Journal of Orthopaedic Surgery and Research

SYSTEMATIC REVIEW

Open Access

Effect of *qigong* on pain and disability in patients with chronic non-specific low back pain: a systematic review and meta-analysis of randomized controlled trials

Donghui Yu[1], Minmin Wu[1], Jiongliang Zhang[1], Wenjing Song[1] and Luwen Zhu[2*]

Abstract

Background Chronic non-specific low back pain (CNLBP) is a common health problem worldwide. Patients with CNLBP often suffer from persistent pain, with a few being disabled by their pain, affecting their daily functioning and social participation. This study aims to systematically evaluate the effects of pain and dysfunction in *Qigong* patients with chronic non-specific back pain through systematic evaluation and gathered analysis of random control test data.

Methods We searched nine databases from their inception dates until April 2024. Relevant randomized controlled trials (RCTs) were included. Patients were assessed for pain using the Visual Analog Scale and Numeric Pain Rating Scale and for disability using the Oswestry Disability Index and Roland-Morris disability questionnaire. The risk of bias was assessed using the Cochrane Collaboration tool. CMA V3.0 was used to analyze data.

Results Sixteen RCTs involving 1175 participants were included. These studies have different designs, and the participants are mainly around 60 years old. The results showed that the *qigong* practice improved pain significantly more than the control measures ([Mean Difference MD] = − 1.34, 95% confidence intervals [CI] − 1.76 to − 0.92, $p < 0.001$ Minimal Clinically Important Differences MCID = 1.5), and the efficacy of short-term interventions (MD = − 1.88, 95% CI − 2.87 to − 0.9, $p < 0.001$) was superior to that of long-term interventions (MD = − 1.07, 95% CI − 1.49 to − 0.65, $p < 0.001$). For improvement in the degree of dysfunction, *qigong* practice showed a higher effect size (MD = − 5.88, 95% CI − 7.98 to − 3.78, $p < 0.001$ MCID = 5) than that observed in the control group.

Conclusion *Qigong* practice is effective in improving disability in patients with CNLBP, but has no significant effect on improving pain. However, due to the high heterogeneity, the results need to be interpreted with caution.

Keywords *Qigong*, Chronic non-specific low back pain, Rehabilitation, Meta-analysis

Background

Low back pain (LBP) is a common health problem worldwide and significantly impacts an individual's quality of life. According to the World Health Organization, LBP is a leading cause of long-term disability worldwide, affecting work, life, and social participation. According to the Global Burden of Disease Study, > 85% of the world population has experienced at least one episode of LBP

*Correspondence:
Luwen Zhu
zhuluwen1983@126.com
[1] Heilongjiang University of Chinese Medicine, Harbin, China
[2] The Second Affiliated Hospital of Heilongjiang University of Chinese Medicine, Harbin, China

during their lifetime, with the prevalence of LBP reaching 60–70% in developed countries [1–3]. Chronic non-specific LBP (CNLBP) is among the most common types of LBP [4–6].

Currently, the primary treatment for CNLBP include medication, physical therapy, and surgery. Medications usually include analgesics, non-steroidal anti-inflammatory drugs, and muscle relaxants; however, long-term drug use may cause adverse gastrointestinal reactions and kidney damage. Physical therapy, including acupuncture, tuina, and physiotherapy, is effective in relieving pain and improving function [7–10]. However, its therapeutic effect varies individually. Furthermore, surgery is usually opted for in cases of serious conditions, such as severe lumbar disc herniation and degenerative spinal lesions; however, surgery is risky, has a long recovery period, and is expensive [3, 11–15].

Exercise can reduce pain, increase range of motion, reduce the risk of symptom recurrence, and help individuals return to normal activities and work [16–19]. *Qigong* exercise is a traditional Chinese meditative movement therapy with specific characteristics that focuses on body awareness and concentration during slow, relaxed, and fluid body movements from dynamic to static postures [20, 21]. Traditional Chinese *qigong*, which mainly includes *wuqinxi*, *baduanjin*, *liuzijue*, guiding techniques, and *yijinjing*, is believed to regulate qi and blood flow and improve the body's resistance and its self-healing ability. *Qigong* promotes blood circulation and improves the local supply of oxygen and nutrients, thereby reducing pain and promoting tissue repair [16, 22–25]. Furthermore, it reduces lumbar discomfort by regulating body posture and movement patterns and relieving pressure and tension on the spine and skeletal muscles [26–29]. *Qigong* and tai chi are both traditional Chinese mind–body practices rooted in the principles of balancing qi (vital energy), but they differ in structure, purpose, and application. *Qigong* emphasizes static postures, breath regulation, and meditative focus to cultivate and harmonize qi, often tailored for specific therapeutic goals such as pain relief or rehabilitation. In contrast, tai chi is a martial art characterized by continuous, flowing sequences of movements (forms) that integrate self-defense techniques with health-promoting exercises. While both practices share mindfulness and gentle movement, tai chi's structured choreography and martial origins distinguish it from the more adaptable, health-centric approach of *qigong* [30, 31]. *Qigong* is generally considered a low-risk, non-invasive practice, there have been a few reported instances of mild discomfort such as muscle soreness or fatigue, particularly among individuals who are new to the practice or engage in intensive sessions. In rare cases, patients with pre-existing conditions such as severe musculoskeletal or cardiovascular issues may experience exacerbated symptoms, although these instances are infrequent.

This review focuses exclusively on *qigong* for chronic non-specific low back pain (CNLBP) to isolate its unique mechanisms and therapeutic potential. Prior meta-analyses have often conflated *qigong* with tai chi [32], obscuring their distinct effects. By excluding tai chi studies, we ensure methodological homogeneity and enhance the clinical relevance of our findings for practitioners seeking *qigong*-specific evidence. While prior meta-analyses have evaluated mind–body therapies for low back pain, none have exclusively focused on *qigong* or incorporated Chinese-language RCTs. Recent reviews grouped *qigong* with yoga and tai chi, limiting insights into its unique mechanisms and efficacy [32]. This review fills this gap by synthesizing *qigong*-specific evidence, including culturally distinct interventions from East Asian databases. Recently, an increasing number of randomized controlled trials (RCTs) have explored the field extensively, necessitating an in-depth, comprehensive meta-analysis to reassess the potential effects of *qigong* on health and human functioning.

Information and methodology

Study protocol

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses 2020 guidelines (PRISMA 2020) [33], as detailed in the Supplementary material 1. This study has been registered with the PROSPERO platform (registration no. CRD42024530214).

Search strategy and study selection

Relevant literature was comprehensively identified by searching foreign and Chinese databases, including PubMed, Embase, CENTRAL of the Cochrane, Web of Science, CNKI, Sinomed, the Chinese Medical Association, Wanfang, and VIP. The search terms used included both free-text terms and Medical Subject Headings (MeSH) keywords. MeSH terms such as "*qigong*," "*baduanjin*," "*wuqinxi*," "*yijinjing*," "*liuzijue*," "low back pain," and " non-specific low back pain" were used to enhance the sensitivity and specificity of the search. No language restrictions were applied during the database search. Studies in all languages were considered to minimize selection bias. The complete search strategy is shown in Supplementary material 2. These studies underwent a two-stage screening process; titles and abstracts were independently reviewed by two authors to assess their relevance according to predefined inclusion and exclusion criteria. Subsequently, the full text of the remaining articles was assessed in

detail to determine whether they met the inclusion criteria. If necessary, disagreements between reviewers were resolved through discussion and consultation with a third author.

Literature inclusion and exclusion criteria

Type of literature: randomized controlled study. Study participants: Patients diagnosed with chronic nonspecific low back pain (CNLBP) of any sex or age were included [34]. Intervention: Studies focusing on *qigong* therapies, including but not limited to, *Baduanjin*, *Liuzijue*, *Wuqinxi*, *Yijinjing* techniques. Control measures: other comforting exercise therapies were administered besides *qigong* training and conventional rehabilitation, or no treatment was administered. Outcome indicators: the degree of pain was assessed using Visual Analog Scale (VAS) or Numerical Rating Scale (NRS). The severity of LBP symptoms was assessed using the Oswestry disability index (ODI) or Roland-Morris disability questionnaire (RMDQ), focusing on the impact on functional activity.

Non-RCTs, such as conferences, abstracts, and reviews; cases of LBP caused by other liver or kidney diseases; patients with serious diseases that affect outcome indicators, such as stroke and heart failure; and data that were unavailable or insufficient to extract and analyze the VAS, NPRS, ODI, and RMDQ data required for this study, were excluded.

Data extraction

Data were independently extracted by two reviewers using a standardized form. Data extracted from the studies included general information (authors, publication year, and language), basic characteristics (sample size, age, and type of intervention), and time and duration of the intervention (duration of a workout session and the weekly frequency of the workouts). To quantify agreement between the two independent reviewers (DY and JZ) during data extraction, we calculated Cohen's kappa coefficient (κ) for a randomly selected subset of 20% of the included studies (n = 3/16) [35]. Discrepancies in extracted data were assessed before consensus discussions or third-party arbitration. Disagreements between reviewers were resolved through discussion, and a third reviewer was consulted if consensus could not be reached. This procedure ensured that data extraction was consistent, accurate, and reproducible. The primary outcome of this review was pain and related indicators of disability in patients with CNLBP. Outcome data (mean and standard deviation of raw data) were extracted and summarized to assess the effect of *qigong* on pain and disability in patients with CNLBP.

Risk of bias assessment

The quality assessment was completed according to the Cochrane Handbook for Systematic Evaluation. The researchers carefully read the literature and determined whether each element of the assessment was high bias, low bias, or unclear [36]. If the two researchers had conflicting evaluations, a third researcher reviewed and discussed the decision.

GRADE quality of evidence assessment

The quality of evidence for each outcome indicator, including the risk of bias, risk of inconsistency, indirect bias, imprecision, and risk of publication bias, was assessed using GRADE Profiler 3.6. This study included RCTs; therefore, only five factors were evaluated, namely the risk of bias, heterogeneity, indirectness, precision, and other factors, and the quality was rated as high, moderate, low, or very low [37].

Statistical processing

A comprehensive meta-analysis (CMA V3.0, Biostat, USA) was used to combine effect sizes and assess the heterogeneity and publication bias. Random-effect models were used to generalize the results to comparable studies. Continuous variables were estimated using difference in mean (MD) sizes and 95% confidence intervals (CI). Heterogeneity across studies was evaluated using the I^2 statistic, which quantifies the percentage of total variability in effect estimates attributable to heterogeneity rather than chance. The thresholds for interpreting I^2 values were based on established guidelines: Low heterogeneity: $I^2 = 0–25\%$, Moderate heterogeneity: $I^2 = 25–50\%$, High heterogeneity: $I^2 = 50–75\%$, Very high heterogeneity: $I^2 > 75\%$. These thresholds align with recommendations from the Cochrane Handbook for Systematic Reviews of Interventions [38]. If the degree of heterogeneity of the included studies was moderate or high, sensitivity analyses were required to assess the impact of individual studies on the pooled results. Accordingly, to examine the robustness of the results and address the higher heterogeneity observed in the meta-analysis, we conducted sensitivity analyses by excluding one study per iteration to assess the impact of single studies on the pooled effect size. Additionally, prespecified subgroup analyses were conducted based on the type of *qigong* intervention and its duration. Publication bias was assessed through funnel plot asymmetry and Egger's test. To adjust for potential asymmetry, the cut-and-patch method (trim-and-fill procedure) was applied. This method iteratively trims studies causing asymmetry from the funnel plot and imputes missing studies to estimate a corrected effect

size. The final adjusted effect size and confidence intervals were reported to account for publication bias.

Results

Literature search results and basic characteristics

In total, 190 articles were identified, of which 47 passed the preliminary screening. Finally, 16 articles were deemed eligible after reviewing the full text; 12 in Chinese and four in foreign languages [39–54]. The screening process is illustrated in Fig. 1. Inter-rater reliability for data extraction was assessed using Cohen's kappa coefficient (κ) on a 20% random sample of studies. The κ score of 0.82 (95% CI 0.72–0.92) reflects strong agreement between reviewers, ensuring the robustness of the extraction process. The included studies are from three countries: China [39, 43–54], Thailand [41], and Germany [40, 42], and 1,175 participants were mainly patients with CNLBP. Most of the participants were aged < 60 years, including those who participated in the studies by Zhang [52], which included nurses with CNLBP, and Phattharasupharerk [41], which included office workers with CNLBP. The interventions received by the experimental group included *qigong* training with conventional treatment or *qigong* training alone, with each intervention

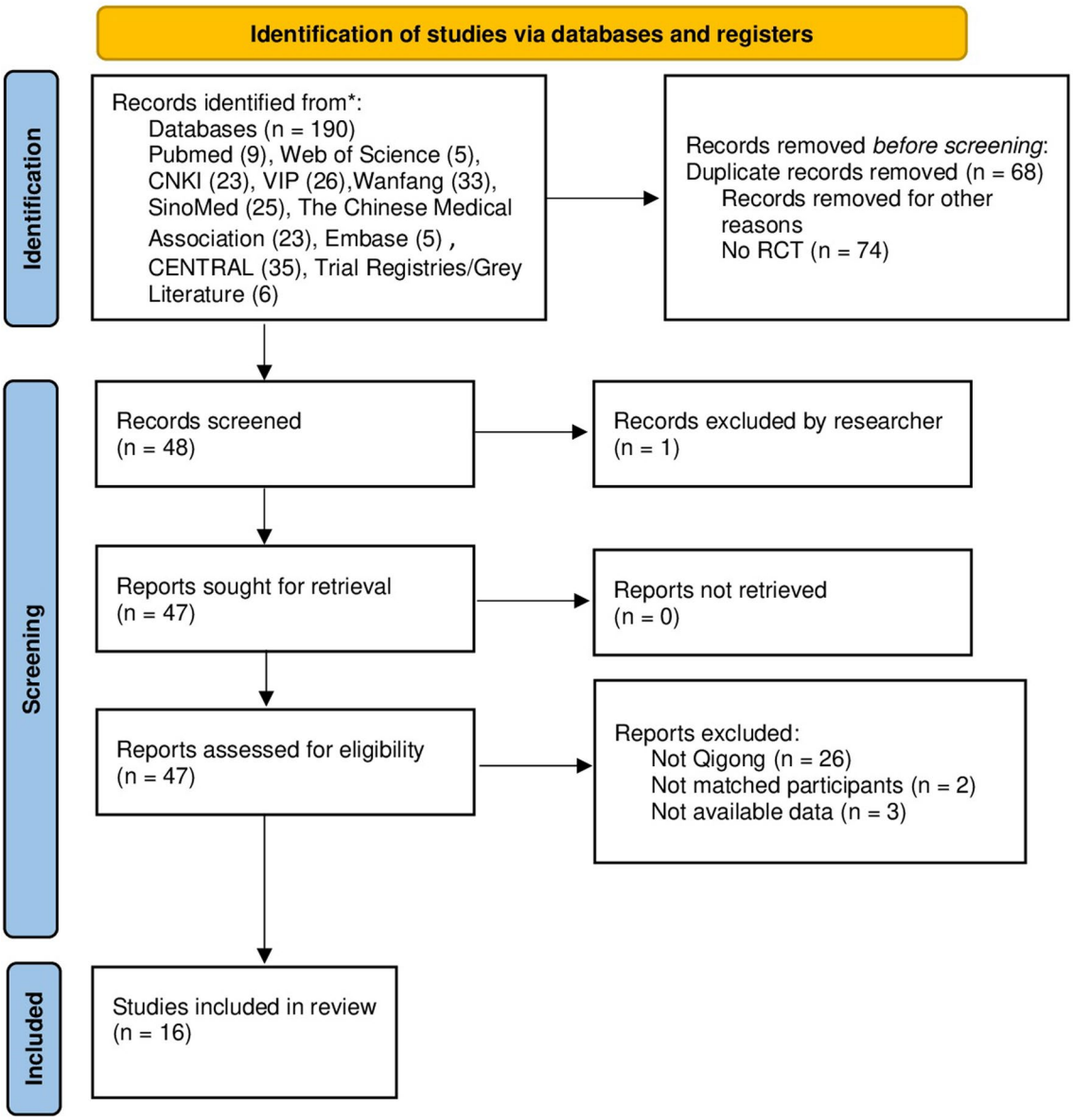

Fig. 1 PRISMA flow diagram of the search process for the study of qigong on pain and disability in patients with chronic non-specific low back pain

lasting for 30–60 min, with only the studies by Blodt [42] and Teut [40] extending the *qigong* intervention to 90 min. The control group either received no intervention or interventions comprising conventional training (each intervention lasted for 30–60 min) or health education. Most experiments were conducted for 1–12 weeks, with only Fang conducting an intervention for 6 months [48] (see Table 1).

Risk of bias assessment

The risk of bias assessment of the included studies showed that 93.75% of the studies had low risk of randomized sequence generation, with only 6.25% showing a high risk. Only 37.5% of the studies showed low risk regarding allocation concealment, whereas 62.5% had an unclear risk. In the assessment of blinding the participants and personnel for bias, 6.25%, 25%, and 68.75% were classified as high risk, low risk, and unclear, respectively. In the blinding of outcome assessments, 12.5% of studies were assessed as low risk, whereas the remaining were classified as unclear. For the risk of bias due to incomplete outcome data, 12.5% of the studies were assessed as high risk, with the remaining classified as low risk. Most studies in the risk of other biases were unclear, 18.75% of the studies were low risk. Selective reporting showed that 93.75% of the studies were unclear and 6.25% were low risk. The results of the risk of bias assessment indicated a low-to-moderate risk of bias for all included studies. However, the unclear risk associated with blinding and high risk found in some articles should be carefully considered when interpreting the results. Further details are shown in Figs. 2 and 3.

Meta-analysis results

Among the 16 studies assessed, 15 used the VAS to measure pain as an outcome indicator. Eleven studies reported outcome indicators of disability, of which 10 used the ODI scale. Pain was measured using the Visual Analog Scale (VAS) shows a reliability of r = 0.96 and is widely used to assess pain intensity across various conditions. Disability was measured using the Oswestry Disability Index (ODI) has a Cronbach's alpha of 0.9. These outcome measures were selected due to their established reliability, validity, and frequent use in clinical research on low back pain. For the interpretability of the results and better clinical reference, we used studies with the same scale and estimated them using the MD size and 95% CIs. Substantial heterogeneity was observed in our meta-analysis ($I^2 = 90.26\%$ for pain outcomes, $I^2 = 90.54\%$ for disability outcomes). To address these concerns, we conducted subgroup analyses based on intervention duration and *qigong* types and employed random-effect models in the analyses, which helped explain the observed variations in treatment effects while accounting for between-study differences.

QiGong on pain measured by VAS

Fifteen studies reported VAS scores in the experimental and control groups, with 554 and 565 participants included in the experimental and control groups, respectively, and a high degree of inter-study heterogeneity ($I^2 = 90.26\%$, $p < 0.001$). Using a random-effects model, the results showed lower scores in the experimental group than in the control group (MD = −1.34, 95% CI −1.76 to −0.92, $p < 0.001$) (Fig. 4). While this reduction is statistically significant, its clinical relevance should be interpreted with reference to the MCID for VAS in CNLBP populations. Previous studies suggest an MCID of 1.5–2.0 points for VAS in chronic LBP, indicating that our observed MD (−1.34) approaches but does not fully meet this threshold [55, 56]. Subgroup analysis according to *qigong* type showed that *baduanjin* [n = 8] (MD = −1.18, 95% CI −1.46 to −0.9, $p < 0.001$); *liuzijue* [n = 2] (MD = −2.88, 95% CI −4.55 to −1.22, $p < 0.001$); *guanyinzizaigong* [n = 1] (MD = −3.44, 95% CI −4.3 to −2.58, $p < 0.001$); *wuqinxi* [n = 2] (MD = −0.72, 95% CI −1.35 to −0.08, $p = 0.03$); *neiyanggong* [n = 2] (MD = −0.1, 95% CI −1.11 to 0.9, $p = 0.84$); and *yijinjing* [n = 1] (MD = −1.24, 95% CI −1.64 to −0.84, $p < 0.001$) scored lower in the experimental group than in the control group (Fig. 5). Subgroup analysis based on the intervention duration (short-term [< 12 weeks] vs. long-term [≥ 12 weeks]) showed that the short- [n = 5] (MD = −1.2, 95% CI −2.87 to −0.90, $p < 0.001$) and long-term [n = 10] (MD = −1.07, 95% CI −1.5 to −0.65, $p < 0.001$) intervention trial groups scored lower than the control group (Fig. 6).

QiGong on pain measured by ODI

Ten studies reported the ODI scores of 278 and 288 participants in the test and control groups, respectively. The heterogeneity between the studies was high ($I^2 = 90.54\%$, $p < 0.001$). Using a random-effects model, the results showed that the ODI scores were lower in the experimental group than in the control group (MD = −5.88, 95% CI −7.98 to −3.78, $p < 0.001$) (Fig. 7). For ODI, the MCID is typically defined as 10 points in chronic LBP populations [57]. While our result represents a statistically significant improvement, the magnitude (−5.88) falls below this threshold, suggesting modest clinical relevance. Subgroup analysis according to the *qigong* type showed that *baduanjin* [n = 6] (MD = −5.88, 95% CI −8.09 to −3.67, $p < 0.001$); *liuzijue* [n = 2] (MD = −10.17, 95% CI −13.94 to −6.41, $p < 0.001$); *wuqinxi* [n = 1] (MD = −0.89, 95% CI −4.65 to 2.87, $p = 0.64$); and *guanyinzizaigong*

Table 1 Characteristics of the included studies

Author	Region/year	Sample size (IG/CG)	Male	Age (year)	Course of disease	Prescription Intervention	Time	Duration	Frequency	Outcomes
Liu, et al	China/2022	25/25	IG: 8	IG: 44.44 ± 12.48	IG: 19.44 ± 7.53 months	IG: Yijinjing	IG: 30 min	IG: 12 week	IG: 3/week	VAS, SF-36, LROM, ODI, HAMA, HAMD, IL-6, TNF-α, 5-HT
			CG: 9	CG: 47.96 ± 17.32	CG: 22.32 ± 11.20 months	CG: Health education	CG: I h	CG: 12 week	CG: 1/week	
Qi, et al	China/2017	25/25	IG: 12	IG: 49.53 ± 10.87	IG: 4.53 ± 2.08 months	IG: Baduanjin	IG: NI	IG: 2 months	IG: 5/week	VAS, JOA
			CG: 13	CG: 48.27 ± 11.35	CG: 4.36 ± 1.44 months	CG: Suspension exercise therapy	CG: 45 min	CG: 2 months	CG: 5/week	
Ning, et al	China/2014	26/26	IG: 12	IG: 40.73 ± 11.52	IG: NI	IG: Wuqinxi	IG: 30 min	IG: 3 months	IG: 3/week	VAS, ODI, LROM, RR
			CG: 11	CG: 42.13 ± 11.18	CG: NI	CG: Core strength training	CG: NI	CG: 3 months	CG: 3/week	
Ye, et al	China/2018	25/28	IG: 10	IG: 40.31 ± 7.59	IG: 6.95 ± 3.50 months	IG: Liuzijue + Usual care	IG: 30 min	IG: 4 week	IG: 5/week	VAS, ODI
			CG: 15	CG: 38.98 ± 8.27	CG: 7.07 ± 2.98 months	CG: Usual care	CG: 30 min	CG: 4 week	CG: 5/week	
Gao, et al	China/2016	30/30	IG: 17	IG: 35.68 ± 12.56	IG: 16.33 ± 6.89 months	IG:Baduanjin + Routine Rehabilitation	IG: 30 min	IG: 8 week	IG: 6/week	VAS, HADS, ODI, PSEQ
			CG: 21	CG: 36.45 ± 12.38	CG: 17.10 ± 6.52 months	CG: Routine Rehabilitation	CG: 30 min	CG: 8 week	CG: 6/week	
Phattharasupharerk, et al	Thailand/2018	36/36	IG: 12	IG: 35.7 ± 3.6	IG: NI	IG:GuanYinZiZaiGong	IG: 1 h	IG: 6 week	IG: 1/week	VAS, RMDQ, LROM, CSPI, HR, RR, ST-5
			CG: 14	CG: 34.8 ± 4.3		CG: Waiting List				
Yang, et al	China/2022	29/27	IG: 14	IG: 31.24 ± 3.82	IG: 13.31 ± 2.54 months	IG: Baduanjin	IG: 30 min	IG: 4 week	IG: 5/week	NPRS, ODI, SEMG
			CG: 13	CG: 31.78 ± 2.59	CG: 12.15 ± 2.14 months	CG: walking	CG: 30 min	CG: 4 week	CG: 5/week	
Su, et al	China/2019	32/32	IG: 8	IG: 58.19 ± 4.70	IG: 4.63 ± 1.21 years	IG: Baduanjin	IG: 45 min	IG: 12 week	IG: 4/week	VAS, ODI
			CG: 11	CG: 58.75 ± 5.21	CG: 4.78 ± 1.60 years	CG: Health education	CG: NI	CG: 12 week	CG: 4/week	
Liu, et al	China/2020	47/53	IG: 9	IG: 58.34 ± 4.89	IG: 4.02 ± 1.01 years	IG: Baduanjin	IG: ≥ 30 min	IG: 12 week	IG: 5/week	VAS, ODI
			CG: 14	CG: 60.92 ± 7.52	CG: 3.77 ± 1.33 years	CG: Medical treatment + Aerobic exercise	CG: NI	CG: 12 week	CG: 5/week	
He, et al	China/2019	60/60	IG: 38	IG: 41.70 ± 6.58	IG: 16.47 ± 2.21 months	IG: Baduanjin	IG: NI	IG: 12 week	IG: 5/week	VAS, ODI, FFD, JOA
			CG: 42	CG: 42.52 ± 6.61	CG: 16.82 ± 2.26 months	CG: Routine Rehabilitation	CG: NI	CG: 12 week	CG: 5/week	
Fang, et al	China/2015	32/31	IG: NI	IG:52.91 + 15.80	IG: 13.17 + 9.21 years	IG: Wuqinxi	IG: 30–60 min	IG: 6 months	IG: 3–4/week	VAS, IEMG

Table 1 (continued)

Author	Region/year	Sample size (IG/CG)	Male	Age (year)	Course of disease	Prescription Intervention	Time	Duration	Frequency	Outcomes
			CG: NI	CG:53.88 + 14.17	CG: 12.36 ± 10.75 years	CG: McKenzie Gymnastics	CG: 30–60 min	CG: 6 months	CG: 3–4/week	
Su, et al	China/2020	37/39	IG: 8	IG: 68.86 ± 4.63	IG: 4.57 ± 1.07 years	IG: Baduanjin	IG: 45 min	IG: 12 week	IG: 4/week	VAS, ODI
			CG: 11	CG: 70.74 ± 6.96	CG: 5.10 ± 1.74 years	CG: Health education	CG: NI	CG: 12 week	CG: 4/week	
Zhang, et al	China/2019	37/40	IG: NI	IG: NI	IG: NI	IG: Baduanjin	IG: NI	IG: 10 week	IG: 5/week	LROM, VAS
			CG: NI	CG: NI	CG: NI	CG: Five point support functional exercise	CG: NI	CG: 10 week	CG: 5/week	
Zhang,	China/2023	20/20	IG: 12	IG: 42.8 ± 2.7	IG: NI	IG: Breathing exercises and core exercises	IG: 30 min	IG: 4 week	IG: 5/week	VAS, ODI
			CG: 11	CG: 43.5 ± 3.8	CG: NI	CG: Usual care	CG: 30 min	CG: 4 week	CG: 5/week	
Blodt, et al	Germany/2015	64/63	IG: 6	IG: 45.7 ± 10	IG: 2.7 ± 1.4 years	IG: Neiyanggong	IG: 90 min	IG: 12 weeks	IG: 1/week	VAS, RMDQ, SF-36
			CG: 19	CG: 47.7 ± 10.8	CG: 3.2 ± 1.5 years	CG: Exercise therapy	CG: 60 min	CG: 12 weeks	CG: 1/week	
Teut, et al	Germany/2016	58/57	IG: 8	IG: 72.4 ± 5.7	IG: 18.1 ± 13.2 years	IG: Neiyanggong	IG: 90 min	IG: 3 months	IG: 1/week	FRI, VAS, SF-36, GDS, BF
			CG: 5	CG: 72.6 ± 6.0	CG: 19.6 ± 16.3 years	CG: Waiting list				

VAS, visual analog scale; ODI, Oswestry Disability Index; JOA, Japanese Orthopedic Association; FFD, finger-floor distance; IG, intervention group; CG, control group; NI, no information; SF-36, short form 36; LROM, Range of motion of lumbar joint; RR, recurrence rate; ER, effective rate; SF-MPQ, McGill Pain Questionnaire Short-Form; IEMG, integrated electromyography; HAMA, Hamilton Anxiety Scale; HAMD, Hamilton Depression Scale; IL-6, interleukin-6; TNF-α, tumor necrosis factor; 5-HT, 5-hydroxytryptamine; PSEQ, Pain Self-efficacy Questionnaire; RMDQ, Roland-Morris Disability Questionnaire; CSPI, Core Stability Performance Index; HR, heart rate; RR, respiratory rate; ST-5, Srithanya Stress Scale; SEMG, surface electromyography; NPRS, Numeric Pain Rating Scale; GDS, Geriatric Depression Scale; FRI, Functional Rating Index; BF, back function

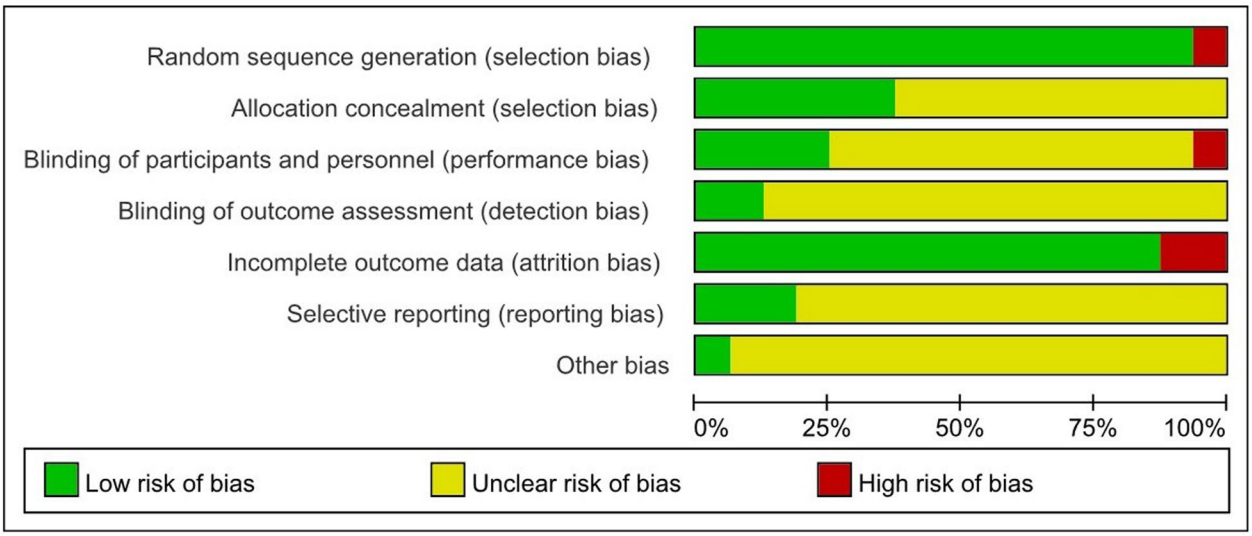

Fig. 2 Evaluation of the quality of the included literature

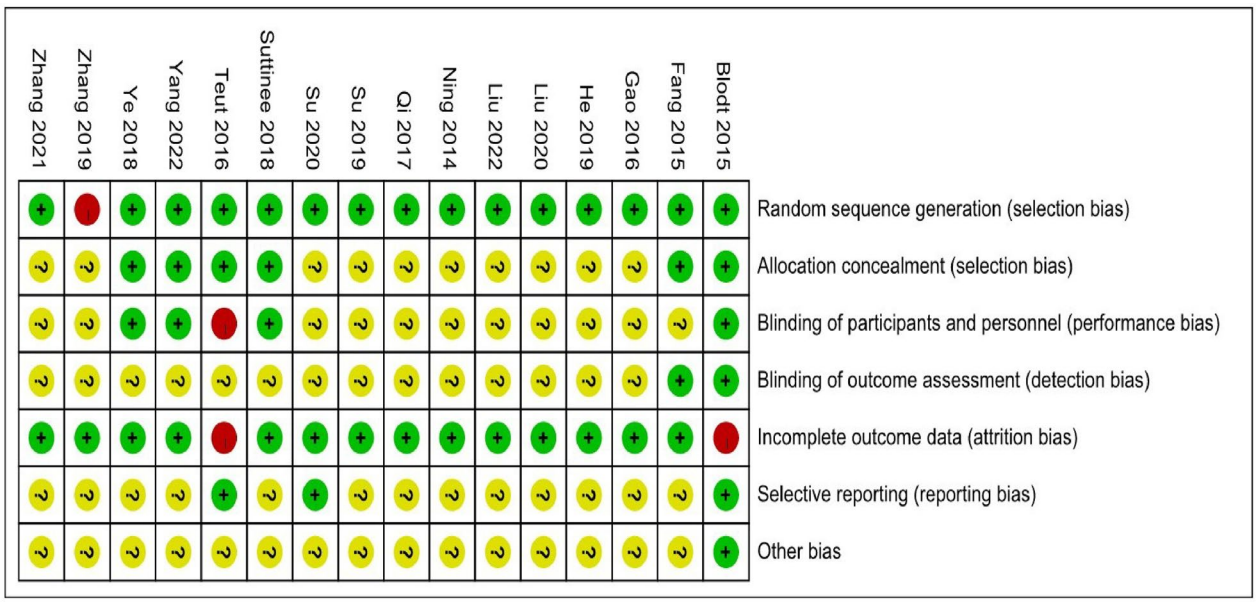

Fig. 3 Percentage of studies with low, unclear, and high risk of bias according to each of the characteristics of the Cochrane Risk of Bias Tool for studying Qigong on pain and disability in patients with chronic non-specific low back pain

[n = 1] (MD = − 3, 95% CI − 4.73 to − 1.27, $p = 0.001$) scored lower in the experimental group than in the control group (Fig. 8). Subgroup analysis according to the intervention duration showed that short- [n = 3] (MD = − 7.34, 95% CI − 13.72 to − 0.97, $p = 0.024$) and long-term [n = 7] (MD = − 5.3, 95% CI − 7.47 to − 3.14, $p < 0.001$) intervention scored lower in the experimental group than in the control group (Fig. 9).

GRADE quality grading of evidence

GRADE Profiler 3.6 was used to evaluate the quality of the strength of evidence for outcome indicators, and the quality of evidence in this study was minimal (Supplementary material 2).

Study name	Time point	Std diff in means	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value
Liu(2022)	Long-term	-1.738	0.332	0.110	-2.389	-1.087	-5.235	0.000
Qi (2017)	Short-term	-1.401	0.316	0.100	-2.020	-0.783	-4.440	0.000
Ning(2014)	Long-term	-0.314	0.279	0.078	-0.861	0.233	-1.126	0.260
Ye(2018)	Short-term	-3.236	0.418	0.174	-4.054	-2.417	-7.746	0.000
Gao(2016)	Short-term	-0.836	0.269	0.072	-1.363	-0.308	-3.104	0.002
Suttinee(2018)	Long-term	-1.844	0.281	0.079	-2.396	-1.293	-6.555	0.000
Yang(2022)	Short-term	-3.764	0.445	0.198	-4.636	-2.891	-8.458	0.000
Su(2019)	Long-term	-1.412	0.279	0.078	-1.959	-0.864	-5.053	0.000
Liu(2020)	Long-term	-0.803	0.208	0.043	-1.211	-0.394	-3.854	0.000
He(2019)	Long-term	-2.715	0.253	0.064	-3.211	-2.219	-10.727	0.000
Zhang(2023)	Short-term	-2.264	0.405	0.164	-3.058	-1.470	-5.590	0.000
Fang(2015)	Long-term	-0.649	0.259	0.067	-1.156	-0.142	-2.510	0.012
Su(2020)	Long-term	-0.939	0.242	0.058	-1.413	-0.465	-3.882	0.000
Zhang(2019)	Short-term	-0.334	0.230	0.053	-0.784	0.116	-1.456	0.146
Blodt(2015)	Long-term	0.223	0.178	0.032	-0.126	0.572	1.250	0.211
Teut(2016)	Long-term	-0.320	0.188	0.035	-0.688	0.048	-1.705	0.088
		-1.354	0.252	0.063	-1.848	-0.861	-5.380	0.000

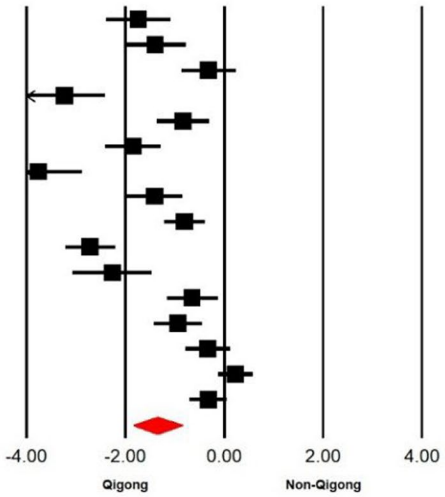

Fig. 4 Results of the meta-analysis comparing VAS scores between the two groups

Group by Type	Study name	Time point	Std diff in means	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value
Baduanjin	Qi (2017)	Short-term	-1.401	0.316	0.100	-2.020	-0.783	-4.440	0.000
Baduanjin	Gao(2016)	Short-term	-0.836	0.269	0.072	-1.363	-0.308	-3.104	0.002
Baduanjin	Yang(2022)	Short-term	-3.764	0.445	0.198	-4.636	-2.891	-8.458	0.000
Baduanjin	Su(2019)	Long-term	-1.412	0.279	0.078	-1.959	-0.864	-5.053	0.000
Baduanjin	Liu(2020)	Long-term	-0.803	0.208	0.043	-1.211	-0.394	-3.854	0.000
Baduanjin	He(2019)	Long-term	-2.715	0.253	0.064	-3.211	-2.219	-10.727	0.000
Baduanjin	Su(2020)	Long-term	-0.939	0.242	0.058	-1.413	-0.465	-3.882	0.000
Baduanjin	Zhang(2019)	Short-term	-0.334	0.230	0.053	-0.784	0.116	-1.456	0.146
Baduanjin			-1.485	0.338	0.114	-2.149	-0.822	-4.390	0.000
Guanyinzizaigong	Suttinee(2018)	Long-term	-1.844	0.281	0.079	-2.396	-1.293	-6.555	0.000
Guanyinzizaigong			-1.844	0.281	0.079	-2.396	-1.293	-6.555	0.000
Liuzijue	Ye(2018)	Short-term	-3.236	0.418	0.174	-4.054	-2.417	-7.746	0.000
Liuzijue	Zhang(2023)	Short-term	-2.264	0.405	0.164	-3.058	-1.470	-5.590	0.000
Liuzijue			-2.745	0.486	0.236	-3.696	-1.793	-5.653	0.000
Neiyanggong	Blodt(2015)	Long-term	0.223	0.178	0.032	-0.126	0.572	1.250	0.211
Neiyanggong	Teut(2016)	Long-term	-0.320	0.188	0.035	-0.688	0.048	-1.705	0.088
Neiyanggong			-0.045	0.271	0.074	-0.577	0.486	-0.168	0.867
Wuqinxi	Ning(2014)	Long-term	-0.314	0.279	0.078	-0.861	0.233	-1.126	0.260
Wuqinxi	Fang(2015)	Long-term	-0.649	0.259	0.067	-1.156	-0.142	-2.510	0.012
Wuqinxi			-0.494	0.190	0.036	-0.866	-0.123	-2.607	0.009
Yijinjing	Liu(2022)	Long-term	-1.738	0.332	0.110	-2.389	-1.087	-5.235	0.000
Yijinjing			-1.738	0.332	0.110	-2.389	-1.087	-5.235	0.000
Overall			-1.026	0.115	0.013	-1.251	-0.801	-8.948	0.000

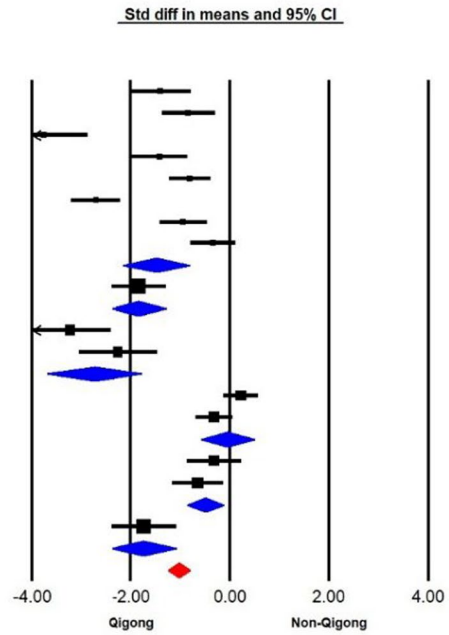

Fig. 5 Subgroup analyses of VAS scores. The blue parts of the figure represent the pooled effect sizes for the different subgroups, and the red parts represent the total effect sizes

Publication bias analysis

For the meta-analysis, Egger's test was performed separately for studies with pain and disability as outcome indicators. Both tests revealed publication bias in the scores of the included studies. A cut-and-patch adjustment method was used to correct the resulting funnel plot asymmetry. After the clipping-and-patching method, the combined effect size for pain- and disability-related outcomes were updated to −1.70 (95% CI −2.15 to −1.25) and −6.34 (95% CI −8.39 to −4.29), respectively; statistical significance was maintained for both and was consistent with the findings before

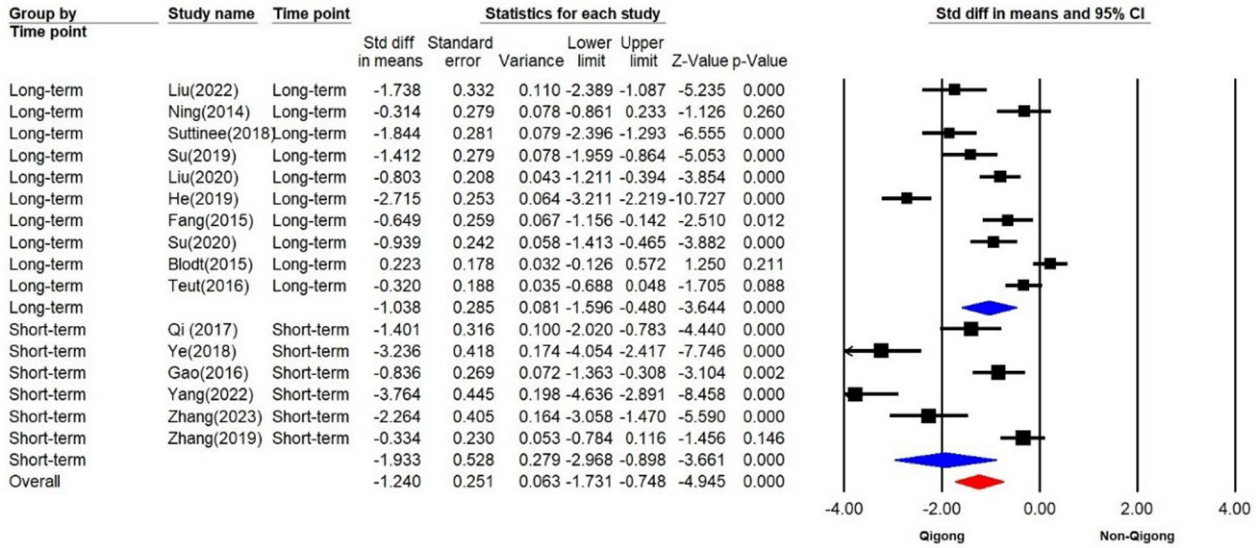

Fig. 6 Subgroup analyses of VAS scores. The blue parts of the figure represent the pooled effect sizes for the different subgroups, and the red parts represent the total effect sizes

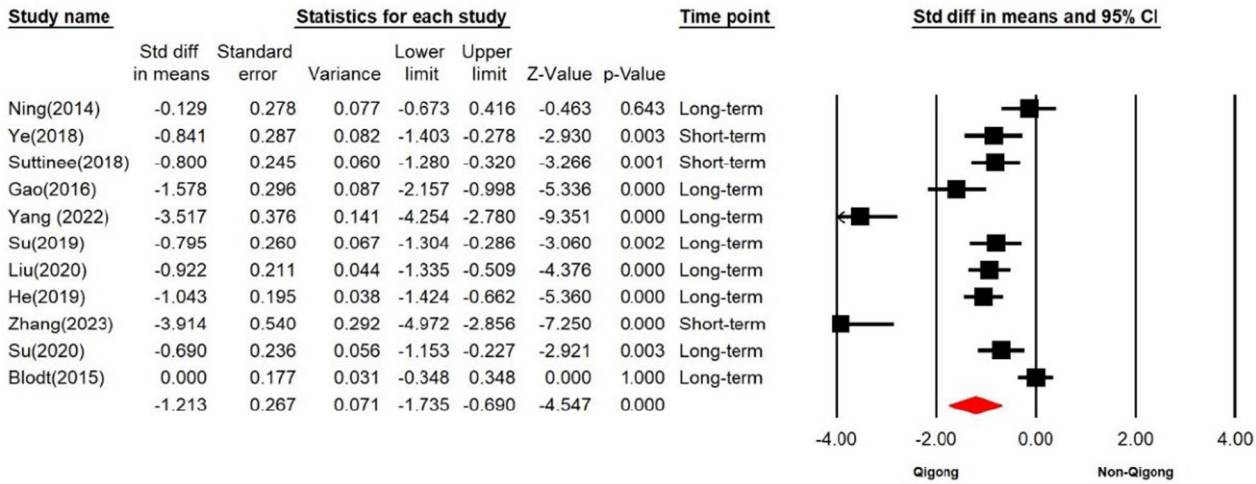

Fig. 7 Results of the meta-analysis comparing ODI scores between the two groups

adjustment. These results suggest that, despite the publication bias, the conclusions of the meta-analysis remained robust and reliable after adjustment using the cut-and-patch method (Supplementary material 3).

Sensitivity analysis

Sensitivity analyses showed that our main findings were reliable. After excluding the study by Ye et al. for the pain outcome, heterogeneity decreased from $I^2 = 90.26\%$ to 84.56%. After excluding the study by Zhang et al. for disability outcomes, heterogeneity decreased from $I^2 = 90.54\%$ to 86.17%. The final effects remained stable (Supplementary Material 3). Subgroup analyses revealed that heterogeneity of the included literature decreased in most domains, explaining the source of the heterogeneity. However, a high level of heterogeneity remained in one domain; therefore, the results were interpreted carefully.

Discussion

This study analyzed 16 articles from three countries, including 1,175 participants. Here, we used a comprehensive meta-analysis (CMA V3.0, Biostat, USA) software to statistically analyze the indicators related to LBP. The study results provide important insights into the role

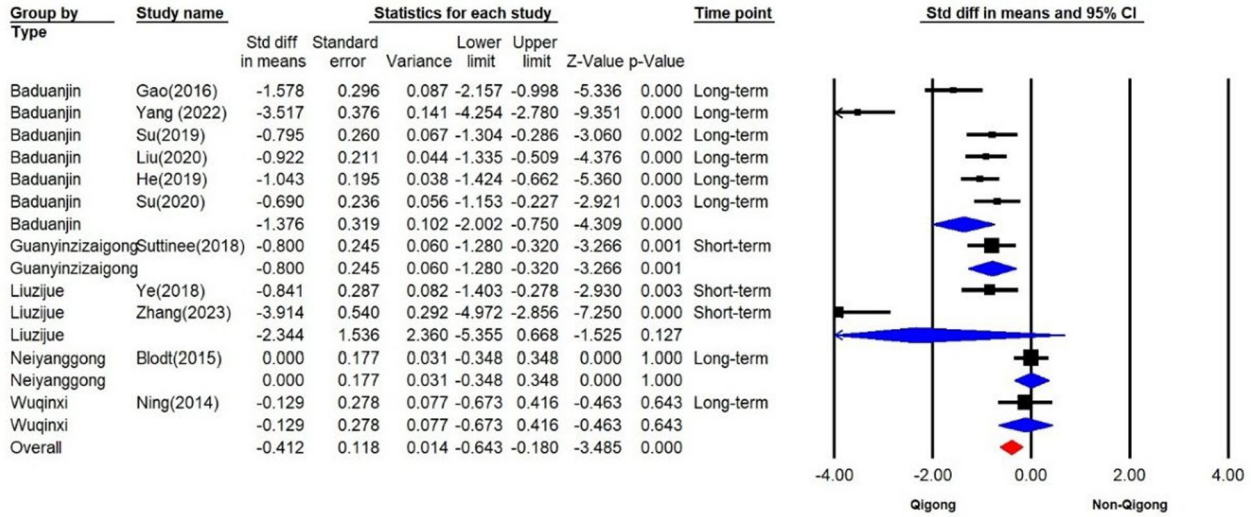

Fig. 8 Subgroup analyses of ODI scores. The blue parts of the figure represent the pooled effect sizes for the different subgroups, and the red parts represent the total effect sizes

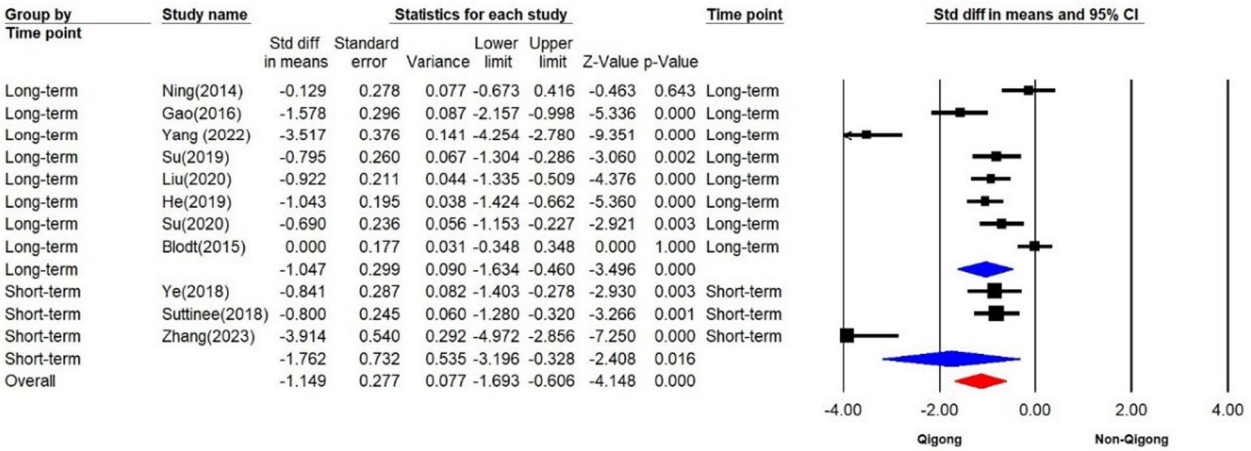

Fig. 9 Subgroup analyses of ODI scores. The blue parts of the figure represent the pooled effect sizes for the different subgroups, and the red parts represent the total effect sizes

of *qigong* in improving pain and disability in patients with CNLBP.

First, the meta-analysis results showed that patients with CNLBP who participated in *qigong* practice achieved significant pain relief (MD = −1.34, 95% CI −1.76 to −0.92, $p < 0.001$), suggesting its effectiveness as a non-pharmacological treatment to improve pain symptoms in patients with LBP. Subgroup analysis of the included studies for the degree of pain relief showed that *liuzijue* was the most effective [47, 53], followed by *yijinjing* [46], *guanyinzizaigong* [41], *baduanjin* [39, 43, 45, 49–52, 54], and *wuqinxi* [44], whereas *neiyanggong* showed the most limited efficacy [40, 42]. The results showed that long- and short-term training effectively improved CNLBP in all populations, and short-term interventions were more effective than long-term interventions. This difference can be attributed to several factors. First, the placebo effect was more pronounced in the short-term intervention. Patients were more likely to be positively influenced by the expectations and psychological cues of *qigong* therapy during the initial treatment period, thereby showing significant pain relief. However, as treatment continues, patients gradually adapt to the treatment, and the placebo effect decreases, leading to a decreased long-term efficacy [58]. Second, continuity and consistency of treatment are important factors. In

the short-term, patients were more cooperative and followed strict treatment plans, resulting in better results. However, patients may experience inconsistencies or interruptions in their treatment plans, which affect the effectiveness of long-term interventions. Furthermore, lifestyle and environmental factors can affect treatment outcomes [59, 60]. In the short-term, patients were more likely to avoid triggers of LBP, such as poor posture or repetitive motion, thereby reducing pain. However, lifestyle and environmental factors may gradually return to their pre-treatment state, leading to a decreased long-term efficacy. Overall, these factors explain the superior results of short-term interventions in CNLBP treatment.

Second, the meta-analysis results showed that *qigong* practice improved functional recovery and disability in patients with CNLBP (MD = − 5.88, 95% CI − 7.98 to − 3.78, $p < 0.001$). This suggests that *qigong* can help improve the functional status of the patient's lower back and reduce the probability of their disability. Subgroup analyses of the included studies showed that long- and short-term *qigong* training improved functional impairment in patients with CNLBP and short-term interventions were more effective than long-term interventions. Regarding the degree of relief from dysfunction, the results showed that *liuzijue* had the best efficacy (MD = − 10.17, 95% CI − 13.94 to − 6.41, $p < 0.001$), followed by *baduanji* and *guanyinzizaigong*, and *wuqinxi* showed little or no improvement.

Recently, the use of *qigong* as a non-pharmacological intervention in patients with CNLBP has gradually increased. By promoting blood and lymphatic circulation and improving nutrient supply and waste metabolism in tissues, *qigong* helps relieve inflammation and swelling in the lower back [61, 40]. Therefore, *qigong* can positively impact pain and disability in patients with CNLBP. Furthermore, by regulating the function of the autonomic nervous system, including the balance of sympathetic and parasympathetic nerves, mind–body movements can influence perception and response to pain, thereby reducing the degree and frequency of pain [62, 63]. Common exercises in *qigong* training include abdominal breathing, slow rhythmic postural adjustment, and gentle stretching. These exercises help increase the strength and flexibility of the lower back muscles, which reduce the incidence of LBP. Provided that the outcome measures of this study involve multiple dimensions and scales, it increases the difficulty and complexity of interpreting the results. Multidimensional outcome measures can provide a more comprehensive assessment of effects; however, many variables and potential interactions should be considered. Therefore, although *qigong* has shown promise as a non-pharmacological treatment for CNLBP, we should interpret the results carefully and emphasize the need for higher standards and consistency in the design and implementation of future research.

In the clinical trial context, several factors merit careful consideration in interpreting our findings. The effectiveness of *qigong* interventions may be influenced by various controlled factors, including practitioner expertise, participant compliance, and the standardization of *qigong* protocols. Previous clinical trials have demonstrated that instructor qualification and teaching methodology significantly impact treatment outcomes [64]. Furthermore, the heterogeneity in *qigong* practice methods and durations across different clinical settings poses challenges for standardization [65]. The included studies encompassed heterogeneous populations, including varying age groups, occupational backgrounds, and cultural contexts. While this diversity enhances ecological validity, it complicates direct generalization to specific subgroups. For instance, the efficacy of qigong in elderly German patients with chronic CNLBP may differ from younger Chinese office workers due to differences in physical capacity, cultural engagement, and baseline pain severity. The level of participant adherence to prescribed *qigong* routines correlates strongly with treatment outcomes [66]. Studies have indicated that supervised practice sessions yield better results than that of home-based programs [67]. Quality control measures in clinical trials of *qigong* interventions are crucial. Studies with stricter control measures and standardized protocols reported more reliable outcomes [68]. In addition to the findings of pain reduction and disability improvement, our systematic review and meta-analysis offer important clinical insights. For clinicians, *qigong* presents a promising non-pharmacological option for managing chronic non-specific low back pain (CNLBP), providing a complementary treatment to conventional therapies. For researchers, this review highlights the need for further high-quality studies to better standardize *qigong* interventions and explore its efficacy across diverse populations and treatment protocols. For patients, *qigong* exercises offer an accessible and low-risk alternative for pain relief and functional improvement, making it a viable option for long-term self-management of CNLBP.

Although *qigong* demonstrated statistically significant reductions in pain (VAS MD = − 1.34) and disability (ODI MD = − 5.88), the clinical meaningfulness of these effects warrants careful consideration. The observed pain reduction (− 1.34) approximates but does not fully reach the MCID threshold of 1.5–2.0 points for VAS in chronic LBP. Similarly, the disability improvement (− 5.88) is approximately half the MCID of 10 points for ODI. These findings suggest that *qigong* may provide incremental benefits, particularly as an adjunct to multimodal therapies. Notably, while the earlier review grouped

qigong with other mind–body practices such as tai chi, which may have obscured the unique effects of qigong, our study focuses exclusively on qigong interventions, thereby providing more specific insights into its effectiveness for chronic non-specific low back pain (CNLBP). Future studies should evaluate longer-term interventions or synergistic combinations with other modalities to determine if clinically meaningful thresholds can be achieved.

Limitation and future directions

The study limitations are reflected mainly in three aspects. First, the sources of the literature for this study are mainly concentrated in the Chinese region, and there may be regional publication bias, which limits the generalizability and extrapolation of the findings. Second, although this study explores the application of *qigong* as a non-pharmacological intervention in patients with CNLBP, significant differences in the implementation of *qigong* training methods worldwide must be recognized. Despite the same training method, parameters such as training frequency, duration, and intensity vary by location and can lead to variability in treatment outcomes. Therefore, to ensure the effectiveness and safety of *qigong* therapy, standardized and scientifically-based guidelines must be developed and adhered to establish uniform and standardized training programs. This includes systematic standardization of key elements, such as training methods, frequency, and duration. Furthermore, extensive clinical trials are needed to accumulate evidence on conducting reasonable evaluations and treatments for patients with CNLBP in clinical practice using *qigong*. This will help establish an effective and feasible *qigong* training program. Finally, the methodological quality and quality of the evidence ratings of the literature included in this study were generally low. The randomization methods of some of the included studies were unclear. Most studies did not mention the concealment of the random allocation scheme in detail, which affected the reliability of the results. The high heterogeneity ($I^2 > 90\%$) observed in both pain and disability outcomes raises significant concerns about the validity of pooling these studies. While random-effects models account for between-study variability, such extreme heterogeneity suggests fundamental differences in study populations, interventions, or methodologies that may render the pooled estimates unreliable. Key sources of heterogeneity include intervention diversity (variations in *qigong* forms, session durations, and frequencies), control group heterogeneity (comparisons involving active, passive controls, or no treatment), and cultural/methodological factors (over 75% of studies conducted in China, potentially influencing adherence and placebo effects, while non-Chinese studies often lacked standardized protocols). These limitations imply that the pooled effect sizes should be interpreted as exploratory rather than definitive. Although subgroup analyses reduced heterogeneity in some domains, residual variability persists, reflecting the challenges of synthesizing highly diverse interventions. Although subgroup analyses attempted to address these differences, the persistent heterogeneity suggests that pooled effect sizes should be interpreted cautiously. Compared to Yang et al., our analysis includes 12 additional qigong RCTs, primarily from Chinese populations, and excludes studies combining qigong with other therapies. This specificity clarifies qigong's standalone benefits, particularly for short-term pain relief, while highlighting the need for cross-cultural validation [32].

While pain and disability are essential endpoints, future reviews should include broader outcomes such as quality of life (QoL) and mental health, particularly as more randomized controlled trials (RCTs) adopt multidimensional assessments. Long-term follow-up data are also crucial to assess the durability of *qigong*'s benefits and its potential to reduce recurrence. Additionally, practical challenges during the review process—such as language and translation barriers, limited access to regional databases, the resource-intensive task of screening 190 records, and the exclusion of grey literature—further restrict the generalizability of the findings. Given the heterogeneity of the included studies, we recommend several future research directions: conducting global multicenter RCTs to establish cultural generalizability, developing standardized protocols for *qigong* interventions, investigating the biological mechanisms through biomarkers, comparing different *qigong* subtypes with established therapies, evaluating long-term adherence and sustainability, integrating patient-centered outcomes, and conducting cost-effectiveness analyses.

Conclusion

This meta-analysis of 16 studies indicates that *qigong* may improve functional status (ODI) in nonspecific low back pain (CNLBP), with changes meeting the minimal clinically important difference (MCID). However, pain reduction (VAS) did not reach MCID thresholds, suggesting limited clinical relevance for pain relief. However, generalizability is limited by the predominance of studies from China, variability in study designs, and participant heterogeneity. Future high-quality, multicenter trials with stratified recruitment across diverse populations are needed to evaluate the efficacy and safety of different *qigong* forms, integrate standardized multidimensional outcomes, and ensure culturally representative sampling. Until further evidence emerges, clinicians should apply these findings cautiously, prioritizing culturally adapted

protocols and population-specific approaches in CNLBP management.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s13018-025-05576-8.

Supplementary file 1

Supplementary file 2

Supplementary file 3

Acknowledgements
Not applicable.

Authors contribution
DY, LZ and MW designed the study; DY and JZ collected the data; WS and JZ analyzed and interpreted the data; DY, wrote the initial draft; All authors read and approved the final manuscript.

Funding
This work was supported by the National Key Research and Development Program [Grant Number 2023YFC3603902].

Availability of data and materials
No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate
Not applicable.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

Received: 25 October 2024 Accepted: 5 February 2025
Published online: 24 February 2025

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