Environment and Social Psychology (2024) Volume 9 Issue 12
doi: 10.59429/esp.v9i12.3174

RESEARCH ARTICLE

The effects of pilates exercise on depression and sleep quality in adults: A systematic review and meta-analysis of randomized controlled trials

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ABSTRACT

Background: In recent years, Pilates has become widely popular due to its distinctive training methods, drawing substantial public interest. Studies have shown that Pilates positively influences the alleviation of depressive symptoms and the enhancement of sleep quality among adults. Yet, there has been no systematic review of these findings. Thus, this research aims to assess the effects of Pilates on adult depression and sleep quality through a comprehensive review and meta-analysis, aiming to underpin exercise prescription with solid evidence. **Methods:** We conducted a thorough search across five databases (PubMed, Web of Science, Scopus, Embase, and Cochrane Library) for randomized controlled trials (RCTs) that examine the impacts of Pilates on adult depression and sleep quality, including studies up to September 2024. The primary endpoints were changes in depression symptoms and sleep quality. We used Review Manager 5.4 and Stata 18 for statistical analysis, calculating effect sizes with standardized mean differences (SMD) and standard deviations (SD), with confidence intervals set at 95%. The quality of included studies was assessed using the Cochrane risk assessment tool. **Results:** This review included 19 studies with a total of 876 participants. All studies were deemed low risk. The meta-analysis demonstrated that Pilates training significantly reduces depression symptoms (SMD = -0.77; 95% CI: [-1.00, -0.53]; $P<0.01$) and improves sleep quality (SMD = -0.46; 95% CI: [-0.78, -0.14]; $P<0.01$).

Keywords: Pilates; Adults; Depression; Sleep Quality; Meta-analysis

1. Introduction

Recent global studies show that around 280 million people are affected by depression, making up 3.8% of the global population, with adults and the older adults (over 60 years) representing 5% and 5.7%, respectively [1]. Depression's typical symptoms include difficulty focusing, profound guilt, despair about the future, insomnia, physical exhaustion, reduced self-efficacy, and a heightened risk of suicide [2,3]. According to the World Health Organization, approximately 700,000 individuals commit suicide worldwide annually [1].

ARTICLE INFO
Received: Received: 18 October 2024 | Accepted: 30 October 2024 | Available online: 1 December 2024

CITATION
Huang YW, Sun YH, Sun XY, et al. The Effects of Pilates Exercise on Depression and Sleep Quality in Adults: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. *Environment and Social Psychology* 2024; 9(12): 3174. doi: 10.59429/esp.v9i12.3174

The increasing incidence of depression not only raises suicide rates but also places considerable strain on

individuals, families, and societal structures, hence, depression has become a pressing public health concern that demands urgent attention [3-5].

Depression arises from the interplay of social, psychological, and biological factors [1]. As societies rapidly evolve, the increased pressures of daily life and work contribute to the heightened risk of developing depression [1]. Additionally, depression is intricately linked to one's physical health. Research indicates that people with less physical activity, poor sleep, or those suffering from chronic illnesses are more prone to depression compared to the general healthy population [1, 6-8]. Sleep is recognized as a critical element influencing mental health [9], directly affecting an individual's stress levels and life quality [10]. Studies have revealed that those experiencing insomnia are over ten times more likely to suffer from depression and anxiety than those who sleep well [11]. A meta-analysis from 2011 pointed out that individuals with insomnia, who are not already depressed, have twice the risk of developing depression as those without sleep problems [12]. Thus, a significant link exists between sleep quality and the likelihood of experiencing depression and anxiety [6].

Currently, established treatments for depression encompass psychotherapy, pharmacotherapy, or their combination [1, 5, 13]. However, research shows that both psychotherapy and pharmacotherapy achieve a remission rate of only about 50% [14, 15], with the cost of psychotherapy making it less accessible to patients lacking financial means [14]. While pharmacotherapy is relatively more affordable and frequently used in clinical settings [5], it is often associated with adverse effects [16, 17]. Additionally, approximately one-third of patients with depression become resistant to various antidepressants [18]. Globally, around two-thirds of those suffering from depression do not receive effective treatment [19, 20], a figure that increases to three-quarters in economically less developed regions [21]. Clinical treatments for sleep problems encounter similar obstacles [22-28]. Thus, there is a critical need to explore additional effective treatments to ameliorate depression and sleep disorders [29-31].

Exercise is extensively advocated as an effective supplemental treatment for depression and enhancing sleep quality [32, 33]. Results from an online meta-analysis show that exercise interventions surpass antidepressants in effectiveness for reducing symptoms of depression [34]. Likewise, these interventions significantly improve sleep quality, thus decreasing the risk of depression [33]. While numerous exercise programs are available, selecting an appropriate and efficacious one is essential. Prior studies suggest that strength training is particularly beneficial for alleviating depression [34], and exercises that promote muscle relaxation and alleviate fatigue prove more effective in enhancing sleep [35].Global fitness trends reveal that resistance training, aerobic exercises, High-Intensity Interval Training(HIIT), and Pilates are highly popular [36, 37]. Studies indicate that High-Intensity Interval Training(HIIT) is effective in improving depressive symptoms and sleep quality [38, 39], but due to its high intensity and heart rate demands, it is not suitable for everyone [40]. Likewise, resistance and aerobic exercises also enhance depression and sleep quality [38, 39] and are accessible to most individuals, though their repetitive motions may lead to monotony and discontinuation [41]. Pilates training has been shown to significantly improve both depressive symptoms and sleep quality [38, 39, 42]. Compared to High-Intensity Interval Training(HIIT), resistance, and aerobic training, Pilates involves lower intensity, is suitable for all age groups, and avoids monotonous, repetitive actions, making it less likely to induce boredom. Therefore, Pilates serves as a fitting and effective alternative for those unsuitable for High-Intensity Interval Training(HIIT) or traditional aerobic and resistance training.

Pilates, created by Joseph Hubertus Pilates in 1920, is a distinctive exercise method [43]. It emphasizes the integration of body and mind with a focus on precise control of movements and postures [44]. Pilates is a widely beloved exercise option [45], and it is frequently chosen as the preferred exercise method in private

training studios around the world [37]. Studies indicate that Pilates enhances bodily balance, muscle strength, and flexibility [46, 47], providing substantial benefits to both physical and mental health [48, 49]. Curi et al. conducted a 16-week Pilates program with sessions twice weekly, finding significant relief from depressive symptoms and enhancement of sleep quality [50]. Aibar-Almazán et al. also reported that 12 weeks of Pilates training twice weekly could improve sleep quality and reduce depressive symptoms in menopausal women [51]. While Pilates is confirmed to ameliorate depressive symptoms and sleep quality [52-54], variations in the training frequency and duration across studies make it challenging to identify the most effective regimen for clinical application. A meta-analysis by Xu et al. on postmenopausal women indicated notable improvements in depression and sleep quality from Pilates, though it did not delve into variations in training frequency and duration [38]. Ju et al.'s research further highlighted the effectiveness of Pilates in treating depressive symptoms in women, especially over a 16-week period, though the study focused solely on women and lacked a thorough investigation into the effects of training frequency [42].In terms of sleep quality, a meta-analysis conducted by Chen et al. demonstrated that Pilates training effectively enhances sleep quality, yet the study did not assess variables like exercise frequency or duration [55].

Given these insights, it is essential to perform a meta-analysis on the frequency and duration of Pilates training to explore its impact on depression and sleep quality in adults. Consequently, this research, through a systematic literature review and meta-analysis, seeks to further delineate the influence of Pilates on adult depression symptoms and sleep quality, with a particular focus on the effects of training frequency and duration on the outcomes. The findings will offer clinicians a more scientific and practical foundation for Pilates exercise prescriptions.

2. Materials and methods

The design and execution of this systematic review adhered to the PRISMA guidelines [56].It has been registered in OSF (Dol:https://doi.org/10.17605/OSF.IO/HQ38P).

2.1. Literature search strategy

The search strategy was designed to retrieve studies assessing the impact of Pilates interventions on depression and anxiety symptoms among female patients. This search included the electronic databases PubMed, Web of Science, Scopus, Embase, and Cochrane Library, from their establishment until September 1, 2024. The literature search utilized a combination of the following keywords and Boolean operators: "Exercise Movement Techniques" or "Exercise Movement Technics" or "Pilates-Based Exercises" or "Exercises, Pilates-Based" and "Adult" or "Adults" or "Depression" or "Depressive Symptom" or "Sleep Quality" or "Qualities, Sleep" and "Randomized Controlled Trial" or "randomized" or "placebo". The search terms are detailed in Supplementary File S1.

2.2. Eligibility criteria (inclusion and exclusion criteria)

Inclusion criteria: (1) `Participants:` Both healthy adults and adults with illnesses. (2) `Intervention:` Pilates exercise routines. (3) `Control:` Adults who do not engage in exercise training or those receiving health education or treatment for underlying diseases. (4) `Outcome:` Depression symptoms and sleep quality will be assessed using validated scales such as the Beck Depression Inventory (BDI), General Health Questionnaire-12 (GHQ-12), Edinburgh Postnatal Depression Scale (EPDS), Calgary Depression Scale for Schizophrenia (CDSS), Hospital Anxiety and Depression Scale (HADS-D), Pittsburgh Sleep Quality Index (PSQI), Nottingham Health Profile (NHP-sleep), or other credible depression or sleep quality scales. (5) `Study Design:` Randomized Controlled Trials (RCTs).

Exclusion Criteria: (1) Conference papers, reviews, meta-analyses, abstract-only articles, animal studies, and non-RCT research; (2) Replicated studies; (3) Studies with missing data or unclear reporting; (4) Control groups that include minors or engage in other forms of exercise; (5) Non-Pilates interventions or those that combine Pilates with other types of training. This study analyzed 19 research papers, with the inclusion and exclusion process detailed in Figure 1(For specific reasons for exclusion, please refer to Supplementary File **Table 1**).

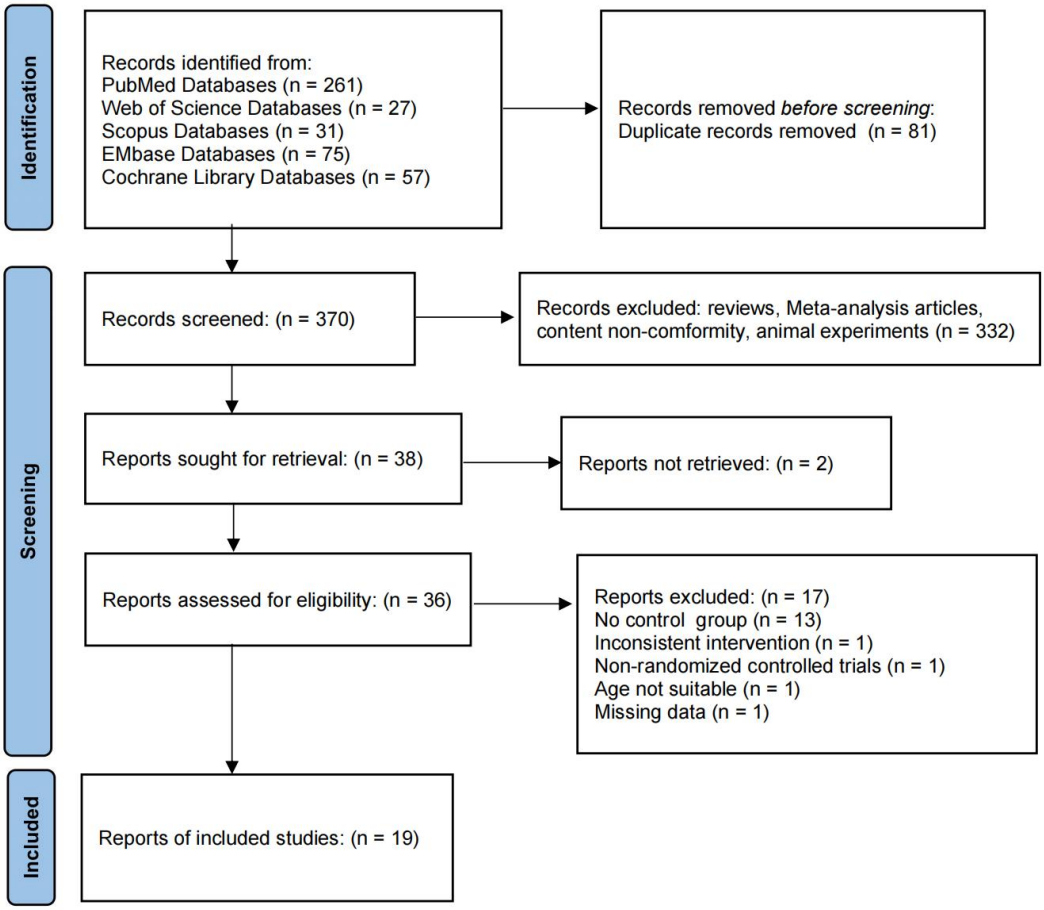

Figure 1. PRISMA flow chart for inclusion and exclusion of studies.

2.3. Data extraction

All literature retrieved from the databases was uploaded into EndNote 20 software (Thomson ResearchSoft, Stanford, CT, USA), and duplicates were subsequently removed. Two researchers (Y.H. and Y.S.) independently selected studies for inclusion based on established criteria. Initially, they screened articles by title and abstract to access the full texts of potentially eligible studies. Then, they reviewed the full texts to confirm the eligibility of these studies for final inclusion. Any discrepancies were resolved through discussions between the two primary reviewers, and if necessary, by consulting a third reviewer (X.S.) to reach a consensus.

The data extracted from the studies included: (1) Basic details of the studies, such as the name of the study, author details, and date of publication; (2) Characteristics of the participants, including sample size per group, age, gender, and health status; (3) Detailed information on the interventions, such as duration; (4) Outcome data (mean and standard deviation of indicators).

2.4. Assessment of Risk of Bias

The quality of the included studies was evaluated using the Cochrane Risk of Bias tool. Studies were assessed based on indicators classified into three categories: "low risk of bias," "high risk of bias," and "unclear risk of bias." The overall quality of the studies was judged by the number of "low risk of bias" ratings they received. Studies with four or more "low risk of bias" ratings were assigned a Grade A, those with two to three were assigned a Grade B, and those with one or none were assigned a Grade C.

2.5. Statistical Analysis

Data analysis was conducted using Review Manager 5.4 statistical software (RevMan, The Nordic Cochrane Centre, Copenhagen, Denmark) and StataMP 18 (Stata Corporation, College Station, TX). Given the variation in measurement scales across studies, standardized mean differences (SMD) and standard deviations (SD) were computed for each study's effects, utilizing a 95% confidence interval as the combined effect size metric. For studies that provided only median, interquartile range, and standard error, formulas were used to derive SMD and SD to manage heterogeneity between studies [57,58]. Heterogeneity was evaluated using the I^2 test, where I^2 values of 0-25% suggest no or low heterogeneity, 25-75% indicate moderate heterogeneity, and 75-100% suggest high heterogeneity [59]. A fixed-effect model is employed for analyses when I^2 is 0-25%, and a random-effects model is applied when I^2 is 25-75%.

3. Result

3.1. Study General Characteristics

In accordance with the PRISMA reporting guidelines, 19 trials comprising 19 groups were analyzed (**Table 1**), involving a total of 876 participants. The intervention group exclusively participated in Pilates training, whereas the control group either engaged in regular physical activities or remained inactive. Each Pilates training session lasted between 10 to 60 minutes, typically spanning 50 to 60 minutes, and sessions were held twice weekly. The interventions lasted between 6 and 16 weeks, with durations of 8 to 12 weeks being the most frequent.

3.2. Risk of Bias in the Included Articles

The quality of the included studies was evaluated using the Cochrane Risk of Bias tool. However, in randomized controlled trials involving exercise as an intervention, implementing double-blinding is challenging to some extent. Nonetheless, studies on these limitations suggest that this high-risk factor exerts minimal influence on the experimental outcomes. Overall, all included studies were assessed as low risk, as illustrated in **Figure 2**（Risk of bias summary in Supplementary **Figure S1**）.

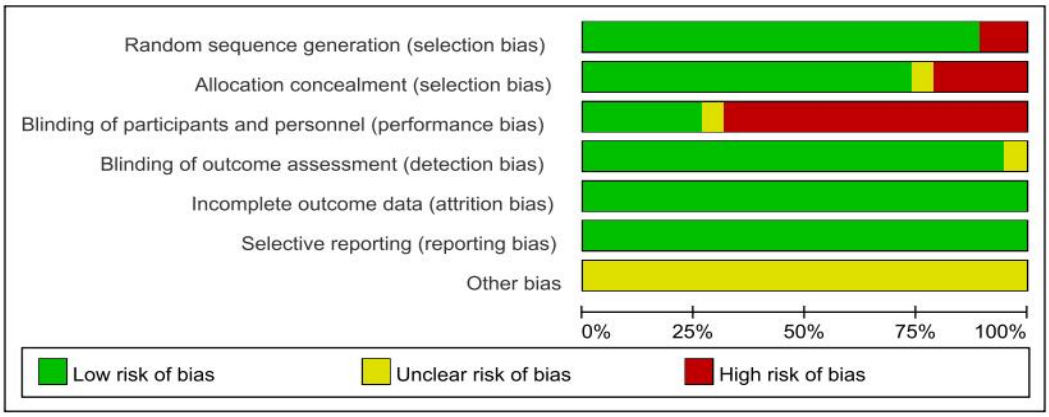

Figure 2. Risk of bias of included studies.

3.3. Meta-Analysis Results

3.3.1. Depressive

The study incorporated 16 studies from 16 publications, assessing the impact of Pilates training on depressive symptoms in adults (Figure 3), with a total sample size of 722 participants. The analysis demonstrated that Pilates training significantly reduces depressive symptoms in adults (SMD = -0.77, 95% CI: -1.00 to -0.53), with moderate heterogeneity (I^2 = 52%) and strong statistical significance ($p < 0.01$), indicating that Pilates is an effective intervention for alleviating depressive symptoms in adults.

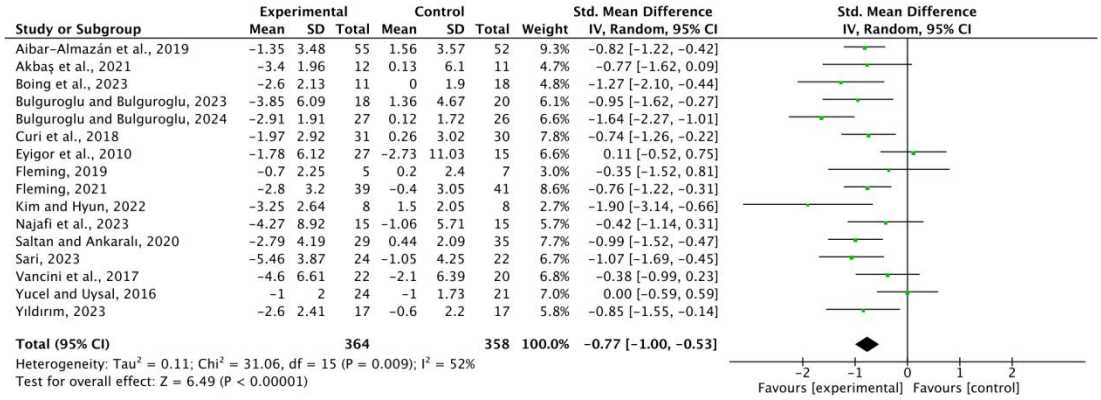

Figure 3. Forest plot of Depression of experimental and control groups.

3.3.2. Sleep Quality

The study incorporated 9 studies from 9 publications, assessing the impact of Pilates training on sleep quality in adults (Figure 4), with a total of 447 participants. The analysis revealed that Pilates training significantly enhances sleep quality in adults (SMD = -0.46, 95% CI: -0.78 to -0.14), with moderate heterogeneity (I^2 = 60%) and strong statistical significance ($p < 0.01$), indicating that Pilates is an effective intervention for improving sleep quality in adults.

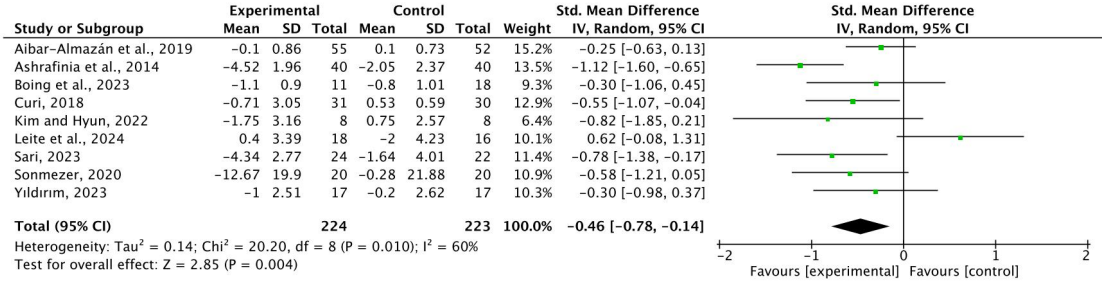

Figure 4. Forest plot of Sleep Quality of experimental and control groups.

3.4. Subgroup Analysis

Since the study included experiments with different exercise frequencies and durations, a subgroup analysis was performed based on the exercise frequency and duration reported in the original studies.

Table 1. Characteristics of study participants.

Study	Genders (Male:Female)	Sample Size		Age		Experimental Group				Control Group	Health Status	Outcome Indicators
		PT	CON	PT	CON	Interventions	PT Duration	Frequency	Duration	Interventions		
Eyigor et al. 2010	42:0	27	15	48.52±7.62	49.73±8.71	Mat Pilates	60 min	3/week	8 weeks	Breast cancer prevention activities	Breast cancer patients	BDI
Ashrafinia et al. 2014	0:80	40	40	24.6±3.6	24.4±3.6	Mat Pilates	30 min	5/week	8 weeks	Activities of daily living	Postpartum women	PSQI
Yucel and Uysal 2016	0:45	24	21	58.5±7	53.5±9	Mat Pilates	45 min	3/week	12 weeks	Medication and diet therapy	Diabetes patients	HADS-D
Vancini et al. 2017	41:13	22	20	31.1±4	31.9±4	Mat Pilates	60 min	3/week	8 weeks	No training	Overweight individuals	BDI
Curi et al. 2018	0:61	31	30	64.25±0.14	63.75±0.08	Mat Pilates	60 min	2/week	16 weeks	No training	Healthy individuals	GHQ-12,PSQI
Aibar-Almazán et al. 2019	0:107	55	52	69.98±7.83	66.79±10.14	Mat Pilates	60 min	2/week	12 weeks	Daily activities	Postmenopausal women	HADS-D,PSQI
Fleming 2019	1:11	5	7	53.8±7.95	51.3±6.8	Mat Pilates	60 min	2/week	8 weeks	Activities of daily living	Multiple sclerosis patients	HADS-D
Saltan and Ankaral 2020	10:54	29	35	18.82±1.07	19.42±1.38	Mat Pilates	NR	3/week	12 weeks	Activities of daily living	Healthy university students	BDI
Sonmezer 2020	0:40	20	20	29±2.75	28±2.1	Mat Pilates	60-70 min	2/week	8 weeks	Routine prenatal care	Pregnant women with back pain	NHP（sleep）
Akbaş et al. 2021	NR	12	11	40.4±8.39	39.12±6.68	Mat Pilates	40-50 min	2/week	6 weeks	Individual activities	Schizophrenia patients	CDSS
Fleming 2021	11:69	39	41	47.4±10.2	46.7±10	Mat Pilates	NR	2/week	8 weeks	Activities of daily living	Multiple sclerosis patients	HADS-D
Kim and Hyun 2022	0:16	8	8	39.71±2.01	38.14±1.39	Mat Pilates	50 min	2/week	8 weeks	No training	Pregnant women	EPDS,PSQI
Boing et al. 2023	0:29	11	18	54.3±10.4	56.8±11.2	Mat Pilates	60 min	3/week	16 weeks	Educational meetings	Breast cancer patients	BDI,PSQI
Bulguroglu 2023	NR	18	20	26-33	24-32	Mat Pilates	60 min	3/week	8 weeks	Breathing and relaxation training	Healthy university students	BDI
Najafi et al. 2023	0:30	15	15	36.20±4.33	40.4 ± 5.35	Mat Pilates	60 min	3/week	8 weeks	Activities of daily living	Multiple sclerosis patients	BDI
Sari 2023	1:45	24	22	42.46±14.99	41.96±10.62	Mat Pilates	10 min	2/week	8 weeks	Home exercise	Multiple sclerosis patients	HADS-D, PSQI
Yıldırım 2023	0:34	17	17	30.8±7	28.8±5.6	Mat Pilates	60 min	2/week	12 weeks	Routine prenatal care	Pregnant women with back pain	HADS-D, PSQI
Bulguroglu 2024	0:53	27	26	25-31	27-30	Mat Pilates	50 min	2/week	8 weeks	Breathing and relaxation training	Pregnant women	EPDS
Leite et al. 2024	0:34	18	16	55.29±10.93	55.29±10.93	Mat Pilates	60 min	3/week	16 weeks	Activities of daily living	Breast cancer patients	PSQI

Attention: *PT= Pilates training; NR = Not Reported; BDI = Beck Depression Inventory; HADS-D = Hospital Anxiety and Depression Scale; GHQ-12 = General Health Questionnaire-12; EPDS = Edinburgh Postnatal Depression Scale; CDSS = Calgary Depression Scale for Schizophrenia; PSQI = Pittsburgh Sleep Quality Index; NHP-sleep = Nottingham Health Profile.*

3.4.1. Impact of Exercise Frequency on Depression

The subgroup analysis on the impact of exercise frequency on depression (**Figure 5**) revealed that both twice-weekly Pilates sessions (SMD = -0.93, 95% CI = [-1.17, -0.7]) and thrice-weekly sessions (SMD = -0.54, 95% CI = [-0.92, -0.15]) significantly reduced depressive symptoms in adults. However, the results suggest that twice-weekly Pilates sessions may have a more pronounced effect.

3.4.2. Impact of Exercise Duration on Depression

The subgroup analysis of exercise duration on depression (**Figure 6**) indicated that 6 weeks of Pilates training (SMD = -0.77, 95% CI = [-1.62, 0.09]) did not result in a significant reduction in depressive symptoms. However, Pilates training over 8 weeks (SMD = -0.78, 95% CI = [-1.16, -0.4]), 12 weeks (SMD = -0.68, 95% CI = [-1.09, -0.26]), and 16 weeks (SMD = -0.9, 95% CI = [-1.38, -0.43]) all significantly alleviated depressive symptoms in adults. Among these, 16 weeks of Pilates training showed the most pronounced effect.

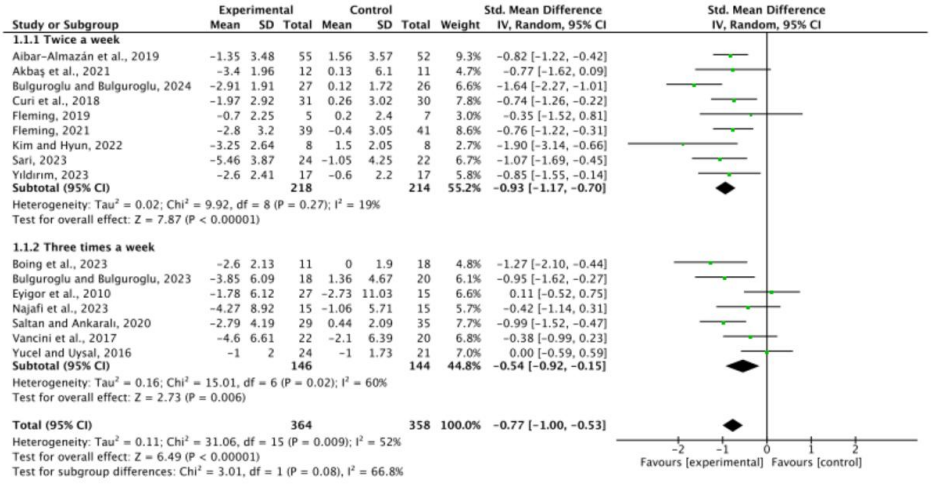

Figure 5. Forest plot of the effect of exercise frequency on depression.

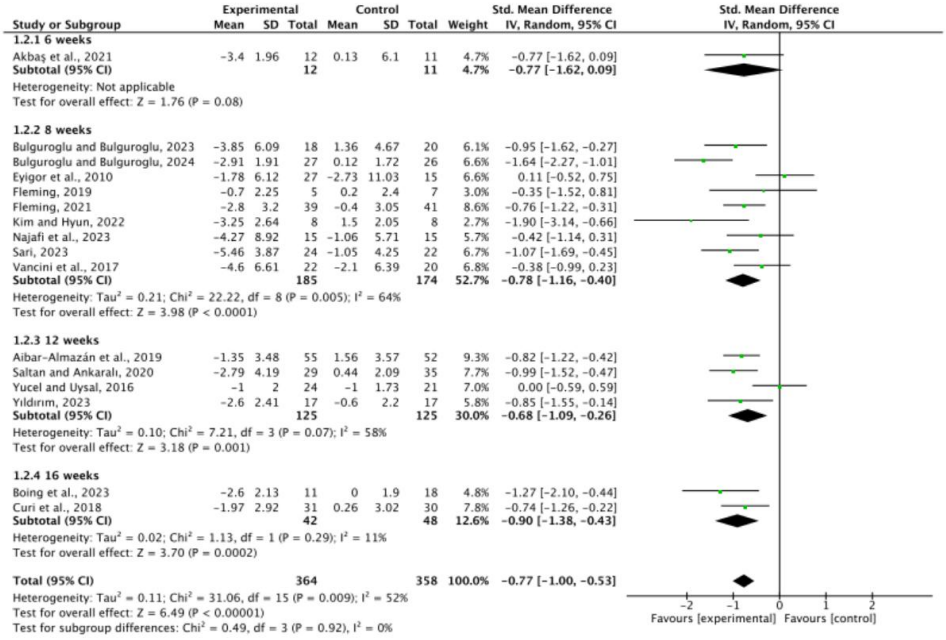

Figure 6. Forest plot of the effect of exercise duration on depression.

3.4.3. Impact of Exercise Frequency on Sleep Quality

The subgroup analysis on the effect of exercise frequency on sleep quality (**Figure 7**) indicated that three sessions of Pilates per week (SMD = 0.17, 95% CI = [-0.73, 1.07]) did not result in significant improvements in sleep quality. However, two sessions per week (SMD = -0.46, 95% CI = [-0.69, -0.23]) and five sessions per week (SMD = -1.12, 95% CI = [-1.6, -0.65]) both significantly enhanced sleep quality in adults. The most pronounced effect was observed with five sessions per week.

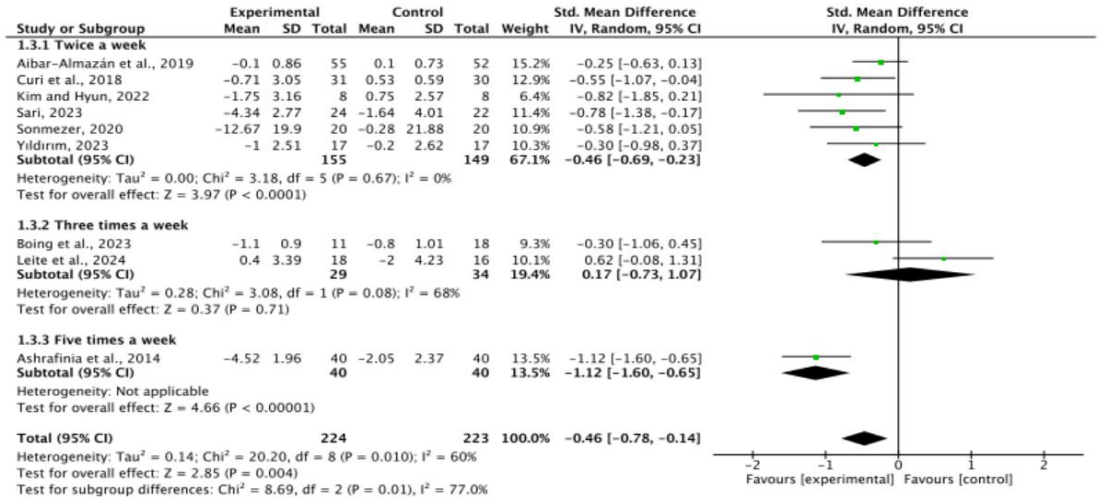

Figure 7. Forest plot of the effect of exercise frequency on sleep quality.

3.4.4. Impact of Exercise Duration on Sleep Quality

The subgroup analysis on the effect of exercise duration on sleep quality (**Figure 8**) indicated that 12 weeks (SMD = -0.26, 95% CI = [-0.59, 0.07]) and 16 weeks (SMD = -0.1, 95% CI = [-0.81, 0.61]) of Pilates training did not significantly enhance sleep quality. However, 8 weeks of Pilates training (SMD = -0.88, 95% CI = [-1.19, -0.57]) significantly improved sleep quality in adults.

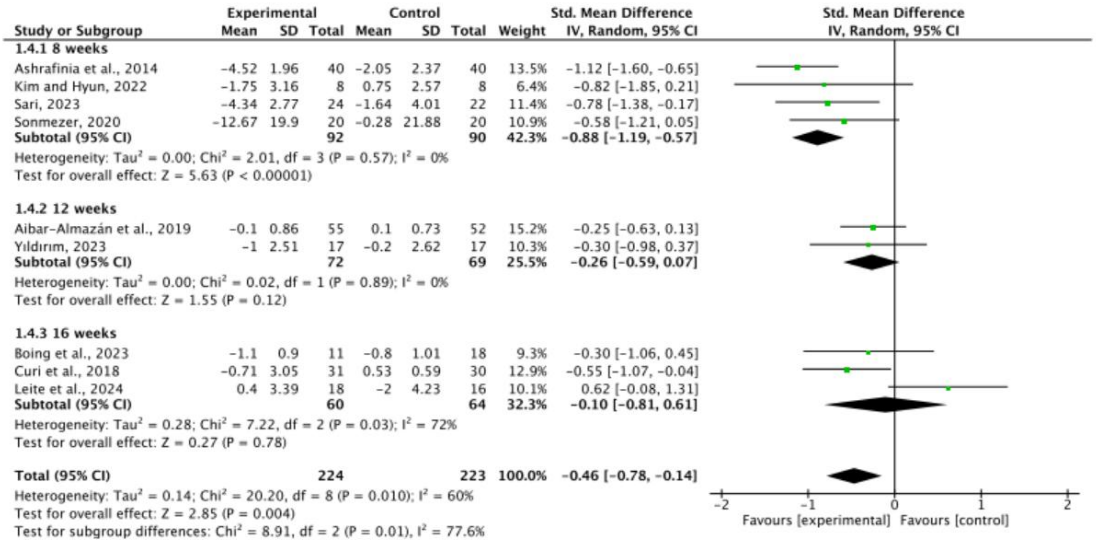

Figure 8. Forest plot of the effect of exercise duration on sleep quality.

3.5. Analysis of publication bias

The funnel plot displays symmetry, suggesting a low risk of bias (Supplementary Figure S2).

3.6. Sensitivity analysis

This study undertook a sensitivity analysis using effect sizes (ES). Given the moderate heterogeneity observed in the 16 studies on the impact of Pilates training on adult depression (I^2 = 52%, P = 0.09), a sensitivity analysis was necessary. Likewise, the 9 studies on Pilates training affecting adult sleep quality showed moderate heterogeneity (I^2 = 60%, P = 0.01), leading to sensitivity analyses to confirm data stability and precision. The results revealed that the effect sizes from each study closely matched the central line. Excluding any individual studies did not change the combined effect size or the relationship between Pilates training and both depression and sleep quality, indicating strong stability in the meta-analysis findings. The sensitivity analysis results for depression and sleep quality are illustrated in Supplementary Figure S3 and Figure S4.

4. Discussion

This research employed systematic reviews and meta-analyses to examine the effects of Pilates exercises on depression and sleep quality among adults, with the goal of identifying suitable exercise prescriptions for this population. Among the 19 randomized controlled trials reviewed, findings indicate that Pilates exercises help reduce depressive symptoms and enhance sleep quality in adults. Specifically, 16 trials focused on depression as an outcome measure, while 9 trials assessed sleep quality outcomes.

4.1. Depression

Depression is a prevalent mental health disorder [1] that significantly impacts the well-being of adults, prompting increasing focus from medical professionals on effective mitigation strategies. Beyond traditional medication, physical activity is extensively utilized to enhance depressive symptoms [32]. Exercises such as resistance training, aerobic workouts, High-Intensity Interval Training(HIIT), yoga, and Pilates are frequently selected [36,37]. Noetel et al. reported that aerobic exercises, strength training, and yoga notably improve depressive symptoms in adults [34]. Similarly, Tao et al.'s study on the impacts of High-Intensity Interval Training(HIIT) on depression showed that High-Intensity Interval Training(HIIT) contributes to improvements [60]. Pilates, akin to yoga, also significantly ameliorates depressive symptoms. Meta-analyses by Xu et al [38], Ju et al [42], and Fleming et al [61] confirm that Pilates effectively eases depressive symptoms, aligning with the conclusions of this study.

Pilates is increasingly utilized for its ability to enhance both mental health and physical stability, expanding its application in improving physical fitness [62]. Studies by Akbaş et al [63] indicate that Pilates exercises significantly boost physical and mental health in individuals with schizophrenia. Similarly, Eyigor et al [64] have demonstrated significant benefits of Pilates in enhancing physical function, flexibility, fatigue management, depression, and overall quality of life for breast cancer patients. These findings highlight Pilates' efficacy in treating depression. The antidepressant effects of Pilates may be linked to the activation of the AMPK signaling pathway post-exercise, triggering the release of endorphinase [56], an enzyme that regulates mood and induces relaxation [65], and enhances immune function by releasing endorphins, thus alleviating mental stress [66]. Pilates is distinct from other exercises in its low intensity and prolonged duration [56], fitting the endorphin release criteria. Furthermore, Pilates is typically performed in group settings, facilitating social interaction and support during sessions, which contributes to mental health improvement [56].

4.2. Sleep Quality

Sleep quality is an essential indicator of how well individuals sleep, directly influencing their quality of life and physical health [68]. A web-based meta-analysis conducted by Xie et al. revealed that activities like Pilates, yoga, and traditional Chinese martial arts significantly enhance sleep quality in adults [39]. Makhfudli et al. demonstrated that Pilates effectively improves sleep quality in elderly individuals [69]. Likewise, Persaki et al. found that Pilates significantly betters sleep quality in menopausal women [70], corroborating the results of this study. In general, various exercises have a positive impact on sleep as they stimulate the sympathetic nervous system and reduce cortisol levels [71-73]. Furthermore, exercise aids in initiating sleep by managing core body temperature and facilitating heat dissipation [74-76]. Previous research has shown that high-intensity and high-energy exercises, such as High-Intensity Interval Training (HIIT), are particularly effective in enhancing sleep quality, notably HIIT [39].Although High-Intensity Interval Training (HIIT) contributes to better sleep quality, its impact is not as pronounced as Pilates [39]. For some, HIIT may be overly stimulating and not suitable for everyone [40]. Conversely, Pilates is a low-intensity exercise with longer sessions [42], utilizing breathing and body control techniques to alleviate mental stress and enhance sleep [39]. Pilates training focuses on breathing and meditation, impacting brain functionality and positively influencing the autonomic nervous system, thus promoting better sleep [77]. Consequently, Pilates is an effective choice for adults seeking to improve their sleep quality.

In summary, Pilates has unique advantages over other forms of exercise in promoting improvements in depressive symptoms and sleep quality in adults. However, this study has some limitations. Firstly, it included all populations without conducting subgroup analyses for specific groups, covering a wide age range, and the gender analysis was not detailed. Future research should perform more detailed analyses based on age, gender, and health conditions, which would help provide more precise guidance for physicians when prescribing Pilates exercises.

5. Conclusions

Pilates is an effective exercise modality for alleviating depressive symptoms and enhancing sleep quality in adults, thereby improving their overall physical and mental well-being and reducing negative emotions. Based on current research findings, for depression, Pilates sessions held twice weekly for 16 weeks are most effective. In contrast, to significantly improve sleep quality, Pilates sessions five times weekly over an 8-week period are recommended.

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