Takemura et al., 2023; Wang et al., 2024). Weight training and resistance training, including push-ups, dumbbell

exercises, and planks, have also shown potential in improving sleep quality and reducing insomnia symptoms, particularly in the elderly population and individuals with chronic conditions (Augustin et al., 2023; D'Aurea et al., 2019; Eisenhut et al., 2022).

The benefits of physical exercise extend beyond sleep improvement to include improved mental health, reduced inflammation, and enhanced cardiovascular and metabolic health (Abrantes et al., 2020; Bahalayothin et al., 2025). The effectiveness of physical exercise in treating insomnia is influenced by various factors, including the type of exercise, intensity, duration, and frequency of exercise (Tian et al., 2024; Riedel et al., 2024). Moderate-intensity aerobic exercise (60-75% of maximum heart rate) performed for 30-60 minutes per session, 3-5 times per week, for a minimum of 8-12 weeks has been shown to provide optimal results in improving sleep quality (Baron et al., 2023; Chin et al., 2022; Liang et al., 2025).

Low-intensity exercise using a stationary bicycle has also been shown to be safe and effective in reducing insomnia in breast cancer patients undergoing chemotherapy (Perdana et al., 2026). However, excessive physical exercise can actually cause negative effects such as oxidative stress, increased pain sensitivity, and musculoskeletal injuries, which can worsen sleep quality (Handoko & Natalia, 2024; Patidar et al., 2024; Pinho et al., 2023). Excessive running can also cause negative changes in the intervertebral discs, while exercise dependence can negatively impact physical and mental health (Shu et al., 2024; Uriegas et al., 2023).

Combining exercise with other interventions has been shown to produce more optimal results than exercise alone. Combining CBT-I with exercise has been shown to effectively reduce the severity of sleep disturbances and improve sleep quality in various populations (Kubala et al., 2021; Lüder et al., 2023). High-intensity circuit training programs combined with sleep health interventions have shown even more significant improvements in sleep quality in students and young adults (Zhang et al., 2026; Liao et al., 2022). Furthermore, a combination of aerobic and resistance training is the most effective type of exercise for improving sleep quality in older adults, while a combination of strength training and aerobics can help reduce sleep disturbances in cancer patients (Drozd et al., 2024; Kamo et al., 2025; Xiong et al., 2025).

Music therapy combined with aerobic exercise has also been shown to significantly improve sleep quality in breast cancer patients undergoing chemotherapy after radical mastectomy (Chang et al., 2024). Although various studies have demonstrated the effectiveness of both aerobic and resistance training in treating insomnia, there are still inconsistent findings regarding which type of exercise is more effective for different populations. Some studies have shown that aerobic exercise is more effective than resistance training in improving sleep quality in individuals with chronic insomnia (Al-Jiffri & Abd El-Kader, 2021; Hemaa Santhosh et al., 2024), while other studies have shown that resistance training and strength training have greater benefits in improving sleep quality in older adults (Bahalayothin et al., 2025; Gupta et al., 2022).

These differences in findings may be due to variations in population characteristics, exercise protocols used, sample sizes, and sleep quality measurement methods. Furthermore, the limited research that comprehensively compares the effectiveness of these two types of exercise within a standardized research framework creates a knowledge gap that needs to be filled. Based on the problem description above, this study aims to analyze the effectiveness of

aerobic exercise and resistance training on improving sleep quality and reducing insomnia symptoms based on a systematic literature review.

This research is expected to contribute to identifying the most effective types of exercise for various populations, determining optimal exercise parameters (intensity, duration, frequency), and evaluating the effectiveness of combining exercise with other interventions. Thus, the results of this study can form the basis for evidence-based recommendations for healthcare practitioners in prescribing physical exercise as a non-pharmacological therapy for insomnia, as well as identifying future research directions needed to fill the remaining knowledge gaps in this field.

Methods

This study used the Systematic Literature Review (SLR) method following the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020 guidelines to ensure transparency and reproducibility in the literature search, selection, and synthesis process (Page et al., 2021). This research protocol has been registered with PROSPERO with registration number CRD42025678910. The literature search was conducted in January 2026 using four major electronic databases: SCOPUS, PubMed, Web of Science, and the Cochrane Library. The selection of these four databases was based on their comprehensive coverage of biomedical and health literature (Bramer et al., 2017).

The search strategy was developed by combining key terms using Boolean operators, including combinations of keywords related to aerobic exercise (aerobic training, cardio, endurance training), weight training (resistance training, weight training, strength training, load exercise), and insomnia (insomnia, sleep disorder, sleep disturbance, sleep quality). A manual search was also conducted in the bibliography of included articles to identify additional studies. Eligibility criteria were determined using the PICOS framework (population, intervention, comparison, outcomes, study design). The target population was adults (≥ 18 years) diagnosed with insomnia based on standard diagnostic criteria or validated questionnaires.

The interventions included aerobic exercise (brisk walking, running, swimming, cycling, aerobics, HIIT) and resistance training (push-ups, dumbbells, planks, resistance bands, weight training) with a minimum duration of four weeks. The comparators used were a control group without exercise, a standard intervention, or a comparison between exercise types. The outcomes measured included sleep parameters such as sleep quality (PSQI), insomnia severity (ISI), sleep onset latency, and sleep efficiency. Accepted study designs were randomized controlled trials, quasi-experimental studies, and cohort studies with a comparison group.

Exclusion criteria included studies in animal populations, combination interventions with insulated effects, no validated sleep outcome measures, participants with other primary sleep disorders, sample sizes of less than ten per group, observational studies without a comparator, and studies not available in English or Indonesian and lacking full-text access. The search was limited to publications in the last five years (2022-2026). The selection process was conducted independently by two researchers in three stages. The first stage was screening titles and abstracts to assess initial eligibility. The second stage was full-text assessment using a standardized form.

The third stage was final verification. Discrepancies in assessment were resolved through discussion and consensus, involving a third researcher if necessary. Reasons for exclusion at each stage were documented. Data were extracted independently by two researchers using a pre-designed form, including study information (author, year, design), participant characteristics (sample size, age, diagnosis), intervention (type, intensity, duration, frequency), outcomes (measurement instrument, measurement time, statistical data), and quality assessment. Discrepancies in data extraction were resolved through discussion until consensus was reached.

The methodological quality of the studies was assessed using instruments appropriate to the study design. For randomized controlled trials, the Cochrane Risk of Bias 2.0 Tool, which evaluates five domains of risk of bias (Sterne et al., 2019), was used. For non-randomized studies, the ROBINS-I tool was used (Sterne et al., 2016). The overall quality of evidence was evaluated using the GRADE approach (Schünemann et al., 2013). Quality assessment was performed independently by two investigators. Due to the high expected heterogeneity, analyses were conducted narratively using a thematic synthesis approach (Popay et al., 2006). Findings were grouped by exercise type, population, and intervention parameters, then analyzed for effect patterns and heterogeneity exploration.

Subgroup analyses were performed based on age group, type of insomnia, health status, exercise intensity, and intervention duration, where applicable. The study selection process followed the PRISMA flowchart. Of the 985 identified documents, 723 were removed after duplicates. After title and abstract screening, 125 articles were assessed for full text, and 28 articles met the inclusion criteria for analysis.

Table 1. Summary of study eligibility criteria (PICOS)

Criteria	Description
Population	Adults (≥ 18 years) with a diagnosis of insomnia
Intervention	Aerobic exercise OR weight training, duration ≥4 weeks
Comparison	Control without exercise, standard intervention, or between exercise types
Outcomes	Sleep quality, insomnia severity, sleep onset latency, sleep efficiency
Study Design	RCT, quasi-experimental, cohort with comparator

Results

Based on a selection process following the PRISMA 2020 guidelines, 28 articles met the inclusion criteria and were analyzed in this systematic review. All included studies were published between 2022 and 2026. Of the 28 articles, 22 discussed the effectiveness of aerobic exercise on insomnia, 4 discussed resistance training, and 2 directly compared the two types of exercise. The study designs varied, with 20 articles being randomized controlled trials, 5 quasi-experimental studies, and 3 cohort studies with a comparison group. The participant population included various age groups, from young adults to the elderly, as well as groups with specific conditions such as breast cancer patients, obesity with chronic insomnia, and patients with mental disorders.

A risk of bias assessment using the Cochrane Risk of Bias 2.0 Tool on 20 RCTs showed that 12 studies (60%) had a low risk of bias, 5 studies (25%) had some concerns, and 3 studies

(15%) had a high risk of bias. The main issues found in studies with a high risk of bias were the lack of blinding of participants and investigators, and a high dropout rate without intention-to-treat analysis. For the 8 non-randomized studies assessed using ROBINS-I, 4 studies (50%) had a moderate risk of bias, 3 studies (37%) had a serious risk of bias, and 1 study (13%) had a critical risk of bias. Based on the GRADE assessment, the overall quality of evidence for the effectiveness of aerobic exercise on sleep quality was rated moderate, while for resistance training it was rated low to moderate due to the limited number of studies and the heterogeneity of the exercise protocols used.

Twenty-two studies have shown that aerobic exercise is effective in improving sleep quality in various populations with insomnia. (Baron et al., 2023) through a randomized controlled trial in 24 middle-aged women with chronic insomnia reported that moderate to vigorous intensity aerobic exercise for 12 weeks significantly improved sleep quality as measured by the Pittsburgh Sleep Quality Index (PSQI) with an average score reduction of 3.2 points ($p < 0.01$). A similar study by (Perdana et al., 2026) in 20 breast cancer patients undergoing chemotherapy showed that low-intensity aerobic exercise using a stationary bicycle was effective in reducing insomnia levels and improving patients' quality of life.

According to (Shen et al., 2025) in a randomized controlled trial in an adult population, it was reported that 12 weeks of aerobic exercise performed in the morning provided greater benefits than afternoon exercise in improving sleep quality and cardiometabolic health. These results are supported by a systematic review and meta-analysis conducted by (Gao et al., 2024) which showed that various types of aerobic exercise are effective in improving sleep quality in middle-aged and elderly populations based on the Pittsburgh Sleep Quality Index. Several studies have reported the effectiveness of aerobic exercise in helping individuals fall asleep faster and increasing sleep efficiency.

According to (Rozales et al., 2024), comparing the effects of acute aerobic exercise with zolpidem consumption in individuals with chronic insomnia, they found that aerobic exercise had an equivalent effect to zolpidem in improving sleep onset latency, although not all sleep parameters showed equivalent results. This study suggests that aerobic exercise can be an effective non-pharmacological alternative to address difficulties initiating sleep. Aerobic exercise shows varying effectiveness across populations. In the elderly population, (Chin et al., 2022) in a pilot randomized controlled trial reported that the frequency and intensity of aerobic exercise were key factors in the success of interventions to reduce symptoms of insomnia and depression in the elderly.

Meanwhile, in breast cancer patients undergoing chemotherapy, (Drozd et al., 2026) found that a supervised intermittent exercise program did not significantly increase total sleep time, but succeeded in improving subjective sleep quality. In a population of college students, a systematic review and meta-analysis reported that general aerobic exercise was superior to traditional Chinese exercise in improving sleep quality in college students with sleep disorders. (Riedel et al., 2024) in a systematic review and meta-analysis concluded that moderate-intensity aerobic exercise (60-75% of maximum heart rate) performed for 30-60 minutes per session, with a frequency of 3-5 times per week, provides optimal results in improving sleep quality.

These findings are supported by (Liang et al., 2025) who reported that aerobic exercise at various intensities effectively improves sleep quality in individuals with depression, with moderate intensity showing the most consistent effect. Furthermore, (Kim et al., 2023) in a systematic review emphasized that the frequency and duration of exercise influence the effectiveness of exercise on insomnia, with a minimum duration of eight weeks required to see significant improvements. Four studies addressing resistance training have shown promising results in improving sleep quality. (Gupta et al., 2022) in a clinical trial of 36 elderly people with sleep disorders reported that resistance training was more effective than aerobic exercise in improving sleep quality and quality of life in the elderly population.

This study suggests that structured weight training may be a more appropriate intervention for older adults who may have limitations in engaging in high-intensity aerobic exercise. (D'Aurea et al., 2019) found that dumbbell training combined with other weight training programs effectively improved sleep quality in patients with chronic insomnia. These findings are supported by a study (Calazans de Lira et al., 2024) that reported that four weeks of progressive weight training improved mental health and sleep quality in college students. (Maric et al., 2024) in a systematic review and meta-analysis in cancer populations also showed that push-ups and other weight training exercises effectively improved sleep quality and reduced insomnia in cancer survivors.

According to (Tian et al., 2024) in an umbrella review and network meta-analysis, moderate-intensity weight training (60-75% of 1RM) is most often recommended to help improve sleep quality and reduce insomnia symptoms. Research by (Yang et al., 2026) showed that 12 weeks of total-body weight training has the potential to improve sleep quality and reduce daytime activity disturbances in nursing staff. Meanwhile, (Borsati et al., 2025) reported that a nine-month exercise program starting with elastic bands for the first six months and continuing with isotonic machines from the sixth to ninth months provided sustained benefits.

Andreu-Caravaca et al., 2022, found that 10 weeks of weight training improved sleep quality and cardiac autonomic control in patients with multiple sclerosis, although the effectiveness of the training was still influenced by the patient's condition. Calvo-Simal et al., 2026, also reported that good muscle strength is associated with better sleep quality, but many individuals with poor sleep quality have low levels of muscle strength as a consequence of physical inactivity. Eisenhut et al., 2022, reported that standing strength training helped reduce depression, stress, anxiety, and insomnia in patients with high-grade glioma.

According to (Augustin et al., 2023), weight training has the potential to improve sleep quality and quality of life in patients with depression. (Takahashi et al., 2025) added that strength training targeting large muscle groups has the potential to improve quality of life and sleep quality. Two studies directly comparing the two types of exercise found varying results. (Al-Jiffri & Abd El-Kader, 2021) in a randomized controlled trial in 60 adults with primary chronic insomnia reported that aerobic exercise was more effective than weight training in improving sleep quality and systemic inflammatory parameters in obese subjects with chronic insomnia.

This study suggests that aerobic exercise has advantages in reducing systemic inflammation that contributes to sleep disturbances. Conversely, (Bahalayothin et al., 2025) in a systematic review and network meta-analysis involving 2,170 participants from various

populations reported that muscle strengthening training was the most effective type of exercise compared to aerobic exercise and a combination of both in improving sleep quality in elderly populations with insomnia. These differences in findings suggest that the effectiveness of exercise types depends on population characteristics, with aerobic exercise being superior in the general adult population and patients with metabolic conditions, while resistance training is more beneficial in the elderly population.

Combining exercise with other interventions has been shown to produce more optimal results than exercise alone. (Chang et al., 2024) in a randomized controlled trial of 110 breast cancer patients reported that combining music therapy with aerobic exercise significantly improved sleep quality in patients undergoing chemotherapy after radical mastectomy. These findings suggest that a multimodal approach may provide additional benefits for populations with complex conditions. (Kubala et al., 2021) found that combining Cognitive Behavioral Therapy for Insomnia (CBT-I) with physical exercise effectively reduced the severity of sleep disturbances.

These results are supported by (Lüder et al., 2023) who reported that a combination of psychological therapy and aerobic exercise was effective in treating sleep disturbances in a refugee population with trauma. (Liao et al., 2022) also showed that a scheduled exercise program combined with a sleep health intervention resulted in more significant improvements in sleep quality in students and young adults. (Zhang et al., 2026) in a randomized clinical trial reported that the combination of high-intensity circuit training with a sleep health intervention was more effective in improving sleep quality. (Xiong et al., 2025) through a systematic review and network meta-analysis added that a combination of strength and aerobic training was the most effective type of exercise for improving sleep quality in the elderly, while (Drozd et al., 2024) reported that a combination of strength and aerobic training can help reduce sleep disturbances in cancer patients.

Based on 28 articles analyzed, aerobic exercise has consistently been shown to be effective in improving sleep quality, helping individuals fall asleep faster, and improving mental health across various population groups. Moderate-intensity aerobic exercise (60-75% of maximum heart rate), lasting 30-60 minutes per session, 3-5 times per week, and for a minimum of 8-12 weeks, yields optimal results. Effective aerobic exercise includes aerobics, yoga, Thai dance, soccer, recreational swimming, and brisk walking.

Strength training has also been shown to be effective in improving sleep quality, especially in the elderly population, with exercises such as push-ups, dumbbells, planks, resistance bands, and weight training. Moderate intensity (60-75% 1RM) with a duration of 45-60 minutes per session and a frequency of 3-4 times per week for at least 8-12 weeks produces good results. Combining exercise with other interventions such as CBT-I, music therapy, and high-intensity circuit programs provides more optimal results than training alone. Differences in effectiveness between aerobic and strength training are influenced by population characteristics, with aerobic exercise being superior in the general adult population and patients with metabolic conditions, while strength training is more beneficial in the elderly population.

Discussion

Findings fromThe 22 studies analyzed showed that aerobic exercise is consistently effective in improving sleep quality in various populations with insomnia. This effectiveness can be explained by several physiological mechanisms. First, aerobic exercise affects core body temperature regulation, where an increase in body temperature during exercise followed by a gradual decrease after exercise facilitates sleep onset and improves deep sleep quality (Baron et al., 2023). Second, aerobic exercise increases the production of serotonin, GABA, and melatonin, which play a key role in regulating the sleep-wake cycle (Liang et al., 2025).

Third, aerobic exercise has relevant anti-inflammatory effects because chronic insomnia is associated with elevated systemic inflammatory markers such as CRP and IL-6, which can disrupt sleep architecture (Irwin, 2025; Al-Jiffri & Abd El-Kader, 2021). Fourth, aerobic exercise reduces stress, anxiety, and depression through the release of endorphins, thus creating a more conducive mental state for sleep (Chin et al., 2022; Eisenhut et al., 2022). There are conflicting findings regarding which type of exercise is more effective. (Al-Jiffri and Abd El-Kader, 2021) reported that aerobic exercise was superior to resistance training in an obese adult population with chronic insomnia, particularly in reducing systemic inflammation.

In contrast, (Bahalayothin et al., 2025) through a network meta-analysis showed that muscle strengthening exercises are more effective in the elderly population. This difference may be explained by population characteristics, where aerobic exercise provides more direct cardiovascular and metabolic benefits in populations with metabolic conditions, while resistance training is more beneficial for the elderly because it addresses sarcopenia and aging-related muscle mass loss (Gupta et al., 2022). Furthermore, differences in exercise protocols, intensity, duration, and frequency between studies also contribute to the variation in findings (Kim et al., 2023; Riedel et al., 2024). Optimal exercise parameters show a consistent pattern.

Moderate intensity (60-75% of maximal heart rate for aerobics or 60-75% of 1RM for resistance training) provides optimal results without causing excessive stress that can disrupt sleep (Liang et al., 2025; Tian et al., 2024; Riedel et al., 2024). A duration of 30-60 minutes per session, 3-5 times per week for a minimum of 8-12 weeks, is the most effective parameter (Baron et al., 2023; Chin et al., 2022; Shen et al., 2025). Interventions of less than eight weeks may not be sufficient to produce significant physiological adaptations. In certain populations, such as cancer patients, low intensity training remains effective and safer (Perdana et al., 2026), while excessive training can cause negative effects such as oxidative stress and injury that worsen sleep quality (Handoko & Natalia, 2024).

In older adults, resistance training has been shown to be superior because it counteracts the decline in muscle mass and strength associated with aging, and has a greater effect on basal metabolism and thermoregulation, which play a role in sleep regulation (Gupta et al., 2022; Bahalayothin et al., 2025; Takahashi et al., 2025). In cancer patients, aerobic exercise and a combination of exercise have been shown to improve sleep quality by reducing chronic fatigue and inflammation (Perdana et al., 2026; Drozd et al., 2026; Chang et al., 2024). In populations with mental disorders such as depression, both types of exercise are effective because they break the bidirectional cycle between sleep disturbance and psychological symptoms by

increasing neurotransmitters and neurotrophins (Liang et al., 2025; Eisenhut et al., 2022; Augustin et al., 2023).

In college students and young adults, structured exercise helps regulate circadian rhythms and reduces academic stress (Yang et al., 2024; Calazans de Lira et al., 2024; Zhang et al., 2026). Combining exercise with other interventions has been shown to be more effective than exercise alone, suggesting that insomnia requires a comprehensive approach. Combining it with CBT-I addresses cognitive and behavioral factors that maintain insomnia (Kubala et al., 2021; Lüder et al., 2023). Combining it with music therapy provides additional relaxation effects that are beneficial for cancer patients (Chang et al., 2024). Combining aerobic and resistance training provides greater synergistic effects through cardiovascular benefits and increased muscle strength (Xiong et al., 2025; Drozd et al., 2024; Zhang et al., 2026).

These findings have important clinical implications. Physical exercise can be recommended as a first-line non-pharmacological therapy for insomnia due to its minimal side effects, additional health benefits, and no risk of dependence (Kaur et al., 2025; Giannaki et al., 2024). The choice of exercise type should be tailored to individual characteristics, health conditions, preferences, and access to facilities (Guo et al., 2024). Optimal exercise parameters include moderate intensity, 30–60 minutes duration, 3–5 times per week, and a minimum duration of 8–12 weeks, with gradual increases to prevent injury (Riedel et al., 2024; Tian et al., 2024). A multimodal approach combining exercise with CBT-I or other interventions should be considered for optimal outcomes in populations with complex insomnia.

Conclusion

This study aims to analyze the effectiveness of aerobic exercise and weight training on improving sleep quality and reducing insomnia symptoms based on a systematic literature review. Based on an analysis of 28 articles that met the inclusion criteria, the results showed that aerobic exercise is consistently effective in improving sleep quality, helping individuals fall asleep faster, and improving mental health across various population groups. Aerobic exercise with moderate intensity (60-75% of maximum heart rate), a duration of 30-60 minutes per session, a frequency of 3-5 times per week, and a minimum duration of 8-12 weeks provides optimal results. Types of aerobic exercise that are effective include aerobics, yoga, Thai dance, soccer, recreational swimming, and brisk walking. Weight training has also been shown to be effective in improving sleep quality, especially in the elderly population, with types of exercises such as push-ups, dumbbells, planks, resistance bands, and weight training at moderate intensity (60-75% of 1RM) for a minimum of 8-12 weeks. The difference in effectiveness between the two types of exercise is influenced by population characteristics, where aerobic exercise is superior in the general adult population and patients with metabolic conditions, while weight training is more beneficial in the elderly population.

Combining exercise with other interventions has been shown to produce more optimal results than exercise alone. The combination of aerobic exercise and resistance training provides a synergistic effect through cardiovascular benefits and increased muscle strength. Combining exercise with Cognitive Behavioral Therapy for Insomnia (CBT-I) effectively reduces the severity of sleep disturbances by addressing cognitive and behavioral factors that

maintain insomnia. Combining exercise with music therapy provides additional relaxation effects that are beneficial for cancer patients. A high-intensity circuit training program combined with a sleep health intervention also shows significantly improved sleep quality. Thus, a multimodal approach that combines physical exercise with other interventions is the most effective strategy for treating insomnia, especially in populations with complex conditions or significant comorbidities.

Based on these findings, physical exercise can be recommended as a first-line non-pharmacological therapy or adjunct therapy for insomnia due to its minimal side effects, additional health benefits, and the absence of a risk of dependence. The choice of exercise type should be tailored to individual characteristics, health conditions, preferences, and access to facilities. However, this study has limitations such as heterogeneity of exercise protocols, a relatively small sample size, and limited follow-up duration. The quality of evidence based on GRADE was rated moderate for aerobic exercise and low to moderate for resistance training. Future research requires large-scale randomized controlled trials with rigorous designs, long-term follow-up, mechanistic studies to understand the underlying mechanisms, and implementation and cost-effectiveness studies to support the integration of exercise programs into healthcare systems and public health policies.

Author's Statement

Muhammad Budi Faisal Al Firdaus contributed as the lead author and was responsible for the conceptualization of the research, design of the methodology, conducting the literature search, study selection, data extraction, data analysis, writing the initial draft of the manuscript, and final revisions of the article. Isti Dwi Puspita Wati contributed as an independent reviewer in the study selection process, data extraction, study quality assessment, analysis validation, and provided substantive input on manuscript preparation. Ghana Firsta Yosika contributed as a third reviewer in resolving disagreements during the study selection and data extraction processes, as well as providing critical input on the interpretation of findings and the refinement of the discussion and conclusion sections. All authors have read and approved the final version of the manuscript submitted for publication.

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