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REVIEW ARTICLE

Can Pilates Straighten the Curve? A Systematic Review of Pilates in Scoliosis Therapy

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ABSTRACT

Background: Scoliosis is a three-dimensional spinal and trunk deformity affecting 0.93% to 12% of the global population. As a progressive musculoskeletal condition, it impairs mobility and reduces quality of life.

Objectives: Recent studies suggest that Pilates, which is increasingly popular amongst a wide range of people, may improve postural control, spinal flexibility, muscular balance, and pain levels in individuals with scoliosis. However, the evidence remains scattered across studies with varying designs, populations, outcome measures, and intervention protocols. As interest in integrating Pilates into clinical rehabilitation grows, a comprehensive synthesis of the current evidence is needed to assess its effectiveness, limitations, and clinical applicability. Aim: This study aimed to systematically review the current literature to determine the efficacy of Pilates as a therapeutic intervention for scoliosis.

Methods: Following PRISMA guidelines and being registered in PROSPERO, a systematic search was conducted in Scopus, PubMed, Cochrane, and Springer databases to search for published articles from 2005 to 2025 to identify articles that met the inclusion criteria. Keywords were determined as "scoliosis" and "Pilates." Risk of bias and study quality was evaluated with the PEDro Scale.

Results: A total of 6 randomized controlled trials studies involving 201 participants with idiopathic or functional scoliosis were included. Most studies reported improvements in Cobb angle and angle of trunk rotation after Pilates-based interventions ranging from 8 to 12 weeks. Functional outcomes such as pain reduction were also noticed, though long-term effects remain under-researched.

Conclusions: Pilates appears to offer potential benefits as a conservative intervention for scoliosis by improving posture and pain. However, current evidence is limited by heterogeneity in intervention protocols and outcome measures. Further high-quality, large-scale studies are warranted to confirm the therapeutic value of Pilates in scoliosis management and to establish standardized intervention guidelines.

***Keywords*:** *Pilates, scoliosis, posture, mobility*

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INTRODUCTION

Postural disorders have emerged as one of the most prevalent yet frequently underestimated global health issues. These conditions are typically characterized by deviations from optimal body alignment, impairing the body's capacity to sustain normal physiological functions in an upright position. Postural alignment demonstrates substantial variability, influenced by factors such as age, sex, somatic growth, environmental conditions, and the individual's psychophysical status.[1]

Scoliosis is defined as a three-dimensional torsional deformity of the spine and trunk, broadly classified into structural and nonstructural types with approximately 80% of cases classified as idiopathic in origin. Structural scoliosis is due to spinal abnormalities, while nonstructural scoliosis results from extra-spinal factors such as leg length discrepancy, pelvic asymmetry, and paraspinal muscle imbalance. Leg length inequality and muscle spasms are common causes of the nonstructural form. In nonstructural scoliosis, pelvic tilt from leg length differences may lead to compensatory spinal curvature as the body adjusts to maintain balance. Idiopathic scoliosis refers to spinal curvature without a known cause and is not linked to congenital, neuromuscular, or syndromic conditions. Diagnosis is typically confirmed through a standing anteroposterior radiograph demonstrating a Cobb angle greater than 10 degrees. Global prevalence estimates of scoliosis in the general population range from 0.93% to 12%. As a progressive condition, scoliosis can negatively impact spinal alignment, trunk mobility, and postural symmetry, leading to diminished quality of life. In more advanced cases, it may contribute to respiratory dysfunction and has also been associated with psychological distress.[11,2,3]

Various therapeutic modalities have been proposed for the management of scoliosis, each offering distinct perspectives. Recently, exercise therapy has emerged as a validated conservative treatment approach, with evidence supporting its efficacy. The primary objective of conservative management is to halt the progression of spinal curvature. Emerging research has demonstrated that Pilates-based exercise interventions, which is increasingly popular amongst a wide range of people, can lead to significant improvements in postural control, spinal flexibility, muscular balance, and pain levels in individuals with scoliosis[4]. However, the evidence remains scattered across studies with varying designs, populations, outcome measures, and intervention protocols. As interest in integrating Pilates into clinical rehabilitation grows, a comprehensive synthesis of the current evidence is needed to assess its effectiveness, limitations, and clinical applicability. This study aimed to systematically review the current literature to determine the efficacy of Pilates as a therapeutic intervention for scoliosis.

METHODS

Protocol and registration

This study was registered using the International Prospective Register of Systematic Reviews PROSPERO (https://www.crd.york.ac.uk/PROSPERO/view/CRD420251114397)

Search Strategy

A search was carried out in the databases Scopus, PubMed, Cochrane, and Springer. The search strategy was constrained to the period from January 2005 to July 2025. Only articles written in English were included. The search strategy used was as follows: (scoliosis [MeSH Terms] OR scoliosis [Title/Abstract]) AND (pilates [MeSH Terms] OR pilates [Title/Abstract]. We employed comparable search terms or synonymous terms in alternative databases. This systematic review was conducted in accordance with the Preferred Reporting Items in Systematic Reviews and Meta-Analyses (PRISMA) Statement.

Study Selection and Criteria

The studies were chosen according to predetermined criteria for inclusion and exclusion after searching through the databases. Initially, the identification of studies relied on screening titles and abstracts, which was followed by full-text evaluation and the eventual inclusion of studies. Three reviewers conducted the screening process for the articles. Criteria for inclusion and exclusion were based on the PICOS format. For the population criterion, individuals who were diagnosed with scoliosis and did not have any other concomitant disease were included, regardless of gender and age. Studies including radiologically diagnosed cases were enrolled in this systematic review. The interventions included were using a Pilates training program (Pilates, mat Pilates, other Pilates training programs). Studies performed before or after surgical intervention were excluded.

Studies including surgical and post-surgical interventions were excluded. The outcome of our interest included any measurement method that evaluates scoliosis, spine, deformity, or posture. Only randomized controlled trials (RCTs) were examined for this study. A limitation was placed by including only English language studies published from January 2005 to July 2025

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Table 1. Inclusion and exclusion criteria were based on the PICOS model

	Inclusion	**Exclusion**
Population	Scoliosis, regardless of gender and age	Having any other concomitant disease
Intervention	Pilates, Mat Pilates, or a Pilates training program	Intervention did not involve Pilates
Comparator	Any comparator	Surgery Pre/post-operation interventions
Outcome	Any measurement method that evaluates scoliosis, spine, or deformity	
Study	RCT	Non-randomized study Qualitative study Review Analytical study Protocol
Language	English	Non-English
Year	2005–Present	Before 2005

Data Extraction and Data Synthesis

After reviewing all of the final included studies, data extraction was performed in Microsoft Excel independently by two researchers. The potential for bias in the included studies was assessed utilizing the second iteration of the Risk of Bias tool (RoB 2). The evaluation of bias risk in the included studies was conducted by two researchers. The researchers conducted a thorough analysis of each assessment domain, addressing any discrepancies through the consultation of a third researcher. The evaluation encompassed several critical dimensions: the process of randomization, deviations from the intended interventions, the handling of missing outcome data, the measurement of outcomes, the selection of reported results, and an overarching assessment of bias. However, a reliability assessment of the studies was made using the PEDro scale. After data extraction, narrative synthesis was conducted. Heterogeneity tests and meta-analysis of the studies were not performed.

RESULTS

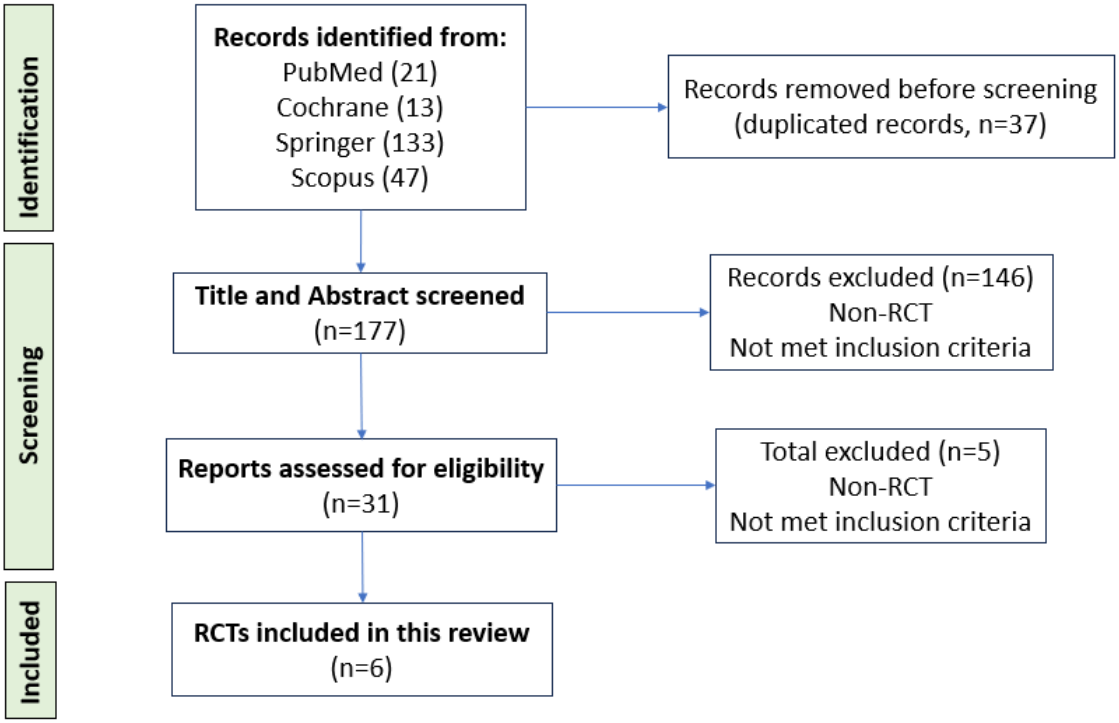

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) 2020 flow diagram of the systematic review screening process.

Table 2. PEDro scale

Author	1	2	3	4	5	6	7	8	9	10	11	Total 2-11/10
Kisa et al., 2023	Y	Y	N	N	N	N	N	Y	N	Y	Y	5
Manzak Dursun et al., 2024	Y	Y	N	Y	N	N	Y	Y	N	Y	Y	7
Araujo et al., 2011	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	9
Park et al., 2014	Y	Y	Y	Y	N	N	N	Y	Y	Y	Y	8
Kim et al., 2016	Y	Y	Y	Y	N	N	N	Y	Y	Y	Y	8
Özden et al., 2023	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	11

NOTE. Item score: 1, meets criteria; 0, does not meet criteria; Criteria: 1, eligibility criteria; 2, random allocation; 3, concealed allocation; 4, baseline comparability; 5, blind subjects; 6, blind therapists; 7, blind assessors; 8, adequate follow-up; 9, intention to treat analysis; 10, between group comparisons; 11, point estimates and variability.

Table 3. Population, intervention, and outcome

Author	Populations	Intervention					Outcome
		Age, y	Sex	Duration	Frequency	Study Design	
Kisa et al., 2023	50	11,58±3,62 years	M/F	24 weeks	N/A	RCT	Cobb angle ATR Center of force mass (CoM) displacement Maximum pressure
Manzak Dursun et al., 2024	32	10–18	M/F	12 weeks	every day	RCT	ATR Pulmonary functions Respiratory muscle strength Exercise capacity
Araujo et al., 2011	31	18-25	F	12 weeks	twice a week for 60 min per session	RCT	Cobb angle Range of motion of trunk flexion Pain
Park et al., 2014	31	20s-30s	M/F	8 weeks	Three times a week for 60 min per session	RCT	Degree of spinal curvature ALLD ROM in the TMJ Deviation of TMJ
Kim et al., 2016	24	15.6 ± 1.1 years	F	12 weeks	Three times a week for 60 min per session	RCT	Cobb angle Weight distribution
Özden et al., 2023	34	15-30	M/F	8 weeks	twice a week for 60 min per session	RCT	ATR Cobb angle Posture assessment Pain

DISCUSSION

This systematic review synthesized available evidence on the effectiveness of Pilates-based interventions for scoliosis, incorporating both randomized controlled trials (RCTs) and quasi-experimental designs. Across the included studies, Pilates was delivered either as the primary treatment or in comparison with other exercise modalities, including scoliosis-specific three-dimensional (3D) approaches such as Schroth and SEAS, conventional therapeutic exercise, or no intervention. The review examined outcomes spanning radiographic indices, functional performance, and patient-reported measures.

Overall, the evidence suggests that Pilates may contribute to reductions in Cobb angle and angle of trunk rotation (ATR), although the magnitude of change was generally modest. Araujo et al. (2011) reported significant reductions in Cobb angle, alongside notable improvements in flexibility and pain, with between-group differences favoring Pilates most strongly for functional rather than radiographic

outcomes. Similarly, Başaran Özden and Kuru Çolak (2023) found significant gains in posture and pain, although their study lacked radiographic measures, limiting conclusions regarding structural changes. In pediatric cohorts, Pilates produced reductions in Cobb angle and ATR comparable to 3D scoliosis-specific exercises, suggesting potential utility as an alternative intervention in certain contexts. Nevertheless, the modest curve corrections observed align with prior findings that exercise may be more effective in slowing progression than in reversing established deformities.

Functional improvements were reported more consistently than structural ones. Several studies documented gains in flexibility, trunk muscle endurance, and postural alignment. Both Araujo et al. and Kim et al. (2016) noted improvements in balance and weight distribution symmetry. In pediatric populations, enhancements in gait parameters, such as reduced center of mass displacement, were observed, suggesting that Pilates may positively influence functional stability. These benefits are plausibly explained by the Pilates emphasis on core strengthening, proprioceptive awareness, and postural control—mechanisms directly relevant to scoliosis rehabilitation.

Comparisons with scoliosis-specific 3D methods remain limited. Kim et al. reported comparable improvements between Schroth and Pilates in terms of Cobb angle reduction and weight distribution, without significant between-group differences. This finding implies that Pilates may achieve outcomes similar to specialized scoliosis programs in some domains. However, 3D-specific methods retain a theoretical advantage due to their targeted focus on spinal derotation and three-dimensional correction. Pilates may therefore be best conceptualized as complementary rather than replacement therapy, with potential to enhance adherence and engagement, particularly in younger populations who may benefit from its accessible and adaptable format.

Despite encouraging findings, several methodological limitations temper the strength of current evidence. Although some studies described adequate randomization and allocation concealment, others failed to detail these procedures, introducing uncertainty regarding selection bias. Blinding was seldom applied; while participant blinding is impractical in exercise interventions, assessor blinding for objective outcomes such as Cobb angle was often absent, raising concerns of measurement bias. None of the included studies reported pre-registered protocols, leaving the risk of selective outcome reporting. Small sample sizes (typically 24–50 participants) further limited statistical power, while variability in control conditions—from no treatment to structured alternative exercise programs—complicated cross-study comparisons. Furthermore, intervention durations were generally short (6–12 weeks), with a lack of long-term follow-up to assess sustained effects or curve progression.

Taking together, these findings suggest that Pilates may offer short-term benefits in posture, flexibility, trunk balance, and pain reduction in individuals with scoliosis. Effects on Cobb angle appear comparable to those of certain scoliosis-specific exercise methods, though modest and of uncertain clinical significance. Given its accessibility, adaptability, and potential to improve adherence, Pilates may be particularly valuable in clinical settings lacking access to specialized scoliosis programs. However, its role in structural correction, particularly among skeletally immature patients at high risk of progression, remains unclear.

Future research should prioritize rigorously designed, adequately powered RCTs incorporating standardized radiographic and functional outcome measures, assessor blinding, and pre-registered protocols. Longer follow-up is also essential to evaluate the durability of treatment effects and the impact on curve progression. Such methodological advancements are critical to clarify whether Pilates can be recommended as a primary intervention or whether it should remain an adjunctive therapy within a broader scoliosis management framework.

CONCLUSIONS

Pilates demonstrates potential as a conservative therapeutic option for individuals with scoliosis, particularly in improving posture, flexibility, and pain outcomes. Nevertheless, the available evidence is constrained by small sample sizes, heterogeneous intervention protocols, and variability in outcome measures. To establish the clinical efficacy of Pilates and its role within scoliosis management, further large-scale, methodologically rigorous trials are required. Standardization of intervention protocols and outcome assessments will be essential for drawing more definitive conclusions and developing evidence-based clinical guidelines.

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