International Journal of Innovative Technologies in Social Science

e-ISSN: 2544-9435

Operating Publisher
SciFormat Publishing Inc.
ISNI: 0000 0005 1449 8214

2734 17 Avenue SW,
Calgary, Alberta, T3E0A7,
Canada
+15878858911
editorial-office@sciformat.ca

ARTICLE TITLE	PHYSICAL ACTIVITY IN THE MANAGEMENT OF INSOMNIA IN ADULTS AGED 60 YEARS AND OLDER
DOI	https://doi.org/10.31435/ijitss.1(49).2026.4997
RECEIVED	11 January 2026
ACCEPTED	19 March 2026
PUBLISHED	27 March 2026
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PHYSICAL ACTIVITY IN THE MANAGEMENT OF INSOMNIA IN ADULTS AGED 60 YEARS AND OLDER

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ABSTRACT

Insomnia is highly prevalent among adults over the age of 60 and is associated with impairments in physical, cognitive, and emotional functioning, as well as an increased risk of cardiovascular and psychiatric disorders. In this population, pharmacological treatment is often limited by adverse effects and concerns regarding long-term safety, leading to growing interest in non-pharmacological interventions, particularly exercise, for the management of insomnia. The objective of this review was to examine the existing evidence on the efficacy of physical activity as an adjunct, non-pharmacological therapy for the treatment of insomnia in individuals aged 60 years and older. A literature search was conducted using the PubMed, Scopus, and Google Scholar databases. Studies evaluating the effects of physical activity on insomnia and sleep quality in adults aged 60 years and above were considered. Subjective sleep outcomes were primarily assessed using validated instruments, including the Pittsburgh Sleep Quality Index (PSQI), Insomnia Severity Index (ISI), and Epworth Sleepiness Scale (ESS). Evidence from randomized controlled trials, observational studies, and meta-analyses consistently demonstrates that physical activity is associated with significant improvements in scores on the Pittsburgh Sleep Quality Index and the Insomnia Severity Index among older adults. Low-intensity to moderate-intensity exercise performed several times per week over a period of weeks was sufficient to produce meaningful reductions in insomnia symptoms. Various modalities, including resistance training, aerobic exercise, combined exercise programs, walking, and mind-body practices such as tai chi, were shown to be beneficial. Notably, resistance training appeared to yield the greatest improvements in sleep quality in several studies. Overall, exercise represents a safe, accessible, and effective non-pharmacological strategy for improving sleep quality and reducing insomnia symptoms in adults aged 60 years and older. Even modest amounts of regular, low-intensity to moderate-intensity physical activity can lead to clinically significant improvements in both subjective and objective measures of sleep.

KEYWORDS

Insomnia, Physical Activity, Older Adults, Aging, Sleep Quality, Non-Pharmacological Treatment

CITATION

Aleksandra Oparcik, Szymon Stupnicki, Jakub Tarczykowski, Mikołaj Zakryś, Katarzyna Anna Zakryś, Mateusz Szot, Natalia Kwaśniewska. (2026) Physical Activity in the Management of Insomnia in Adults Aged 60 Years and Older. *International Journal of Innovative Technologies in Social Science*. 1(49). doi: 10.31435/ijitss.1(49).2026.4997

Introduction

Sleep can be defined as a complex neurological state necessary for adequate rest and energy restoration to maintain bodily homeostasis. The importance of sleep is emphasized by the fact that humans spend, on average, one third of their lives sleeping (Elavarsi & Shukla, 2017). High-quality sleep is essential for health, supporting cognitive functions such as learning and memory, regulation of immune function, and energy restoration (Murre et al., 2014) (Gamaldo et al., 2012). Above all, sleep has a regenerative function, which is of particular interest to sleep medicine. The effectiveness of regeneration is measured by two parameters: sleep duration and sleep quality. Both of these elements are important for interpretation in research, regardless of whether subjective or objective methods are used. The first group of methods includes a medical interview focused on the patient's sleep, in which standardized and validated questionnaires play a supporting role. Objective methods, on the other hand, focus on assessing sleep using polysomnography and actigraphy. Despite its shortcomings, polysomnography still seems to be the gold standard (Heitmann et al., 2011).

When sleep quality is disturbed, it can lead to a condition called insomnia, defined by the International Classification of Sleep Disorders, Version 3 (ICSD-3), as a disorder characterized by one or more of the following symptoms occurring at least three days per week for the past three months: difficulty falling asleep, difficulty maintaining sleep continuity, waking up before the planned wake-up time, resistance to going to bed at the appropriate time, or inability to fall asleep without a parent or caregiver (Kay-Stacey & Attarian, 2016). Epidemiologically speaking, insomnia affects about 30% of the population in general, while about 10% of the population has impairments in daily functioning due to insomnia ("National Institutes of Health State of the Science Conference Statement," 2005). Insomnia mostly affects older and middle-aged individuals, shift workers, women, and those with psychiatric disorders (Holst & Landolt, 2022). Patients with insomnia are at increased risk of developing hypertension, atherosclerosis, acute coronary syndrome, depression, and suicidal thoughts (Laugsand et al., 2011) (Pigeon et al., 2012).

Insomnia management strategies may be divided into pharmacological and non-pharmacological methods. Pharmacological methods include traditional benzodiazepines, benzodiazepine receptor agonists, sedative antidepressants, antihistamines, phytotherapeutics, melatonin receptor agonists, and orexin receptor antagonists. Despite the benefits of pharmacological treatments for insomnia, they are not without risks and are best used on a short-term basis as an acute treatment, typically not exceeding four weeks (Riemann et al., 2023). Prolonged use of hypnotics has been found to pose risks such as addiction, decline in cognitive function, and an increased risk of falls among the older population (Andrade, 2018). Cognitive-behavioral therapy for insomnia and other non-pharmacological methods, such as exercise therapy, phototherapy, music therapy, and non-invasive brain stimulation techniques, are used in the management of insomnia (Riemann et al., 2023).

Methods

The objective of this study was to synthesize key evidence regarding the use of physical activity as a non-pharmacological intervention for the treatment of insomnia in individuals aged 60 years and older. This review followed a narrative approach and did not adhere to a predefined systematic review protocol. The review was based on articles published between 2000 and 2025 and retrieved from the PubMed, Scopus, and Google Scholar databases, with particular emphasis on peer-reviewed articles published in English. The literature search was conducted in November 2025. Preprints, case reports, and conference abstracts were excluded to ensure that only reliable evidence was used in the analysis. The effectiveness of physical activity as a treatment intervention, in relation to its duration, type, and timing in patients aged 60 years and older, was considered during the analysis.

The analysis included studies that used subjective research methods, in which participants completed validated questionnaires, such as the Pittsburgh Sleep Quality Index, the Insomnia Severity Index, and the Epworth Sleepiness Scale. The Pittsburgh Sleep Quality Index is the most commonly used measure of sleep quality and assesses sleep over the previous month (Buysse et al., 1989) (Mollayeva et al., 2016). The Insomnia Severity Index is a short, reliable, and accurate tool for measuring patients' perception of insomnia and is sensitive to changes following treatment (Bastien, 2001) (Morin et al., 2011). The Epworth Sleepiness Scale is a subjective measure of daytime sleepiness used in sleep research (Miletin & Hanly, 2003). Some studies also used actigraphy to assess sleep onset latency, total sleep time, wake after sleep onset, and sleep efficiency.

The literature search was conducted using the following keywords: insomnia, physical activity, older adults, aging, sleep quality, non-pharmacological treatment.

Characteristics of Insomnia in Adults Aged 60 Years and Older

Studies have shown that people over the age of 60 are prone to many diseases, including insomnia, which significantly affects their mental and physical condition (Miletin & Hanly, 2003) (Ohayon et al., 2017). Compared to younger adults, older people are more prone to reduced deep sleep, sleep architecture disturbances, and circadian rhythm disorders, often manifested by difficulty falling asleep, frequent nighttime awakenings, and early morning awakening (Zdanys & Steffens, 2015). In recent years, there has been growing evidence that physical exercise, when properly planned and performed regularly, can effectively support cardiovascular function, regulate metabolic and endocrine processes, and increase muscle strength (Feinsilver & Hernandez, 2017). With increasing age, total sleep time and sleep efficiency decrease, while sleep fragmentation increases, along with reductions in slow-wave sleep and rapid eye movement sleep (Mander et al., 2017).

However, definitive data regarding the optimal nature, intensity, duration, and frequency of physical activity are still unclear, especially in individuals aged 60 years and older. In addition, individuals aged 60 years and older are likely to have systemic conditions such as hypertension, diabetes mellitus, and rheumatoid arthritis, which may significantly affect sleep quality (Garcia, 2008). According to researchers, more than half of older adults report sleep-related complaints, including difficulty falling asleep, premature awakening, poor sleep continuity, and daytime sleepiness (Wang et al., 2020) (Ganguli et al., 1996).

In recent years, there has been an increasing trend toward nonpharmacological treatment modalities that may provide more sustained benefits and be better tolerated in terms of adverse effects than medications (Petit, 2003) (Schutte-Rodin et al., 2008). For patients older than 60 years of age, approved nonpharmacological therapies for insomnia include cognitive behavioral therapy for insomnia and mindfulness-based therapies, which have been shown to be effective in improving sleep in this population (Lee & Yu, 2021) (Samara et al., 2020). However, it should be noted that these methods can be costly, often require a long time to achieve full effectiveness, and may be difficult to access in many regions, particularly in countries with limited availability of psychotherapists and among older adults with reduced mobility (MacLeod et al., 2018).

Physical activity has been proposed as an alternative non-pharmacological therapeutic intervention. It is characterized by easy accessibility, the possibility of organizing exercises independently or in groups, with or without supervision, and flexibility regarding location and timing (Hartescu et al., 2015). However, before implementing physical activity interventions, it is necessary to determine which strategy is most effective for this specific population, which is the aim of this analysis.

Clinical Evidence for Physical Activity in Insomnia Among Older Adults

In recent years, physical activity as a therapeutic approach in the treatment of insomnia among the elderly population has been the subject of interest for many researchers. A number of clinical trials, meta-analyses, and review papers have been conducted.

Yafan Li et al. focused their meta-analysis on assessing the impact of exercise interventions on subjective sleep quality in the elderly population and on examining the dose–response relationship of this activity. The meta-analysis was performed using tools such as standardized mean differences (SMDs) and confidence intervals (CIs) for quantitative effect estimation. Subgroup analysis, meta-regression, and non-linear dose–response modeling were also included. The analysis included 26 randomized studies involving 2,189 elderly participants. The results of the meta-analysis indicated that physical activity programs significantly improved subjective sleep quality (SMD = −2.46, 95% CI: −2.99 to −1.93, $p < 0.001$). The strongest effects were observed in interventions involving sessions lasting ≤30 minutes (weighted mean difference [WMD] = −4.25, 95% CI: −5.49 to −3.02), with low intensity (WMD = −2.79, 95% CI: −3.44 to

−2.14), carried out twice a week (WMD = −2.52, 95% CI: −3.00 to −2.04), and lasting up to 8 weeks (WMD = −2.45, 95% CI: −2.99 to −1.91). Meta-regression did not reveal any significant linear relationships between intervention parameters and sleep outcomes. However, a non-linear, U-shaped dose–response relationship was established, with the optimal effect at about 527 metabolic equivalent minutes per week (METmin/week; Hedges' g = −0.82, 95% CI: −1.12 to −0.52). The results revealed that low-frequency physical activity of low to moderate intensity and short duration could be effective in improving subjective sleep quality in older adults, even when undertaken in small doses (Li et al., 2025).

In a meta-analysis conducted by Di Geng et al., the relationship between physical activity and sleep quality in older patients was explored. The meta-analysis included 50 studies with a total of 3,937 patients. In terms of patient-reported outcomes related to sleep, exercise interventions led to an improvement in sleep quality (WMD = −2.18; 95% CI: −2.83 to −1.53; $p < 0.01$) and a reduction in insomnia severity (SMD = −0.52; 95% CI: −0.79 to −0.25; $p < 0.01$), but did not significantly improve daytime sleepiness (SMD = −0.66; 95% CI: −1.41 to 0.09; $p = 0.09$). In clinical outcome measurements, exercise increased total sleep time (TST; WMD = 8.98; 95% CI: 1.19 to 16.78; $p < 0.05$), increased sleep efficiency (SE; WMD = 3.66; 95% CI: 2.46 to 4.85; $p < 0.01$), and decreased wake after sleep onset (WASO; WMD = −11.85; 95% CI: −15.58 to −8.11; $p < 0.01$), but did not significantly reduce sleep onset latency (SOL; WMD = −3.05; 95% CI: −6.23 to 0.13; $p = 0.06$) or awakenings per night (WMD = −0.73; 95% CI: −1.98 to 0.52; $p = 0.25$). The authors concluded that physical exercise had a positive effect on improving sleep quality in older people and that it is a safe, effective, and low-cost method of supporting the treatment of insomnia in this population (Geng et al., 2025).

The topic was expanded upon in a study examining the impact of specific types of physical activity and identifying the type that improves sleep quality the most, as described in a review by Pakwan Bahalayothin et al. The review included 2,170 participants from 25 studies. Direct analysis showed a significant improvement in the Global Pittsburgh Sleep Quality Index (GPSQI) score (a global measure derived from the Pittsburgh Sleep Quality Index) after combined training (unstandardized mean difference [USMD] = −2.35; 95% CI: −3.13 to −1.57; $p < 0.001$; $I^2 = 69.13\%$). A significant reduction in GPSQI was also observed for aerobic exercise (USMD = −4.36; 95% CI: −7.86 to −0.86; $p = 0.01$; $I^2 = 97.83\%$). In the network meta-analysis, strength training, aerobic training, and combined training all contributed to significant decreases in GPSQI (USMD: −5.75, −3.76, and −2.54, respectively). Resistance training showed the greatest effectiveness in improving GPSQI, achieving the highest surface under the cumulative ranking curve (SUCRA) value (94.6%). The study concluded that strength training was more effective in improving sleep quality than other types of exercise (Bahalayothin et al., 2025).

In a subsequent study, Iuliana Hartescu et al. expanded their research to include the recommended level of physical activity needed to improve sleep quality. In a representative sample of British participants aged 65 years and older (n = 926), using a cross-sectional design and controlling for confounding variables, a minimum of 150 minutes of walking per week, in accordance with international guidelines, was associated with a significantly decreased risk of insomnia symptoms (odds ratio [OR] = 0.67; 95% CI: 0.45–0.91; $p < 0.05$). In a four-year longitudinal study (n = 577), a higher level of walking was shown to be a significant predictor of a decreased risk of difficulty falling asleep (OR = 0.64; 95% CI: 0.42–0.97; $p < 0.05$) and maintaining sleep (OR = 0.63; 95% CI: 0.41–0.95; $p < 0.05$). These findings provide evidence supporting the hypothesis that adherence to current physical activity guidelines in daily life may contribute to improved sleep quality in older adults (Hartescu et al., 2016).

Farkhondeh Sharif et al. investigated the effect of aerobic exercise on the quality and quantity of sleep among older adults visiting health centers in the city of Lar in southern Iran. Sixty voluntary participants aged 60 to 75 years (mean ± standard deviation [SD]: 64.8 ± 5.2) were randomly assigned to two groups of 30: an experimental group and a control group. Participants in the experimental group underwent a physical activity program consisting of three sessions per week for 12 consecutive weeks. Pre-test and post-test assessments of sleep quality and quantity were carried out using the Pittsburgh Sleep Quality Index (PSQI). Results of the independent-samples t-test showed that the experimental group experienced a 44.46% improvement in sleep quality ($p < 0.0001$). The results showed an overall increase of 98.16% ($p = 0.038$) in sleep duration and a 76.6% improvement in sleep latency. Although the difference between the two groups regarding changes in sleep latency was not statistically significant ($p = 0.089$), the results indicate that aerobic exercise positively affects both the quality and quantity of sleep in older adults and may serve as an inexpensive and side-effect-free alternative therapy for managing insomnia. However, to improve generalizability and draw more reliable conclusions, larger and more diverse samples are required (Sharif et al., 2015).

An interesting study on physical activity among older adults is an ongoing randomized crossover trial conducted by Gali Albalak et al. The investigators are conducting a study involving 40 healthy older adults aged 65–75 years with subclinical or clinical insomnia (Insomnia Severity Index [ISI] ≥ 10) living in the municipality of Leiden and its surroundings. Each participant will complete three consecutive 14-day intervention periods: one period of sedentary behavior and two periods of increased physical activity—one involving morning exercise and the other evening exercise. The intervention phases will be separated by a one-week washout period.

During the active intervention phases, participants will engage in supervised or unsupervised outdoor physical activity for 14 days, including endurance, strength, and stretching exercises. The primary outcome measure will be the change in insomnia severity, as assessed by the Insomnia Severity Index. Secondary outcomes will include objective sleep quality assessed using triaxial accelerometry, subjective sleep measures, timing of nocturnal melatonin onset, circadian heart rate rhythms, heart rate variability, respiratory rate, oxygen saturation, mood, and objective measures of emotional arousal and stress.

In addition, diaries documenting eating habits (including the timing and composition of meals) will be collected. Blood samples will be obtained at baseline and after each intervention phase to measure metabolic and physiological biomarkers, as well as gene expression related to circadian rhythm regulation. As this trial is ongoing, its results may provide important insights into the mechanisms linking physical activity and sleep within an internal medicine framework (Albalak et al., 2024).

Researchers have also focused on types of physical activity associated with relaxation techniques, such as tai chi. Parco M. Siu et al. used actigraphy to compare a control group, a conventional exercise group, and a tai chi group in a sample of 320 older adults. The study included 320 participants (mean age 67.3 ± 6.8 years; mean duration of insomnia 124.4 ± 134.5 months; 80% women), who were randomly assigned to the control group (n = 110), the exercise group (n = 105), or the tai chi group (n = 105). Compared with the control group, both the exercise and tai chi groups demonstrated improved sleep efficiency (SE), shorter sleep onset latency (SOL), and fewer awakenings. No significant differences were observed between the exercise and tai chi groups. The beneficial effects confirmed by actigraphy persisted in both intervention groups during the follow-up period. Traditional physical exercise and tai chi contributed to improved sleep quality, and the benefits persisted for up to 24 months, although the magnitude of changes in sleep parameters was relatively small. The lack of differences in objective sleep indicators between the tai chi group and the exercise group suggests that tai chi may be a valuable alternative to conventional exercise in the treatment of insomnia (Siu et al., 2021).

Edwin C. Chin et al. focused on studying the minimization of the effects of insomnia, specifically the severity of depression in older people, through physical activity. Participants were randomly assigned in a 1:1:1:1:1 ratio to one of five groups: attention control (CON), moderate walking once a week (MOD × 1/week), moderate walking three times a week (MOD × 3/week), vigorous walking once a week (VIG × 1/week), and vigorous walking three times a week (VIG × 3/week). The weekly exercise volume in the walking groups was standardized to meet minimum physical activity recommendations. Before the start of the program and after 12 weeks, the following were assessed: depression and anxiety using the Hospital Anxiety and Depression Scale (HADS), subjective sleep quality using the Pittsburgh Sleep Quality Index (PSQI), insomnia severity, 7-day actigraphy sleep measurements, 7-day sleep diaries, cardiorespiratory fitness, adherence, and habitual physical activity. Both the MOD × 3/week and VIG × 3/week groups showed significant reductions in symptoms of depression (HADS–Depression: −68.6% and −67.4%, respectively) and anxiety (HADS–Anxiety: −54.3% and −59.8%) compared with the control group ($p < 0.01$). Improvement in subjective sleep quality occurred in the MOD × 3/week (−31.4% in PSQI), VIG × 1/week (−34.1% in PSQI), and VIG × 3/week (−38.3 % in PSQI) groups, but not in the MOD × 1/week group, compared with CON ($p < 0.05$). No serious adverse events were reported. The results indicate that three sessions per week of walking, whether moderate or vigorous intensity, effectively reduce the severity of depression in older adults with insomnia. However, further research is needed to more precisely determine the role of exercise frequency in alleviating depressive symptoms (Chin et al., 2022).

Table 1. Summary of studies on the effect of physical activity on sleep in older adults

Author & Year	Population / N	Type of Intervention	Main Findings	Conclusions
(Li et al., 2025)	2189 participants, 26 RCTs	Various types of exercise; dose–response analysis	Improvement in subjective sleep quality: SMD = −2.46; best effects with ≤30 min sessions, low intensity, 2×/week; U-shaped dose–response (optimal 527 METmin/week)	Short, low-intensity exercise is particularly effective in improving subjective sleep quality.
(Geng et al., 2025)	3937 participants, 50 studies	Various forms of physical activity	Improved PSQI (WMD = −2.18), reduced insomnia severity (SMD = −0.52); longer sleep duration, higher sleep efficiency; no effect on sleep latency or awakenings	Exercise is a safe and effective intervention for insomnia.
(Bahalayothin et al., 2025)	2170 participants, 25 studies	Aerobic, resistance, combined training	Largest GPSQI improvement in resistance training (USMD = −5.75); aerobic and combined training also effective	Resistance training yields the most pronounced improvement in sleep quality.
(Hartescu et al., 2016)	926 + 577 participants	Walking (cross-sectional + 4-year cohort)	≥150 min/week associated with lower insomnia risk (OR = 0.67); more walking → fewer difficulties falling and staying asleep	Meeting physical activity recommendations improves sleep in older adults.
(Sharif et al., 2015)	60 participants, RCT	Aerobics 3×/week, 12 weeks	44% improvement in sleep quality; longer sleep; improved latency (group differences not significant)	Aerobic exercise is effective, safe, inexpensive, and sustainable.
(Albalak et al., 2024)	40 participants (crossover study, ongoing)	Sedentary vs morning/evening exercise	Assessed ISI, objective sleep quality, circadian rhythms, biomarkers, melatonin, HRV	Study will provide insights into the impact of exercise timing on sleep physiology.
(Siu et al., 2021)	320 participants	Tai chi vs traditional exercise vs control	Improved sleep efficiency and reduced awakenings in both active groups; no differences between tai chi and exercise; effects maintained for 24 months	Tai chi is a viable alternative to conventional exercise.
(Chin et al., 2022)	Several hundred participants, 5 groups	Moderate/intense walking 1–3×/week	Reduced depression (~68%) and anxiety (−54–59%); best effects at 3×/week; improved PSQI	Frequency is key - 3 weekly sessions yield the greatest benefits.

Table 2. Comparison of effectiveness of different types of physical activity in reducing insomnia severity in older adults

Type of Activity	Source(s)	Main Effects	Effect Size / Metrics	Overall Effectiveness
Aerobic exercise	(Geng et al., 2025); (Bahalayothin et al., 2025); (Sharif et al., 2015)	Improved PSQI, longer sleep duration, fewer awakenings	USMD = −4.36 (aerobic); +44% PSQI	**High**
Resistance / strength training	(Bahalayothin et al., 2025)	Largest improvement in GPSQI among all exercise types	USMD = −5.75; SUCRA = 94.6%	**Very high - highest effectiveness**
Combined training (aerobic + resistance)	(Bahalayothin et al., 2025)	Improved PSQI, less than resistance training	USMD = −2.35	**Moderate -high**
Tai Chi	(Siu et al., 2021)	Higher sleep efficiency, shorter wake after sleep onset, fewer awakenings; comparable to conventional exercise	+3.4% sleep efficiency; −13.3 min wake after sleep onset	**High**
Walking (moderate/intense)	(Chin et al., 2022); (Hartescu et al., 2016)	Improved PSQI, lower risk of insomnia; mood improvement	Depression reduction ~68%; OR insomnia = 0.67	**High, especially ≥3 sessions/week**
Low-intensity, short sessions (≤30 min)	(Li et al., 2025)	Best improvement in subjective sleep quality; U-shaped dose-response	SMD = −2.46; optimal 527 METmin/week	**High – very effective at low dose**
Traditional/mixed exercises	(Siu et al., 2021)	Improved objective sleep parameters; effects sustained 24 months	+3.5% sleep efficiency; −17 min wake after sleep onset	**High**
Morning / evening exercise (planned study)	(Albalak et al., 2024)	Assessment of broad physiological and circadian sleep parameters	Results pending	**To be evaluated**

Conclusions

An analysis of available clinical trials, meta-analyses, and review papers clearly indicates that physical activity is an effective, safe, and easily accessible form of non-pharmacological therapeutic intervention in the treatment of insomnia in older people. Physical interventions, regardless of their nature—from aerobic exercise, walking, and strength training to relaxation techniques such as tai chi—have a beneficial effect on both subjective and objective sleep quality. Meta-analyses covering large populations of seniors provide strong evidence for a reduction in sleep disturbance indicators, such as global sleep quality scores, time awake after falling asleep, sleep efficiency, and insomnia severity.

Of particular interest are the dose–response findings, which indicate that optimal effects can be achieved with a relatively low training load—short, low-intensity sessions performed several times per week. At the same time, data from comparative meta-analyses show that strength training generates the greatest improvement in sleep quality, although aerobic activity and combined training also provide clinically significant benefits. Observational studies confirm that meeting the minimum recommendations for physical activity (e.g., ≥150 minutes of walking per week) is associated with a lower risk of insomnia symptoms and beneficial long-term effects on sleep regulation. Intervention studies, including those evaluating tai chi, indicate that improvements in sleep quality can last for many months, regardless of the form of activity, provided that it is performed regularly.

As observed in the studies above, it is also emphasized that physical activity has various other beneficial effects in addition to improving sleep problems, such as reducing symptoms of anxiety and depression, improving metabolic health, and increasing physical fitness and psychophysiological well-being. It has further been asserted that physical activity interventions are particularly beneficial when used in conjunction with standard insomnia management, with minimal adverse effects in older patients.

In conclusion, it is evident that physical activity should be incorporated into insomnia prevention and treatment in older individuals. However, further studies are required to investigate different aspects of physical

activity in relation to other factors associated with sleep disturbances, particularly circadian rhythm regulation and patients' mental status. Future research could examine whether physical activity significantly influences, or differentially affects, various stages of the sleep cycle. It may also be useful for future studies to rely on objective assessments such as polysomnography or electroencephalography to determine the most appropriate type and intensity of physical activity for individuals, taking into account their physical and mental status as well as existing comorbidities.

Funding Statement: This research did not receive any funding.
Conflicts of Interest Statement: The authors declare no potential conflict of interest.

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