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Effects of Yoga on Depression and Anxiety in Patients with Musculoskeletal Disorders: A Systematic Review and Meta-Analysis

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ABSTRACT

Background: Musculoskeletal disorders (MSDs) are a major cause of disability and are often accompanied by depression and anxiety, which may worsen pain and limit rehabilitation outcomes. Yoga, as a mind–body intervention, may provide both physical and psychological benefits; however, evidence regarding its effectiveness in MSD populations remains inconsistent.

Methods: This systematic review and meta-analysis followed the PRISMA 2020 guidelines. Randomized controlled trials evaluating the effects of yoga on depression and/or anxiety in adults with musculoskeletal disorders were identified from PubMed/MEDLINE, Scopus, Cochrane Library, and CINAHL (January 2012–December 2025). A random-effects model was applied, and effect sizes were reported as mean differences or standardized mean differences with 95% confidence intervals. Risk of bias was assessed using the Cochrane Risk of Bias Tool.

Results: Ten RCTs involving 1.063 participants were included. Yoga significantly improved depressive symptoms compared with control groups (MD = 1.19; 95% CI: 0.26–2.13; p = 0.01; I^2 = 61%) and significantly reduced anxiety (MD = 4.09; 95% CI: 0.64–7.54; p = 0.02; I^2 = 96%). Overall study quality ranged from low to moderate, mainly due to limited blinding.

Conclusions: Yoga is associated with significant reductions in depression and anxiety among patients with musculoskeletal disorders. Despite substantial heterogeneity, yoga may be considered a complementary intervention within holistic musculoskeletal rehabilitation. Further high-quality trials with standardized protocols are required.

Background

Musculoskeletal disorders (MSDs) are among the leading causes of disability and reduced quality of life worldwide. These conditions encompass a wide range of chronic disorders, including osteoarthritis, low back pain, neck pain, and other musculoskeletal conditions, which are commonly characterized by persistent pain, functional limitations, and reduced ability to perform activities of daily living. Beyond their physical impact, individuals with MSDs are at a substantially increased risk of psychological comorbidities, particularly depression and anxiety. These psychological conditions may exacerbate pain perception, reduce treatment adherence, and hinder rehabilitation processes and functional recovery (Amell & Kumar, 2001; da Costa & Vieira, 2010).

The relationship between musculoskeletal disorders and psychological distress is bidirectional. Chronic pain and movement limitations may precipitate psychological stress, depression, and anxiety, while negative psychological states can heighten pain sensitivity, worsen musculoskeletal dysfunction, and prolong symptom duration. Consequently, comprehensive management of MSDs should not be limited to biomechanical and pharmacological approaches but should also incorporate interventions that simultaneously address psychological dimensions of the condition (del Campo et al., 2017; Heikkinen et al., 2019).

In recent decades, non-pharmacological mind–body interventions have gained increasing attention in the management of musculoskeletal disorders. Yoga, as a prominent mind–body practice, integrates physical postures (asanas), breathing techniques (pranayama), and meditation or mindfulness components, which together may confer benefits to both physical and psychological health. Several biological and psychological mechanisms have been proposed to explain the effects of yoga, including modulation of the autonomic nervous system, attenuation of hypothalamic–pituitary–adrenal (HPA) axis activity, enhanced emotional regulation, and improved coping with stress and chronic pain (Curtin & Norris, 2017; Riley & Park, 2015).

A growing number of randomized controlled trials (RCTs) have examined the effectiveness of yoga interventions in patients with musculoskeletal disorders, reporting promising effects on depressive and anxiety symptoms. However, findings across studies remain heterogeneous, likely due to variations in yoga styles, intervention duration and intensity, patient characteristics, control conditions, and the psychological outcome measures employed. Moreover, several studies have been limited by relatively small sample sizes, which may reduce statistical power and limit the generalizability of their findings.

Although previous systematic reviews have explored the benefits of yoga for musculoskeletal conditions or mental health outcomes more broadly, comprehensive meta-analyses specifically focusing on the effects of yoga on depression and anxiety among patients with musculoskeletal disorders, based exclusively on RCT evidence, remain scarce. Addressing this evidence gap is particularly important given the high prevalence of psychological comorbidities in MSD populations and the increasing emphasis on non-pharmacological interventions in evidence-based clinical practice.

Therefore, the present meta-analysis aims to systematically synthesize evidence from randomized controlled trials examining the effects of yoga interventions on depression and anxiety in patients with musculoskeletal disorders. The findings are expected to provide a more robust and integrated assessment of yoga as a complementary intervention and to inform clinical decision-making and the development of more holistic rehabilitation guidelines for individuals with musculoskeletal disorders.

Materials and Methods

This systematic review was conducted in accordance with the most recent Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al., 2021). The review protocol was developed with reference to the PRISMA 2020 checklist.

- **Search Strategy**

A comprehensive literature search was performed using both Medical Subject Headings (MeSH) terms and free-text keywords. The primary search terms included *"musculoskeletal disorder," "yoga," "depression,"* and *"anxiety."* Electronic databases searched comprised PubMed/MEDLINE, Scopus, the Cochrane Library, and CINAHL, covering the period from January 2012 to December 2025.

- **Study Selection**

Study selection was conducted independently by two reviewers through a multi-stage screening process. Initially, titles and abstracts of all retrieved records were screened to exclude studies that were clearly irrelevant to the study objectives. Subsequently, full-text articles

that met the preliminary criteria were independently assessed by both reviewers for eligibility based on predefined inclusion and exclusion criteria. Any disagreements between the reviewers were resolved through discussion and consensus. If consensus could not be achieved, a third reviewer was consulted to facilitate resolution. Final decisions regarding study inclusion were made following thorough discussion and mutual agreement.

Inclusion criteria were as follows: studies involving patients with clinically diagnosed musculoskeletal disorders, such as osteoarthritis or other chronic musculoskeletal conditions, adult participants of either sex, participants experiencing psychological symptoms, specifically depression and/or anxiety, yoga as the primary intervention, including variations such as Hatha Yoga, Integrated Yoga, Medical Yoga, or yoga combined with mindfulness, randomized controlled trial (RCT) design, studies published in peer-reviewed, indexed scientific journals, availability of full-text articles; and publications written in English.

Exclusion criteria included: studies involving participants with severe comorbid conditions, such as cancer or major neurological disorders, interventions not involving yoga or not positioning yoga as the main component, non-clinical studies, animal studies, or laboratory-based research, observational study designs without intervention (e.g., cross-sectional, cohort, or case–control studies), systematic reviews, meta-analyses, editorials, commentaries, protocols, or theses not subjected to peer review, studies lacking required quantitative data (e.g., mean, standard deviation, or confidence intervals), studies with non-extractable data for meta-analysis; non-English publications, duplicate records, or articles without accessible full texts.

- **Data Extraction**

Data extraction was independently performed by two authors using a standardized data extraction form. Extracted information included first author name, year of publication, country of study, study design, and study and participant characteristics, such as mean age, sex distribution, and sample size in the intervention and control groups.

Detailed information regarding intervention characteristics was also extracted, including the type and variation of yoga, control group characteristics, intervention duration and frequency, and follow-up period. Data on the primary outcomes depression and anxiety were collected based on validated assessment instruments used in each study, such as the PHQ-9, PHQ-8, HADS, CES-D, DASS, and STAI.

For meta-analytic purposes, mean values, standard deviations (SDs), and sample sizes for both intervention and control groups were extracted at relevant time points. When available, 95% confidence intervals (95% CIs) and additional data required for effect size calculation were also recorded. Information related to methodological quality and risk-of-bias domains was systematically extracted in accordance with the applied assessment framework. In cases of incomplete or unclear data, full texts and supplementary materials were re-examined to ensure accuracy and completeness. Any discrepancies during data extraction were resolved through discussion and consensus, with involvement of a third author when necessary.

- **Study quality and risk of bias assessment**

Methodological quality and risk of bias were independently assessed by two reviewers using the criteria recommended in the Cochrane Handbook for Systematic Reviews of Interventions. Disagreements were resolved through discussion, and a third reviewer was consulted if consensus could not be reached.

Risk of bias was evaluated across the following domains: random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, selective reporting; and other sources of bias.

Each domain was categorized as low risk, high risk, or unclear risk according to Cochrane criteria. Justifications for each judgment were systematically documented based on the information reported in the included studies.

Risk-of-bias assessments were summarized and visualized using Review Manager (RevMan) version 5.3, providing an overall overview of the methodological quality of the included studies.

- **Data Analysis**

All statistical analyses were performed using Review Manager (RevMan) version 5.3 (DerSimonian & Laird, 1986), Given the variability in study design, participant characteristics, and intervention types and durations, a random-effects model was applied to account for between-study heterogeneity. Because different measurement instruments were used to assess the same outcomes, effect sizes were calculated using standardized mean differences (SMDs) with 95% confidence intervals (95% CIs). Effect size magnitudes were interpreted according to Cohen's criteria, with SMDs of ≥0.20 to <0.50 considered small, ≥0.50 to <0.80

moderate, and ≥0.80 large (Cohen, 2013). The direction of effect was defined such that negative values indicated greater reductions in depression or anxiety in the yoga group compared with the control group. Outcomes were included in the meta-analysis only if they were reported in at least two eligible studies.

Statistical heterogeneity was assessed using the I^2 statistic, with values <25% indicating low heterogeneity, 25–50% moderate heterogeneity, and >50% high heterogeneity. Where data permitted, subgroup analyses were conducted based on type of yoga intervention,

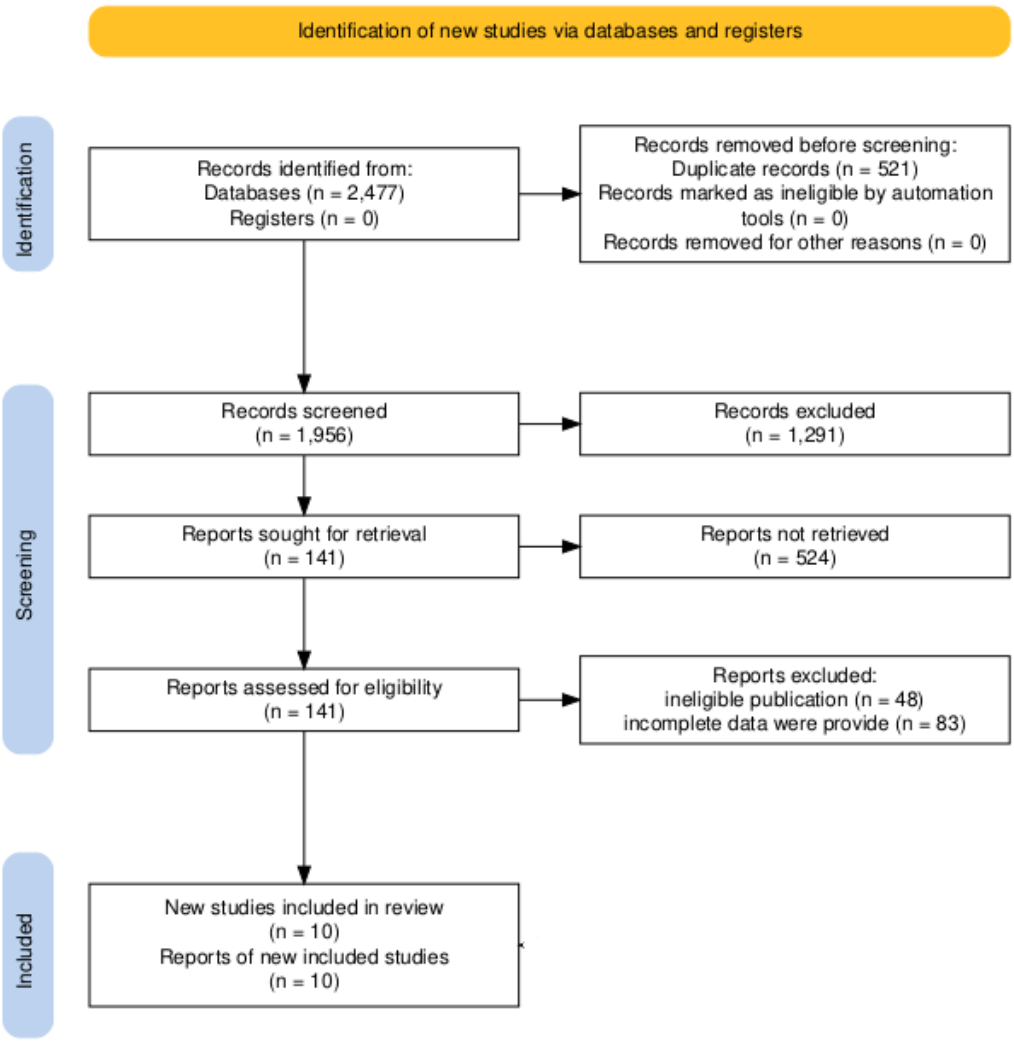


Figure 1 PRISMA flow diagram for database search of studies

Study Characteristics

This meta-analysis included 10 clinical trials conducted across six countries, namely Australia (Abafita et al., 2025), Sweden (Bellfjord et al., 2024; Köhn et al., 2013), the United States (Cheung et al., 2017; Joyce et al., 2021), India(Ebnezar et al., 2012; Metri et al., 2023; Singphow et al., 2022), Canada(Kuntz et al., 2018), dan Croasia (Pukšić et al., 2021). All included studies employed randomized controlled designs, with eight studies using a two-arm randomized controlled trial (RCT) design and one study adopting a three-arm randomized controlled trial.

The total sample size across all studies was 1.063 participants, with individual study sample sizes ranging from 31 to 320 participants. The mean age of participants ranged from 39 to 72 years, and all participants were patients with musculoskeletal disorders experiencing psychological symptoms, primarily depression and/or anxiety. The primary intervention in the experimental groups was yoga, with variations including Hatha Yoga, MediYoga, Integrated Yoga Therapy, Medical Yoga, Yoga in Daily Life, and yoga combined with mindfulness meditation. Intervention duration ranged from 2 to 16 weeks, with most studies implementing yoga programs lasting 8-12 weeks.

Control conditions varied across studies and included strengthening exercises, physiotherapy, general physical exercise, educational control, standard care, and no-exercise control. Outcome assessments were conducted at baseline and immediately post-intervention, with several studies incorporating follow-up assessments at 4, 20, 24, or 52 weeks. The primary outcomes analyzed in this meta-analysis were depression and anxiety, assessed using validated psychometric instruments, including the PHQ-9, PHQ-8, HADS-Depression, HADS-Anxiety, CES-D, DASS-21, DASS-42, and STAI-1. Detailed participant characteristics, intervention protocols, and outcome measures are summarized in Table 1.

Table 1. Summary of included studies

	First author, year, country	Design Study	Study characteristics		Intervention characteristics		Duration of intervention	Follows-up	Outcome (measurement)
			Participants		Intervention types				
			Sample size (n)	Age (mean and SD year, I/C)	Experimental groups	Control groups			
1	Abavita, BJ, et al, 2025, Australia	Randomized Clinical Trial (RCT)	117	61.2 ±7.8 63.7±8.3	Yoga	Strengthening exercise	12 weeks	Baseline, post intervention, and 4 months	Depresi (PHQ-9) 0.64±1.28 0.09±0.75
2	Bellfjord M et al., 2024, Swedia	Randomized Clinical Trial	36	48 ± 12.8 46 ± 12.8	MediYoga	Physiotherapy	8 weeks	Baseline and post intervention and 20 weeks	HADS-Depression 3.9 ±3.4 1.1 ±3.9 HADS-Anxiety 5.4 ±3.0 1.5 ±3.2
3	Cheung et al, 2017, Amerika Serikat	Randomized Controlled Trial (RCT)	83	68.9±7.7 71.8±8.0	Hatha Yoga (HY)	Education Control	8 weeks	Baseline and post intervention	Depression (HADS-D) 0.2±2.9 0.4±2.0 Anxiety (HADS-A) 1.7±3.1 0.0±3.8
4	Ebnezar J. et al., 2012, India	Randomized Controlled Trial (RCT)	250	59,56 ± 9,54 59,42 ± 10,66	Integrated Yoga Therapy (IAYT)	Physiotherapy exercise group	2 weeks	Baseline and post intervention and 12 weeks	State anxiety (STAI-1) 35.52 ± 5.89 20.90 ± 8.14
5	Joyce et al., 2021, Amerika Serikat	Randomized Controlled Trial (RCT)	320	46,7 ± 10,2 44,3 ± 10,3	Hatha yoga	Education control	12 weeks	Baseline and post intervention and 12 weeks, 52 weeks	Depresi (PHQ-8) 1.23 ± 5.3 0.58 ± 5.8 Anxiety (GAD-7) 0.55 ± 4.5 0.47 ± 6.9
6	Köhn M. et al., 2013 Swedia	Randomized Controlled Trial (RCT)	39	54 ± 9 52 ± 15	Medical Yoga group	Standard care	12 weeks	Baseline and post intervention	Depression (HADS-D) 4.1 ± 4.5 1.9 ± 4.12 Anxiety (HADS-A) 5.3 ± 4.3 2.2 ± 4.7
7	Kuntz et al., 2018, Kanada	*three-arm randomized controlled trial*	31	65,5 ± 5,6 71,1 ± 9,3	Yoga Exercise	No Exercise Control	12 weeks	Baseline and post intervention	Depresi (CES-D) 1.0 ± 5.37 3.6 ± 8.53

	First author, year, country	Design Study	Study characteristics		Intervention characteristics		Duration of intervention	Follows-up	Outcome (measurement)
			Participants		Intervention types				
			Sample size (n)	Age (mean and SD year, I/C)	Experimental groups	Control groups			
8	Metri KG et al., 2023 India	Randomized Controlled Trial (RCT)	50	39,8 ± 7,37 38,88 ± 6,67	Integrated Yoga	No Exercise Control	6 weeks	Baseline, post intervention,	Depression (DASS-21) 4.4 ± 7.49 1.66 ± 7.67 Anxiety (DASS-21) 6.6 ± 8.52 1.11 ± 6.63
9	Pukšić et al., 2021 Kroasia	Randomized Controlled Trial (RCT)	57	52,9 ± 12,2 57,9 ± 9,0	Yoga in Daily Life (YIDL)	Education control	12 weeks	Baseline, post intervention, 24 weeks	Depression (HADS-D) 0.77 ± 3.01 0.59 ± 2.28 Anxiety (HADS-A) 1.91 ± 3.65 0.18 ± 3.16
10	Singphow, C et al, 2022 India	Randomized Controlled Trial (RCT)	80	43,74 ± 7,26 41,47 ± 9,53	Yoga and Mind-fulness Meditation (YM)	Physical Exer-cise	16 weeks	Baseline, post intervention, 8 weeks, 16 weeks	Depession (DASS-42) 4.62 ± 4.89 0.84 ± 1.46 Anxiety (DASS-42) 2.62 ± 3.07 0.31 ± 1.73

Risk of Bias Assessment

Risk of bias was assessed for all included studies using the Cochrane Risk of Bias Tool, which evaluates seven key domains: random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, selective reporting, and other sources of bias. Overall, the methodological quality of the included studies ranged from moderate to good. All studies demonstrated a low risk of bias in the domains of random sequence generation and allocation concealment, indicating that adequate randomization and allocation concealment procedures were implemented, thereby minimizing the risk of selection bias.

However, nearly all studies were judged to have a high risk of bias in the domain of blinding of participants and personnel (performance bias). This was primarily attributable to the inherent characteristics of non-pharmacological interventions, such as yoga or physical exercise, which make blinding of participants and intervention providers impractical. Consequently, participants' subjective perceptions of the intervention may have been influenced.

Regarding blinding of outcome assessment (detection bias), some studies were assessed as having a low risk of bias, while others were classified as high risk, reflecting inconsistent reporting or implementation of outcome assessor blinding. This limitation may have affected the objectivity of outcome measurement, particularly for subjective outcomes such as depression and anxiety.

Most studies demonstrated a low risk of bias in the domain of incomplete outcome data (attrition bias), suggesting that participant dropouts and missing data were adequately reported and appropriately managed. Similarly, the majority of studies showed a low risk of bias for selective reporting, indicating that reported outcomes were consistent with the prespecified study objectives or protocols. For the domain of other sources of bias, most studies were classified as having either low or unclear risk, reflecting limited reporting of potential additional sources of bias.

Overall, despite limitations primarily related to performance bias and, to a lesser extent, detection bias, the methodological quality of the included studies was considered acceptable. Therefore, the findings of this meta-analysis can be regarded as reasonably robust; however, they should be interpreted with caution, particularly for subjective outcomes that are more susceptible to bias related to the lack of blinding. Detailed risk-of-bias assessments are presented in Figures 2 and 3.

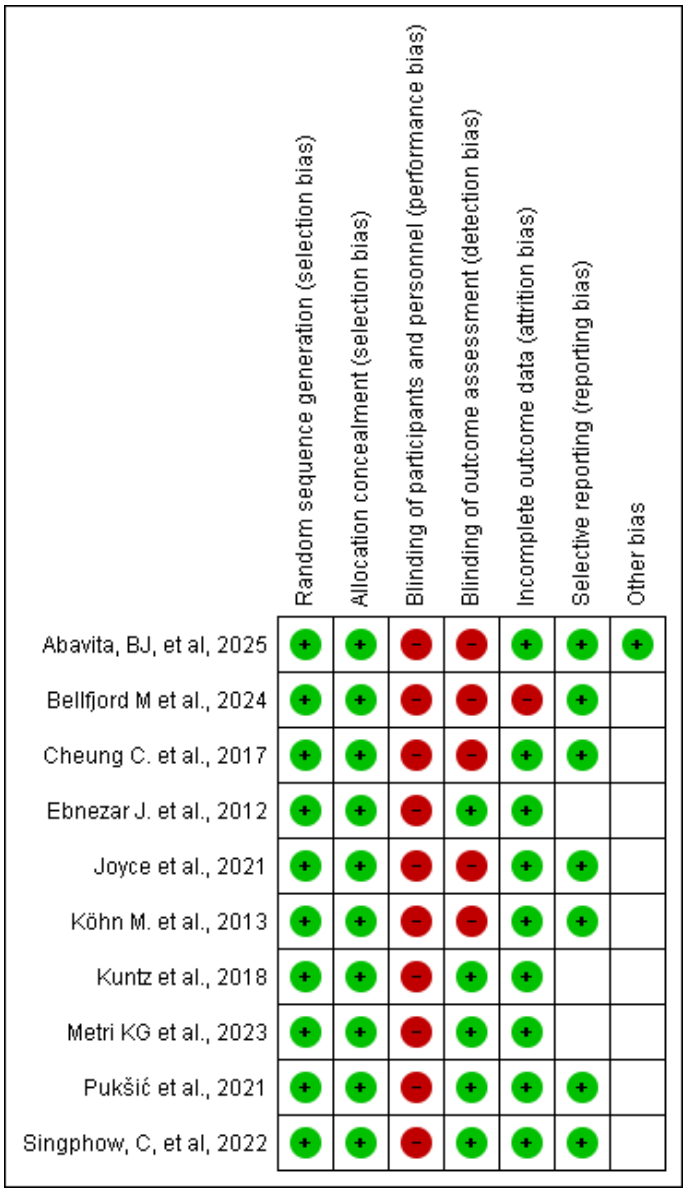


Figure 2. Risk of bias analysis of each included

Effects of Yoga

Depression

A total of nine studies involving 606 participants (intervention group = 341; control group = 265) were included in the analysis to evaluate the effects of yoga interventions on depressive symptoms. A random-effects model was applied due to variability across studies. The meta-analysis demonstrated that yoga had a statistically significant effect compared with control conditions, with a mean difference (MD) of 1.19 (95% CI: 0.26–2.13; p = 0.01). These findings indicate that participants in the yoga intervention groups experienced greater improvements in depressive symptoms than those in the control groups.

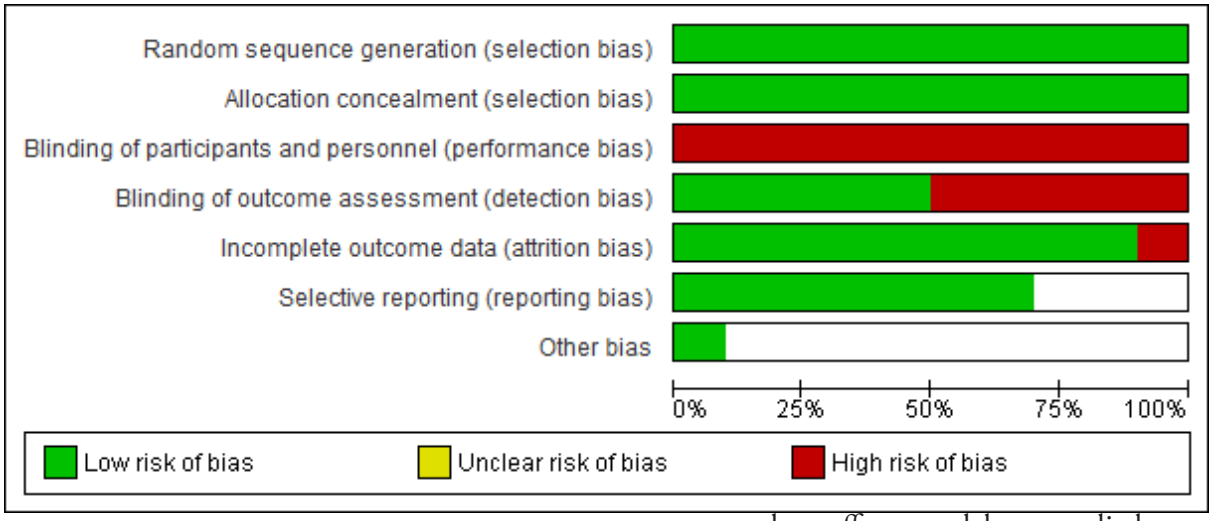


Figure 3. Overall risk of bias analysis of included studies.

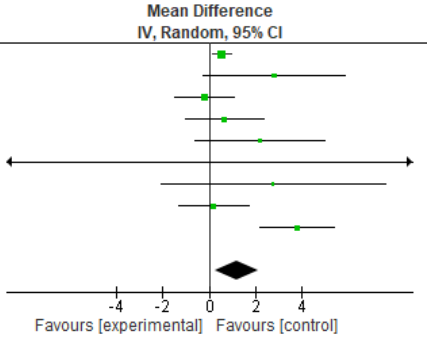
Most individual studies showed effect estimates favoring yoga, although the magnitude of the effect varied across studies. Several studies reported small to moderate effects, while one study demonstrated a very large effect, contributing to the overall variability in effect sizes. Heterogeneity analysis revealed moderate to substantial heterogeneity among studies (I^2 = 61%, χ^2 = 20.72; df = 8; p = 0.008). This suggests that differences in study characteristics, including intervention duration and intensity, participant characteristics, and the psychological outcome measures used, may have contributed to the observed inconsistency across studies.

Overall, the results of this meta-analysis indicate that yoga interventions were statistically effective in improving depressive symptoms compared with control conditions, despite variability in effect sizes across studies. Detailed results are presented in Table 2.

Table 2. Forest plot of Yoga intervention on depression

Study or Subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
Abavita, BJ, et al, 2025	0.64	1.28	58	0.09	0.75	59	23.3%	0.55 [0.17, 0.93]
Bellfjord M et al., 2024	3.9	3.4	13	1.1	3.9	10	6.8%	2.80 [-0.24, 5.84]
Cheung C. et al., 2017	0.2	2.9	32	0.4	2	23	16.5%	-0.20 [-1.50, 1.10]
Joyce et al., 2021	1.23	5.3	127	0.58	5.8	64	13.5%	0.65 [-1.04, 2.34]
Köhn M. et al., 2013	4.1	4.5	18	1.9	4.12	19	7.7%	2.20 [-0.58, 4.98]
Kuntz et al., 2018	1	537	10	36	853	10	0.0%	-35.00 [-659.73, 589.73]
Metri KG et al., 2023	4.4	7.49	20	1.66	7.67	18	3.2%	2.74 [-2.09, 7.57]
Pukšić et al., 2021	0.77	3.01	24	0.59	2.28	24	14.8%	0.18 [-1.33, 1.69]
Singphow, C, et al, 2022	4.62	4.89	39	0.84	1.46	38	14.1%	3.78 [2.18, 5.38]
Total (95% CI)			**341**			**265**	**100.0%**	**1.19 [0.26, 2.13]**

Heterogeneity: Tau² = 0.94; Chi² = 20.72, df = 8 (P = 0.008); I² = 61%
Test for overall effect: Z = 2.50 (P = 0.01)



Anxiety

A total of eight studies involving 704 participants (intervention group = 391; control group = 313) were included to assess the effects of yoga interventions on anxiety. Given the substantial variability across studies, a random-effects model was applied.

The meta-analysis demonstrated that yoga interventions had a statistically significant effect compared with control conditions, with a mean difference (MD) of 4.09 (95% CI: 0.64–7.54; p = 0.02). These findings indicate that participants in the yoga intervention groups experienced significantly greater improvements in anxiety symptoms than those in the control groups.

Most individual studies showed effect estimates favoring the intervention, with several studies reporting moderate to large effects. Nevertheless, the magnitude of effect varied widely across studies, as reflected by the broad confidence intervals observed in some individual trials.

Heterogeneity analysis revealed considerable heterogeneity among studies (I^2 = 96%, τ^2 = 23.18; χ^2 = 168.15; df = 7; p < 0.00001), indicating substantial differences in study characteristics. This heterogeneity is likely attributable to variations in intervention duration and intensity, participant population characteristics, and the instruments and scales used to assess anxiety outcomes.

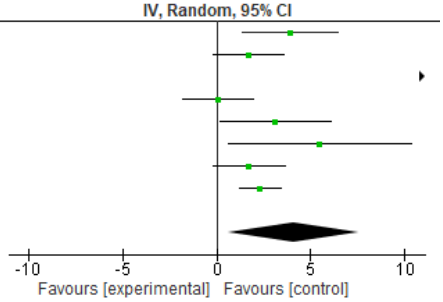
Overall, the results of this meta-analysis suggest that yoga interventions are significantly associated with improvements in anxiety compared with control conditions. However, these findings should be interpreted

with caution due to the very high level of heterogeneity across studies. Detailed results are presented in Table 3.

Table 3. Forest plot of Yoga Intervention on anxiety

Study or Subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
Bellfjord M et al., 2024	5.4	3	13	1.5	3.2	10	12.5%	3.90 [1.33, 6.47]
Cheung C. et al., 2017	1.7	3.1	32	0	3.8	23	12.9%	1.70 [-0.19, 3.59]
Ebnezar J. et al., 2012	35.52	5.89	118	20.9	8.14	117	12.9%	14.62 [12.80, 16.44]
Joyce et al., 2021	0.55	4.5	127	0.47	6.9	64	12.9%	0.08 [-1.78, 1.94]
Köhn M. et al., 2013	5.3	4.36	18	2.2	4.76	19	12.2%	3.10 [0.16, 6.04]
Metri KG et al., 2023	6.6	8.52	20	1.11	6.63	18	10.6%	5.49 [0.66, 10.32]
Pukšić et al., 2021	1.91	3.65	24	0.18	3.16	24	12.8%	1.73 [-0.20, 3.66]
Singphow, C, et al, 2022	2.62	3.07	39	0.31	1.73	38	13.2%	2.31 [1.20, 3.42]
Total (95% CI)			**391**			**313**	**100.0%**	**4.09 [0.64, 7.54]**

Heterogeneity: Tau² = 23.18; Chi² = 168.15, df = 7 (P < 0.00001); I² = 96%
Test for overall effect: Z = 2.32 (P = 0.02)



Discussion

This meta-analysis provides an up-to-date synthesis of evidence regarding the effectiveness of yoga as a mind–body intervention for reducing depression and anxiety among patients with musculoskeletal disorders. Based on the analysis of ten randomized controlled trials involving more than one thousand participants, the primary findings indicate that yoga is significantly associated with reductions in depressive and anxiety symptoms compared with control conditions. These results reinforce the potential role of yoga as a non-pharmacological approach within the comprehensive management of musculoskeletal disorders, which are frequently accompanied by psychological comorbidities.

Effects of Yoga on Depression

The findings of this meta-analysis demonstrate that yoga interventions significantly improved depressive symptoms compared with control interventions, although moderate to substantial heterogeneity was observed. This result is consistent with the biopsychosocial model of chronic pain, which emphasizes the critical role of psychological factors, including depression, in pain perception and functional disability among patients with musculoskeletal conditions. Through the integration of controlled physical movements, breathing techniques, and meditative practices, yoga may enhance emotional regulation, reduce sympathetic nervous system activation, and modulate stress responses via downregulation of hypothalamic pituitary adrenal (HPA) axis activity (Kuntz et al., 2018; Pukšić et al., 2021; Singphow et al., 2022).

Beyond neurophysiological mechanisms, yoga may also enhance self-efficacy, body awareness, and adaptive coping strategies for managing chronic pain. The observed improvements in depressive symptoms across the included studies suggest that the benefits of yoga extend beyond physical outcomes to encompass psychological dimensions that are highly relevant to long-term rehabilitation in musculoskeletal populations.

Effects of Yoga on Anxiety

In addition to depression, this meta-analysis found that yoga interventions significantly reduced anxiety levels compared with control groups. However, this effect was accompanied by very high heterogeneity across studies. The substantial heterogeneity is likely attributable to wide variations in intervention characteristics, including the type of yoga practiced (e.g., Hatha Yoga, Integrated Yoga Therapy, or yoga combined with mindfulness), differences in intervention duration and intensity, as well as variability in participant characteristics and anxiety assessment instruments (Kuntz et al., 2018; Pukšić et al., 2021; Singphow et al., 2022).

Nevertheless, the consistently favorable direction of effect observed in most individual studies suggests that yoga has clinically relevant potential for reducing anxiety among patients with musculoskeletal disorders. This reduction in anxiety is clinically meaningful, as anxiety can exacerbate muscle tension, amplify pain perception, and negatively affect adherence to rehabilitation programs. Accordingly, integrating yoga into standard care may offer additional psychological benefits that are often insufficiently addressed by conventional treatment approaches.

Limitations

This meta-analysis has several limitations that should be acknowledged. First, the number of included studies was relatively limited, which may have reduced the statistical power and constrained the ability to explore sources of heterogeneity in greater depth. Second, heterogeneity across studies was substantial, particularly for anxiety outcomes, likely reflecting variations in yoga type and duration, participant characteristics, control conditions, and the instruments used to assess depression and anxiety. Third, most included

studies had methodological limitations related to the blinding of participants and personnel, which may have increased the risk of performance bias, especially for subjective outcomes. Additionally, some studies had small sample sizes and relatively short follow-up periods, limiting conclusions regarding the long-term effects of yoga interventions. Finally, the restriction to English-language publications may have introduced language and publication bias.

Conclusions

This meta-analysis demonstrates that yoga interventions are significantly associated with reductions in depressive and anxiety symptoms among patients with musculoskeletal disorders compared with control conditions. These findings support the role of yoga as a potentially effective and relevant non-pharmacological mind–body intervention within a holistic rehabilitation framework, offering benefits not only for physical health but also for psychological well-being.

However, the presence of moderate to high heterogeneity across studies particularly for anxiety outcomes and methodological limitations in some included trials indicate that these results should be interpreted with caution. Overall, the available evidence suggests that yoga may be considered a safe and effective complementary therapy to support the management of musculoskeletal disorders. Further research employing more standardized methodologies, larger sample sizes, and longer follow-up periods is needed to strengthen and clarify the magnitude of yoga's effects on psychological health in this population.

Clinical Implications

The findings of this meta-analysis have important implications for clinical practice, particularly within musculoskeletal rehabilitation settings that increasingly emphasize holistic and patient-centered approaches. Yoga may be considered a complementary intervention that is relatively safe, cost-effective, and adaptable across various healthcare settings, including medical rehabilitation services, physiotherapy, and community-based nursing care.

Given the high prevalence of depression and anxiety among patients with musculoskeletal disorders, integrating yoga into multimodal rehabilitation programs may enhance psychological outcomes and, indirectly, improve functional recovery and overall quality of life.

Future Research Directions

Based on the findings of this meta-analysis, future research should focus on clarifying factors contributing to the heterogeneity of yoga's effects on depression and anxiety in musculoskeletal populations. Randomized controlled trials employing more standardized yoga protocols—encompassing type, intensity, duration, and additional components such as mindfulness—are needed to determine optimal and consistent intervention doses.

Given the very high heterogeneity observed for anxiety outcomes, future studies are encouraged to stratify analyses by type of musculoskeletal disorder, baseline psychological characteristics, and control conditions. Furthermore, larger-scale studies with long-term follow-up are essential to evaluate the sustainability of yoga's psychological benefits and related clinical outcomes.

Future research should also integrate assessments of the underlying biological and psychological mechanisms of yoga to strengthen causal inference. Finally, pragmatic trials evaluating the implementation of yoga as part of multimodal rehabilitation programs across diverse clinical settings would enhance the real-world applicability and generalizability of the findings from this meta-analysis.

AUTHOR CONTRIBUTIONS

Musrifatul Uliyah, Abdul Aziz Alimul Hidayat, Nahdah Aulia Aziz involved in study conception and design. Abdul Aziz Alimul Hidayat and Nahdah Aulia Aziz collected the data. Abdul Aziz Alimul Hidayat involved in data analysis and interpretation. Abdul Aziz Alimul Hidayat, Musrifatul Uliyah, Nahdah Aulia Aziz. All authors critically revised the article.

CONFLICT OF INTEREST

None.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable as no new data were created or analyzed in this study.

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