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RECEIVED 16 April 2025 ACCEPTED 30 June 2025 PUBLISHED 10 July 2025

CITATION

Liu S and Xu D (2025) Effects of traditional Chinese exercise on lung function and mental health in patients with COPD: a systematic review and meta-analysis. *Front. Public Health* 13:1612741. doi: 10.3389/fpubh.2025.1612741

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Effects of traditional Chinese exercise on lung function and mental health in patients with COPD: a systematic review and meta-analysis

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Objective: Despite their widespread use in the management of chronic obstructive pulmonary disease (COPD), pharmacological treatments often demonstrate limited efficacy in alleviating symptoms such as dyspnea and psychological pressure. These limitations highlight the need for complementary nonpharmacological interventions. This study aimed to evaluate the efficacy of traditional Chinese exercise (TCE) in improving lung function and mental health among patients with COPD.

Methods: We conducted a comprehensive search across several databases: CNKI (1979–2024), Wanfang (1998–2024), PubMed (1966–2024), the Cochrane Library (1999–2024), and Web of Science (1961–2024), up to September 2024, to gather all randomized controlled trials (RCTs) studies that evaluated the effects of TCE as the primary intervention for patients with COPD. The results were analyzed and presented using Review Manager 5.4 software, ensuring a systematic approach to data interpretation and visualization.

Results: 67 studies were included and encompassing 5,475 patients. The metaanalysis demonstrated that TCE significantly improved various outcomes in COPD patients, including FEV1 [MD = 0.28, 95% CI (0.23, 0.33), p < 0.001], FEV1% [MD = 5.53, 95% CI (4.41, 6.65), p < 0.001], FVC [MD = 0.31, 95% CI (0.29, 0.34), p < 0.001], FEV1/FVC (%) [MD = 6.00, 95% CI (4.27, 7.73), p < 0.001], the 6MWT [MD = 42.14, 95% CI (36.54, 47.73), p < 0.001], CAT [MD = -4.20, 95% CI (-4.74, -3.66), p < 0.001], anxiety [MD = -1.26, 95% CI (-1.64, -0.89), p < 0.001], and depression [MD = -1.26, 95% CI (-1.59, -0.94), p < 0.001].

Conclusion: TCE significantly improved lung function and alleviated anxiety and depression in COPD patients. This study not only highlights the value of TCE as a nonpharmacological intervention but also offers new directions for psychological management, warranting broader implementation.

Systematic review registration: CRD42024586079, https://www.crd.york. ac.uk/PROSPERO/view/CRD42024586079.

KEYWORDS

COPD, traditional Chinese exercise, lung function, mental health, systematic review

1 Introduction

Chronic obstructive pulmonary disease (COPD) is a significant global public health concern that profoundly affects patients' quality of life, and the incidence rate among individuals over 40 years old globally has reached 10% (1). The progressive and irreversible nature of persistent airflow limitation makes daily activities increasingly challenging. Additionally, the prevalence of COPD among individuals aged 40 and older has reached 10%, making it the fourth leading cause of death from respiratory diseases (2). COPD presents with sudden onset, persistent, and recurrent symptoms, which not only impose psychological burdens but also exacerbate anxiety and depression, leading to a decrease in confidence in recovery. Furthermore, the substantial medical resources required to manage COPD contribute to an increased socioeconomic burden. Currently, standardized rehabilitation for COPD is still being explored, with pulmonary rehabilitation considered a crucial part of comprehensive care, with a primary focus on exercise and endurance training (3). However, COPD patients frequently experience shortness of breath, weakness, and limited physical activity, which can entrap them in a vicious cycle of inactivity. Therefore, finding an efficient exercise program with moderate to low intensity has become a pressing need.

Traditional Chinese exercise (TCE), which includes Baduanjin, Taichi, Liuzijue, Wuqinxi, and Yijinjing, is characterized by slow, smooth, gentle movements that have a low impact (4). These exercises combine breath control, psychological awareness, mental focus, and physical activity to promote greater mental calmness and a sense of inner well-being. TCEs typically require no specialized equipment and can be practiced in small indoor spaces or outdoor settings such as parks, making them highly accessible. A typical exercise lasts 20 to 40 min, with a recommended frequency of 3 to 5 times per week, and different training plans can be developed according to the patient's needs. While some forms such as Baduanjin and Liuzijue are simple enough to be self-taught using instructional videos or classes, others like Taichi, Wuqinxi and Yijinjing may require initial coaching from trained instructors to ensure proper technique. As a multi-modal mind-body intervention, TCE aligns well with the exercise needs of COPD patients. Research has shown that TCE can serve as an alternative therapy to improve lung function, flexibility and balance, quality of life, and mental health in COPD patients (5). However, individual studies are often affected by differences in sample size, inclusion criteria, and research methods, resulting in a lack of robust evidence-based research on the efficacy of different types of TCE for treating COPD. This variability makes it challenging to guide clinical practice effectively.

In this study, we implemented an extensive meta-analysis to investigate the impact of TCE as an alternative treatment on the lung function and mental health of patients with COPD. This research fills a gap in the literature and provides new insights and robust psychological intervention strategies for the supportive treatment of COPD.

2 Methods

2.1 Registration

This study was conducted in accordance with the PRISMA statement and has been registered with PROSPERO (CRD42024586079). The PICO tool was used to develop the search strategy, where the *Population* of interest was patients with COPD, the *Intervention* was TCEs, the *Comparison* was usual care or daily activities, and the *Outcomes* were lung function, health status, and mental health.

2.2 Search strategy

Two researchers (S. N. Liu and D. B. Xu) independently searched five databases, including CNKI (1979–2024), Wanfang (1998–2024), PubMed (1966–2024), the Cochrane Library (1999–2024), and Web of Science (1961–2024), for randomized controlled trial (RCT) exploring the effects of TCE on patients with COPD up to September 2024. Since all reviewed studies were published, there was no requirement for ethical approval or patient consent. The search strategy was created by a combination of medical subject heading (MeSH) terms and free words, in which the MeSH terms are "Pulmonary Disease, Chronic Obstructive OR COPD" and "Taichi," "Qigong." Free words are synonyms of each subject word, including "Traditional Chinese Exercise," "Baduanjin," "Taiji," "Liuzijue," "Wuqinxi," and "Yijinjing." All databases were searched in any language. In cases of disagreement between the two researchers, a third researcher was consulted to reach a resolution.

2.3 Inclusion and exclusion criteria

The inclusion criteria included: (1) the study type was an RCT assessing the effects of various TCE on COPD; (2) the experimental group employed TCE (Baduanjin, Taichi, Liuzijue, Wuqinxi, or Yijinjing), whereas the control group received standard treatment, with or without additional exercise interventions; (3) participants were COPD patients diagnosed according to the COPD guidelines of the Chinese Medical Association Respiratory Diseases Society or Global Initiative for Chronic Obstructive Lung Disease (6); (4) multiple outcomes or indicators were used to assess the efficacy of TCE; (5) the experimental outcomes or indicators included one of the following measures: lung function (FEV1, FEV1%, FEV1/FVC%, FVC), health status (6MWT, CAT), and mental health (SAS, SDS, HAM-A, HAM-D, HADS).

The exclusion criteria included: (1) reviews, letters, conference abstracts, and similar types of publications; (2) non-RCT designs, case reports, dissertations, or animal studies; (3) studies with incomplete data that could not be extracted for the calculation of mean values and standard deviations; and (4) studies with patients lacking general

Abbreviations: COPD, Chronic Obstructive Pulmonary Disease; TCE, Traditional Chinese Exercise; RCTs, Randomized Controlled Trials; MeSH, Medical Subject Heading; FEV1, Forced Expiratory Volume in 1 s; FEV1%, the First second Forced Vital Capacity Percentage of Expected Value; FVC, Forced Vital Capacity; FEV1/ FVC (%), the Ratio of the First second Forced Vital Capacity of Forced Vital Capacity; 6MWT, 6-Minute Walk Test; CAT, the COPD Assessment Test; SAS, Self-Rating Anxiety Scale scores; SDS, Self-Rating Depression Scale scores; HAMA, Hamilton Anxiety Scale scores; HAMD, Hamilton Depression Scale scores; HADS, Hospital Anxiety and Depression Scale; MD, mean difference; SMD, Standardized mean differences; 95%CI, 95% confidence interval.

exercise capacity or compliance, making it difficult to cooperate with training, evaluation, and treatment.

2.4 Study selection and data extraction

Two researchers (S. N. Liu and D. B. Xu) independently examined all the studies. After removing duplicates according to predefined criteria, they independently screened and excluded studies that did not meet the inclusion criteria. The following information was extracted from the remaining studies: authors, publication year, demographic characteristics, specific intervention and control plans, measurement methods, and outcome indicators. In cases of disagreement between the two researchers, a third researcher was consulted to reach a resolution.

2.5 Quality appraisal

Two researchers (S. N. Liu and D. B. Xu) independently assessed the risk of bias for all the retrieved studies using the Cochrane Collaboration tool, and if the results were inconsistent, a third researcher was consulted to reach a resolution. The quality assessment of the included studies was represented with "low risk of bias" (+) displayed in green, "high risk of bias" (-) displayed in red, and "unclear risk of bias" (?) displayed in yellow (7).

2.6 Data synthesis and analysis

The analysis and exhibition of the survey results in this study were executed using Manager 5.4 software. The lung function and mental health outcomes examined are continuous variables, analyzed using mean difference (MD) and standardized mean difference (SMD), each accompanied by a 95% confidence interval (CI). To assess statistical heterogeneity, Chi-square tests and I^2 statistics were applied. A fixed-effects model was selected when heterogeneity is not significant ($I^2 < 50\%$ and/or p > 0.05). Conversely, when heterogeneity is significant ($I^2 \ge 50\%$ and/or $p \le 0.05$), a random-effects model was employed, along with subgroup analyses on the basis of exercise duration and frequency, to identify the sources of heterogeneity (8). Furthermore, $p \le 0.05$ indicates a significant difference, demonstrating statistical significance in the meta-analysis results.

3 Results

3.1 Study characteristics

This study included 67 studies published in China between 2008 and 2024 (Figure 1). A total of 5,475 participants were involved, with 2,745 in the treatment group and 2,730 in the control group; participants' ages ranged from 45 to 82 years, with intervention durations ranging from 8 to 108 weeks, frequencies ranging from 1 to 7 times per week, and durations ranging from 15 to 90 min per session. Among the 67 eligible studies, 20 focused on Baduanjin, 18 on Taichi, 18 on Liuzijue, 9 on Wuqinxi, and 2 on Yijinjing. Among them, 19 studies utilized follow-up assessments to determine the benefits of TCE on anxiety and depression. Supplementary Table S1 provides a comprehensive overview of these RCTs.

3.2 Risk of bias assessment

The assessment of bias risk reached a consensus after discussion (9-75). For random sequence generation, 48 studies utilized randomization methods and were evaluated as having a low risk of bias. Of the remaining 19 studies, 12 did not mention the randomization method (17, 31, 35, 36, 39, 41, 46, 63, 66, 68, 71, 72), and 7 grouped patients by age or sex, resulting in a high-risk rating (24, 26, 29, 33, 53, 70, 73). With respect to allocation concealment, 3 studies provided detailed descriptions and were rated as low risk (50, 56, 67), whereas 4 were open-label trials and received a high-risk rating (24, 30, 70, 73). Four studies did not employ blinding and were considered high risk (29, 33, 70, 73), whereas 8 studies applied blinding during outcome assessment and were deemed to have a low risk of bias (13, 33, 43, 50, 56, 61, 67, 75). Outcome data and selective reporting were complete across all studies, indicating low risk. For the category of "other biases," none of the studies provided details, and they were rated as having an unclear risk (Figures 2, 3).

3.3 Results of the meta-analysis

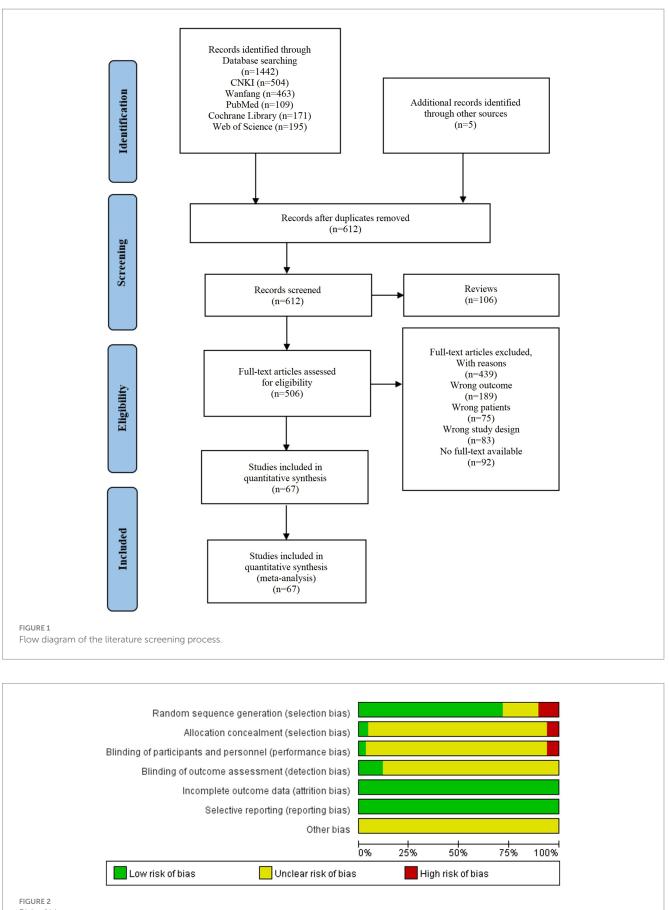
3.3.1 FEV1 (L)

Among the 45 included studies (9, 11, 13, 14, 16, 18–23, 25, 28, 30, 33–35, 37–40, 42–47, 49–51, 55–59, 61–64, 67, 68, 70, 72, 74, 75), the effects of TCE on FEV1 in patients with COPD were reported. These studies examined five different types of exercises: Baduanjin, Taichi, Liuzijue, Wuqinxi, and Yijinjing. The experimental group consisted of 1,895 participants, while the control group included 1,883 participants. The random-effects model indicated no statistical heterogeneity in the Liuzijue and Yijinjing groups (p = 0.45, $l^2 = 0\%$), (p = 0.76, $l^2 = 0\%$). All TCE groups showed significantly higher FEV1 compared to the control group. Results for each group included Baduanjin [MD = 0.32, 95% CI (0.25, 0.40), p < 0.001], Taichi [MD = 0.21, 95% CI (0.12, 0.30), p < 0.001], Liuzijue [MD = 0.21, 95% CI (0.16, 0.25), p < 0.001], Wuqinxi [MD = 0.42, 95% CI (-0.11, 0.73), p < 0.001], and Yijinjing [MD = 0.54, 95% CI (0.36, 0.73), p < 0.001].

Subgroup analyses were conducted based on intervention duration and frequency. In the analysis of intervention duration, the experimental group exhibited a significantly higher FEV1than did the control group before 24 weeks of TCE [MD = 0.27, 95% CI (0.21, 0.34), p < 0.001]. Similarly, for interventions lasting 24 weeks or longer, the experimental group demonstrated a statistically significant improvement in FEV1 [MD = 0.29, 95% CI (0.21, 0.38), p < 0.001]. Additionally, no significant heterogeneity was observed in the subgroup with a frequency of \leq 5 times per week (p = 0.63, $I^2 = 0\%$). Significant differences were found at frequencies of \leq 5 times per week [MD = 0.25, 95% CI (0.22, 0.28), p < 0.001] and > 5 times per week [MD = 0.29, 95% CI (0.26, 0.32), p < 0.001] (Figure 4).

3.3.2 FEV1 (%)

Among the 35 included studies (9, 12, 15, 17, 19, 23, 25, 27–29, 31–33, 35, 38, 41, 42, 45–50, 52, 53, 59–61, 63, 67, 68, 71, 73–75), the effects of TCE on FEV1% in patients with COPD were reported. These



Risk of bias assessment.



studies focused on five specific exercise forms: Baduanjin, Taichi, Liuzijue, Wuqinxi, and Yijinjing. The experimental group consisted of 1,270 participants, while the control group included 1,274 participants. The random-effects model indicated no statistical heterogeneity in the Taichi and Liuzijue groups (p = 0.06, $I^2 = 44\%$), (p = 0.32, $I^2 = 13\%$). However, except for the Yijinjing group, all TCE groups showed significantly higher FEV1% compared to the control group. The results for each group included Baduanjin [MD = 6.26, 95% CI (3.71, 8.81), p < 0.001], Taichi [MD = 3.81, 95% CI (2.59, 5.02), p < 0.001], Liuzijue [MD = 8.19, 95% CI (6.39, 9.99), p < 0.001], Wuqinxi [MD = 4.70, 95% CI (0.74, 8.67), p < 0.002], and Yijinjing [MD = 7.30, 95% CI (-0.60, 15.20), p = 0.07].

Subgroup analyses were performed based on both intervention duration and frequency. In the analysis based on intervention duration, the experimental group exhibited a significantly higher FEV1% than did the control group before 24 weeks of TCE [MD = 6.02, 95% CI (4.31, 7.74), p < 0.001]. Similarly, for interventions lasting 24 weeks or longer, the experimental group demonstrated a statistically significant improvement in FEV1% [MD = 5.11, 95% CI (3.58, 6.65), p < 0.001]. The subgroup analysis based on exercise frequency indicated that both groups in the experimental cohort, significant differences at frequencies of ≤ 5 times per week [MD = 6.32, 95% CI (4.08, 8.56), p < 0.001] and > 5 times per week [MD = 5.23, 95% CI (3.92, 6.55), p < 0.001] (Figure 5).

3.3.3 FVC

In the included literature, 29 studies reported the effects of TCE on FVC in patients with COPD (11, 12, 14, 16–23, 25, 28, 30, 33, 34, 37, 39, 40, 42–44, 48, 52, 57, 58, 67, 68, 72). These studies encompassed four exercise methods: Baduanjin, Taichi, Liuzijue, and Wuqinxi. The experimental group comprised 1,304 participants, whereas the control group included 1,291 participants. The fixed-effects model indicated no statistical heterogeneity in the Baduanjin, Taichi, Liuzijue, and Wuqinxi groups (p = 0.18, $I^2 = 26\%$), (p = 0.06, $I^2 = 45\%$), (p = 0.63, $I^2 = 0\%$), (p = 0.27, $I^2 = 18\%$). Compared with the control group, all TCE groups presented a significantly greater FVC. The results for each group included Baduanjin [MD = 0.33, 95% CI (0.30, 0.37), p < 0.001], Taichi [MD = 0.28, 95% CI (0.22, 0.34), p < 0.001], Liuzijue [MD = 0.22, 95% CI (0.15, 0.30), p < 0.001], and Wuqinxi [MD = 0.47, 95% CI (0.36, 0.58), p < 0.001] (Figure 6).

3.3.4 FEV1/FVC (%)

Among the 43 included studies (9, 11, 12, 14, 15, 17, 19, 21, 23, 27, 28, 30, 32–35, 37–41, 43–45, 47–52, 55–57, 61, 62, 66–68, 70–72, 74, 75), the effects of TCE on FEV1/FVC (%) in patients with COPD were reported. These studies encompassed five types of exercises: Baduanjin, Taichi, Liuzijue, Wuqinxi, and Yijinjing. The experimental group consisted of 1,793 participants, whereas the control group included 1,783 participants. The random-effects model indicated that all TCE groups showed significantly higher FEV1/FVC (%) compared to the control group. Results for each group included Baduanjin [MD = 6.98, 95% CI (4.88, 9.07), p < 0.001], Taichi [MD = 3.89, 95% CI (1.36, 6.42), p < 0.001], Liuzijue [MD = 5.91, 95% CI (3.66, 8.15), p < 0.001], Wuqinxi [MD = 9.54, 95% CI (3.13, 15.95), p < 0.004], and Yijinjing [MD = 4.46, 95% CI (2.55, 6.36), p < 0.001].

Study or Subgroup	Experiment Mean SD		Total Moint	Mean Difference IV, Random, 95% Cl	Mean Difference IV, Random, 95% Cl
1.1.1 Baduanjin	mean SD	Total Mean SD	rotal weight	IV, Kandom, 95% CI	
Cao 2016	1.43 0.42	52 1.23 0.28	50 2.5%	0.20 [0.06, 0.34]	
Hou 2017	1.92 0.34	25 1.74 0.28	23 2.3%	0.18 [0.00, 0.36]	
Huang 2016	1.39 0.53	31 1.27 0.64	30 1.5%	0.12 [-0.18, 0.42]	
Huang 2021	1.97 0.31	38 1.68 0.26	38 2.6%	0.29 [0.16, 0.42]	
Jiang 2023	1.89 0.51	40 1.41 0.47	40 2.0%	0.48 [0.27, 0.69]	
LiuY 2021	3.24 0.51	37 2.49 0.42	37 2.0%	0.75 [0.54, 0.96]	
Ma 2022	2.36 0.22	41 1.89 0.24	41 2.8%	0.47 [0.37, 0.57]	
Wang 2018	1.97 0.57	37 1.61 0.42	36 1.9%	0.36 [0.13, 0.59]	
Wang 2022	1.69 0.41	40 1.42 0.36	40 2.3%	0.27 [0.10, 0.44]	
Xia 2022 Xu 2021	0.98 0.19 1.6 0.32	52 0.82 0.25 132 1.31 0.29	52 2.9% 130 2.9%	0.16 [0.07, 0.25] 0.29 [0.22, 0.36]	
Yang 2023	2.56 0.45	40 2.18 0.35	40 2.2%	0.38 [0.20, 0.56]	
Yu 2019	1.75 0.16	45 1.52 0.12	45 3.0%	0.23 [0.17, 0.29]	
Zhu 2014	1.38 0.18	63 0.96 0.17	60 3.0%	0.42 [0.36, 0.48]	
Subtotal (95% CI)		673	662 33.8%	0.32 [0.25, 0.40]	•
Heterogeneity: Tau ² :	= 0.01; Chi ² = 67	.44, df = 13 (P < 0.00	001); I² = 81%		
Test for overall effect	Z = 8.81 (P < 0.	00001)			
1.1.2 Taichi					
Chi 2021	1.19 0.43	108 1.16 0.37	108 2.7%	0.03 [-0.08, 0.14]	+
Gu 2012	1.49 0.85	33 1.32 0.61	30 1.2%	0.17 [-0.19, 0.53]	_
He 2020	1.49 0.62	45 1.31 0.58	45 1.8%	0.18 [-0.07, 0.43]	+
Hu 2020	1.4 0.61	42 1.35 0.55	42 1.8%	0.05 [-0.20, 0.30]	— —
Li 2012	1.89 0.64	30 1.87 0.66	30 1.3%	0.02 [-0.31, 0.35]	
Li 2016	1.45 0.6	20 1.36 0.57	20 1.2%	0.09 [-0.27, 0.45]	
Li 2019	1.95 0.9	26 1.24 0.92	23 0.7%	0.71 [0.20, 1.22]	
Liu 2021	2.08 0.27	41 1.67 0.23	40 2.7%	0.41 [0.30, 0.52]	
Pan 2018 Peng 2020	1.48 0.11 1.64 0.48	20 1.24 0.11 40 1.28 0.46	21 3.0% 40 2.0%	0.24 [0.17, 0.31] 0.36 [0.15, 0.57]	
Ren 2017	1.72 0.3	30 1.43 0.31	30 2.4%	0.29 [0.14, 0.44]	
Zhang 2014	1.38 0.27	18 1.34 0.29	18 2.2%	0.04 [-0.14, 0.22]	<u> </u>
ZhangY 2019	2.73 0.87	29 2.38 0.77	29 1.0%	0.35 [-0.07, 0.77]	+
Subtotal (95% CI)		482	476 24.0%	0.21 [0.12, 0.30]	◆
Heterogeneity: Tau² Test for overall effect			01),1 = 03%		
1.1.3 Liuzijue Cao 2022	1.42 0.33	29 1.15 0.32	31 2.3%	0.27 [0.11, 0.43]	
Chen 2008	1.19 0.26	21 0.95 0.31	19 2.2%	0.24 [0.06, 0.42]	
Deng 2020	1.32 0.54	30 1.14 0.45	32 1.8%	0.18 [-0.07, 0.43]	+
HouMY 2017	1.75 0.45	50 1.45 0.32	49 2.4%	0.30 [0.15, 0.45]	
Ju 2022	1.89 0.46	80 1.73 0.43	80 2.5%	0.16 [0.02, 0.30]	
Li 2024	1.59 0.3	40 1.35 0.26	40 2.6%	0.24 [0.12, 0.36]	
Sun 2019	1.51 0.32	56 1.35 0.35	56 2.6%	0.16 [0.04, 0.28]	
XuL 2021	1.4 0.34 2.01 0.35	18 1.13 0.31 30 1.78 0.28	20 2.0% 30 2.4%	0.27 [0.06, 0.48] 0.23 [0.07, 0.39]	
Yan 2023 ZhangFR 2019	1.08 0.32	62 1.02 0.36	58 2.6%	0.06 [-0.06, 0.18]	
Zhao 2012	1.26 0.35	23 1.14 0.38	22 2.0%	0.12 [-0.09, 0.33]	
Zhao 2018	1.58 0.21	42 1.33 0.22	42 2.8%	0.25 [0.16, 0.34]	
Subtotal (95% CI)		481	479 28.4%	0.21 [0.16, 0.25]	•
Heterogeneity: Tau ² : Test for overall effect					
1.1.4 Wuqinxi					
Gao 2017	1.55 0.28	36 1.25 0.31	36 2.5%	0.30 [0.16, 0.44]	
Liu 2020	1.61 0.51	50 0.97 0.37	50 2.3%	0.64 [0.47, 0.81]	
Sun 2021	1.31 0.18	40 1.21 0.18	40 2.9%	0.10 [0.02, 0.18]	
Xiao 2023 Subtotal (95% CI)	2.21 0.25	58 1.55 0.24 184	58 2.8% 184 10.5%	0.66 [0.57, 0.75] 0.42 [0.11, 0.73]	
Heterogeneity: Tau ² :	= 0 10 ⁻ Chi ² = 95			0.42 [0.11, 0.75]	
Test for overall effect	start and strategies to the start				
1.1.5 Yijinjing	211 000	55 100 050	57 4.0°	0 50 10 00 0 759	
Gao 2016 Zhang 2016	2.44 0.68 3.12 0.68	55 1.92 0.56 20 2.54 0.16	57 1.9% 25 1.4%	0.52 [0.29, 0.75] 0.58 [0.28, 0.88]	
Subtotal (95% CI)	5.12 0.00	20 2.54 0.18 75	82 3.3%		•
Heterogeneity: Tau ² :	•)9, df = 1 (P = 0.76); l			-
Test for overall effect	: Z = 5.77 (P < 0.				
Total (95% CI)	- 0.02: 068- 25	1895 4 20 df - 44 /P < 0.0	1883 100.0%	0.28 [0.23, 0.33]	
Heterogeneity: Tau ² = Test for overall effect			0001), 17 = 83%		-1 -0.5 0 0.5 1
	. <u>2</u> – 11.00 (F × (%	Favours [experimental] Favours [control]

Study or Subgroup		erimen SD		Mean	ontrol SD		Weight	Mean Difference IV, Random, 95% Cl	Mean Difference IV, Random, 95% Cl
1.1.1 FEV1(L) <24we		00	Total	moun	00	Total	Trongine		
Chen 2008		0.26	21	0.95	0.31	19	2.2%	0.24 [0.06, 0.42]	
Deng 2020		0.54	30	1.14		32	1.8%	0.18 [-0.07, 0.43]	
Gao 2017		0.28	36	1.25		36	2.5%	0.30 [0.16, 0.44]	
Gu 2012		0.85	33	1.32		30	1.2%	0.17 [-0.19, 0.53]	
He 2020		0.62	45	1.31		45	1.8%	0.18 [-0.07, 0.43]	+
Hou 2017	1.92	0.34	25	1.74	0.28	23	2.3%	0.18 [0.00, 0.36]	——
Hu 2020	1.4	0.61	42	1.35	0.55	42	1.8%	0.05 [-0.20, 0.30]	
Huang 2016	1.39	0.53	31	1.27	0.64	30	1.5%	0.12 [-0.18, 0.42]	
Huang 2021	1.97	0.31	38	1.68	0.26	38	2.6%	0.29 [0.16, 0.42]	
Jiang 2023	1.89	0.51	40	1.41	0.47	40	2.0%	0.48 [0.27, 0.69]	
Li 2016	1.45	0.6	20	1.36		20	1.2%	0.09 [-0.27, 0.45]	
Li 2019	1.95	0.9	26	1.24		23	0.7%	0.71 [0.20, 1.22]	
Li 2024	1.59	0.3	40	1.35		40	2.6%	0.24 [0.12, 0.36]	
Liu 2020	1.61		50	0.97		50	2.3%	0.64 [0.47, 0.81]	
Ma 2022	2.36		41	1.89		41	2.8%	0.47 [0.37, 0.57]	
Pan 2018		0.11	20	1.24		21	3.0%	0.24 [0.17, 0.31]	
Ren 2017	1.72	0.3	30	1.43		30	2.4%	0.29 [0.14, 0.44]	
Sun 2021	1.31		40	1.21		40	2.9%	0.10 [0.02, 0.18]	
Wang 2022 Via 2022	1.69		40 62	1.42		40 52	2.3%	0.27 [0.10, 0.44]	
Xia 2022 Xiao 2023		0.19 0.25	52 58	0.82 1.55		52 58	2.9% 2.8%	0.16 [0.07, 0.25] 0.66 [0.57, 0.75]	
Xu 2021	1.6		132	1.31		130	2.8%	0.29 [0.22, 0.36]	
Yan 2023	2.01	0.35	30	1.78		30	2.4%	0.23 [0.22, 0.30]	
Yang 2023		0.45	40	2.18		40	2.2%	0.38 [0.20, 0.56]	
Yu 2019		0.16	45	1.52		45	3.0%	0.23 [0.17, 0.29]	
ZhangFR 2019	1.08		62	1.02		58	2.6%	0.06 [-0.06, 0.18]	
Zhao 2012		0.35	23	1.14		22	2.0%	0.12 [-0.09, 0.33]	
Subtotal (95% CI)			1090			1075	60.6%	0.27 [0.21, 0.34]	•
1.1.2 FEV1(L) ≥24we									
Cao 2016	1.43	0.42	52	1.23		50	2.5%	0.20 [0.06, 0.34]	
0.00.0000	4 40	0.33	29	1 1 5	0.32	31		0.071044.040	
Cao 2022	1.42				0.07		2.3%	0.27 [0.11, 0.43]	
Chi 2021	1.19	0.43	108	1.16		108	2.7%	0.03 [-0.08, 0.14]	÷
Chi 2021 Gao 2016	1.19 2.44	0.43 0.68	108 55	1.16 1.92	0.56	108 57	2.7% 1.9%	0.03 [-0.08, 0.14] 0.52 [0.29, 0.75]	+
Chi 2021 Gao 2016 HouMY 2017	1.19 2.44 1.75	0.43 0.68 0.45	108 55 50	1.16 1.92 1.45	0.56 0.32	108 57 49	2.7% 1.9% 2.4%	0.03 [-0.08, 0.14] 0.52 [0.29, 0.75] 0.30 [0.15, 0.45]	
Chi 2021 Gao 2016 HouMY 2017 Ju 2022	1.19 2.44 1.75 1.89	0.43 0.68 0.45 0.46	108 55 50 80	1.16 1.92 1.45 1.73	0.56 0.32 0.43	108 57 49 80	2.7% 1.9% 2.4% 2.5%	0.03 [-0.08, 0.14] 0.52 [0.29, 0.75] 0.30 [0.15, 0.45] 0.16 [0.02, 0.30]	
Chi 2021 Gao 2016 HouMY 2017 Ju 2022 Li 2012	1.19 2.44 1.75 1.89 1.89	0.43 0.68 0.45 0.46 0.64	108 55 50	1.16 1.92 1.45 1.73 1.87	0.56 0.32 0.43 0.66	108 57 49 80 30	2.7% 1.9% 2.4% 2.5% 1.3%	0.03 [-0.08, 0.14] 0.52 [0.29, 0.75] 0.30 [0.15, 0.45] 0.16 [0.02, 0.30] 0.02 [-0.31, 0.35]	
Chi 2021 Gao 2016 HouMY 2017 Ju 2022	1.19 2.44 1.75 1.89	0.43 0.68 0.45 0.46 0.64 0.27	108 55 50 80 30	1.16 1.92 1.45 1.73	0.56 0.32 0.43 0.66 0.23	108 57 49 80	2.7% 1.9% 2.4% 2.5%	0.03 [-0.08, 0.14] 0.52 [0.29, 0.75] 0.30 [0.15, 0.45] 0.16 [0.02, 0.30] 0.02 [-0.31, 0.35] 0.41 [0.30, 0.52]	
Chi 2021 Gao 2016 HouMY 2017 Ju 2022 Li 2012 Liu 2021	1.19 2.44 1.75 1.89 1.89 2.08 3.24	0.43 0.68 0.45 0.46 0.64 0.27	108 55 50 80 30 41	1.16 1.92 1.45 1.73 1.87 1.67	0.56 0.32 0.43 0.66 0.23 0.42	108 57 49 80 30 40	2.7% 1.9% 2.4% 2.5% 1.3% 2.7%	0.03 [-0.08, 0.14] 0.52 [0.29, 0.75] 0.30 [0.15, 0.45] 0.16 [0.02, 0.30] 0.02 [-0.31, 0.35]	
Chi 2021 Gao 2016 HouMY 2017 Ju 2022 Li 2012 Liu 2021 LiuY 2021	1.19 2.44 1.75 1.89 1.89 2.08 3.24	0.43 0.68 0.45 0.46 0.64 0.27 0.51 0.48	108 55 50 80 30 41 37	1.16 1.92 1.45 1.73 1.87 1.67 2.49	0.56 0.32 0.43 0.66 0.23 0.42 0.46	108 57 49 80 30 40 37	2.7% 1.9% 2.4% 2.5% 1.3% 2.7% 2.0%	0.03 [-0.08, 0.14] 0.52 [0.29, 0.75] 0.30 [0.15, 0.45] 0.16 [0.02, 0.30] 0.02 [-0.31, 0.35] 0.41 [0.30, 0.52] 0.75 [0.54, 0.96]	
Chi 2021 Gao 2016 HouMY 2017 Ju 2022 Li 2012 Liu 2021 LiuY 2021 Peng 2020	1.19 2.44 1.75 1.89 1.89 2.08 3.24 1.64 1.51	0.43 0.68 0.45 0.46 0.64 0.27 0.51 0.48	108 55 50 80 30 41 37 40	1.16 1.92 1.45 1.73 1.87 1.67 2.49 1.28	0.56 0.32 0.43 0.66 0.23 0.42 0.46 0.35	108 57 49 80 30 40 37 40	2.7% 1.9% 2.4% 2.5% 1.3% 2.7% 2.0% 2.0%	0.03 [-0.08, 0.14] 0.52 [0.29, 0.75] 0.30 [0.15, 0.45] 0.16 [0.02, 0.30] 0.02 [-0.31, 0.35] 0.41 [0.30, 0.52] 0.75 [0.54, 0.96] 0.36 [0.15, 0.57]	
Chi 2021 Gao 2016 HouMY 2017 Ju 2022 Li 2012 Liu 2021 LiuY 2021 Peng 2020 Sun 2019 Wang 2018	1.19 2.44 1.75 1.89 1.89 2.08 3.24 1.64 1.51	0.43 0.68 0.45 0.64 0.64 0.27 0.51 0.48 0.32 0.57	108 55 80 30 41 37 40 56	1.16 1.92 1.45 1.73 1.87 1.67 2.49 1.28 1.35 1.61 1.13	0.56 0.32 0.43 0.66 0.23 0.42 0.46 0.35 0.42 0.35	108 57 49 80 30 40 37 40 56	2.7% 1.9% 2.4% 2.5% 1.3% 2.7% 2.0% 2.0% 2.6%	0.03 [-0.08, 0.14] 0.52 [0.29, 0.75] 0.30 [0.15, 0.45] 0.16 [0.02, 0.30] 0.02 [-0.31, 0.35] 0.41 [0.30, 0.52] 0.75 [0.54, 0.96] 0.36 [0.15, 0.57] 0.16 [0.04, 0.28]	
Chi 2021 Gao 2016 HouMY 2017 Ju 2022 Liu 2021 Liu 2021 LiuY 2021 Peng 2020 Sun 2019 Wang 2018 XuL 2021 Zhang 2014	1.19 2.44 1.75 1.89 2.08 3.24 1.64 1.51 1.97 1.4 1.38	0.43 0.68 0.45 0.64 0.27 0.51 0.48 0.32 0.57 0.34 0.27	108 55 50 80 30 41 37 40 56 37 18 18	1.16 1.92 1.45 1.73 1.87 1.67 2.49 1.28 1.35 1.61 1.13 1.34	0.56 0.32 0.43 0.66 0.23 0.42 0.46 0.35 0.42 0.31 0.29	108 57 49 80 30 40 37 40 56 36 20 18	2.7% 1.9% 2.4% 2.5% 1.3% 2.7% 2.0% 2.0% 2.6% 1.9% 2.0% 2.2%	0.03 [-0.08, 0.14] 0.52 [0.29, 0.75] 0.30 [0.15, 0.45] 0.016 [0.02, 0.30] 0.02 [-0.31, 0.35] 0.41 [0.30, 0.52] 0.75 [0.54, 0.96] 0.36 [0.15, 0.57] 0.16 [0.04, 0.28] 0.36 [0.13, 0.59] 0.27 [0.06, 0.48] 0.04 [-0.14, 0.22]	
Chi 2021 Gao 2016 HouMY 2017 Ju 2022 Li 2012 Liu 2021 LiuY 2021 Peng 2020 Sun 2019 Wang 2018 XuL 2021 Zhang 2014 Zhang 2016	1.19 2.44 1.75 1.89 2.08 3.24 1.64 1.51 1.97 1.4 1.38 3.12	0.43 0.68 0.45 0.64 0.27 0.51 0.48 0.32 0.57 0.34 0.27 0.68	108 55 50 80 30 41 37 40 56 37 18 18 20	1.16 1.92 1.45 1.73 1.87 1.67 2.49 1.28 1.35 1.61 1.13 1.34 2.54	0.56 0.32 0.43 0.66 0.23 0.42 0.35 0.42 0.31 0.29 0.16	108 57 49 80 30 40 56 36 20 18 25	2.7% 1.9% 2.4% 2.5% 1.3% 2.0% 2.0% 2.6% 1.9% 2.0% 2.2% 1.4%	0.03 [-0.08, 0.14] 0.52 [0.29, 0.75] 0.30 [0.15, 0.45] 0.16 [0.02, 0.30] 0.02 [-0.31, 0.35] 0.41 [0.30, 0.52] 0.75 [0.54, 0.96] 0.36 [0.15, 0.57] 0.16 [0.04, 0.28] 0.36 [0.13, 0.59] 0.27 [0.06, 0.48] 0.04 [-0.14, 0.22] 0.58 [0.28, 0.88]	
Chi 2021 Gao 2016 HouMY 2017 Ju 2022 Li 2012 Liu 2021 LiuY 2021 Peng 2020 Sun 2019 Wang 2018 XuL 2021 Zhang 2014 Zhang 2014 Zhang 2016 Zhang 2019	1.19 2.44 1.75 1.89 2.08 3.24 1.64 1.51 1.97 1.4 1.38 3.12 2.73	0.43 0.68 0.45 0.64 0.27 0.51 0.48 0.32 0.57 0.34 0.27 0.68 0.87	108 55 50 80 30 41 37 40 56 37 18 18 20 29	1.16 1.92 1.45 1.73 1.87 1.67 2.49 1.28 1.35 1.61 1.13 1.34 2.54 2.38	0.56 0.32 0.43 0.66 0.23 0.42 0.46 0.35 0.42 0.31 0.29 0.16 0.77	108 57 49 80 30 40 56 36 20 18 25 29	2.7% 1.9% 2.4% 2.5% 1.3% 2.0% 2.0% 2.0% 2.9% 2.2% 1.4% 1.0%	0.03 [-0.08, 0.14] 0.52 [0.29, 0.75] 0.30 [0.15, 0.45] 0.16 [0.02, 0.30] 0.02 [-0.31, 0.35] 0.41 [0.30, 0.52] 0.75 [0.54, 0.96] 0.36 [0.15, 0.57] 0.16 [0.04, 0.28] 0.36 [0.13, 0.59] 0.27 [0.06, 0.48] 0.04 [-0.14, 0.22] 0.58 [0.28, 0.88] 0.35 [-0.07, 0.77]	
Chi 2021 Gao 2016 HouMY 2017 Ju 2022 Li 2012 Liu 2021 LiuY 2021 Peng 2020 Sun 2019 Wang 2018 XuL 2021 Zhang 2014 Zhang 2016 Zhang Y 2019 Zhao 2018	1.19 2.44 1.75 1.89 2.08 3.24 1.64 1.51 1.97 1.4 1.38 3.12 2.73 1.58	0.43 0.68 0.45 0.64 0.64 0.27 0.51 0.48 0.32 0.57 0.34 0.27 0.68 0.87 0.21	108 55 50 80 30 41 37 40 56 37 18 18 20 29 42	1.16 1.92 1.45 1.73 1.87 1.67 2.49 1.28 1.35 1.61 1.13 1.34 2.54 2.38 1.33	0.56 0.32 0.43 0.66 0.23 0.42 0.46 0.35 0.42 0.31 0.29 0.16 0.77 0.22	108 57 49 80 30 40 37 40 56 36 20 18 25 29 42	2.7% 1.9% 2.4% 2.5% 1.3% 2.0% 2.0% 2.6% 2.0% 2.0% 2.2% 1.4% 1.0% 2.8%	0.03 [-0.08, 0.14] 0.52 [0.29, 0.75] 0.30 [0.15, 0.45] 0.16 [0.02, 0.30] 0.02 [-0.31, 0.35] 0.41 [0.30, 0.52] 0.75 [0.54, 0.96] 0.36 [0.15, 0.57] 0.16 [0.04, 0.28] 0.36 [0.13, 0.59] 0.27 [0.06, 0.48] 0.04 [-0.14, 0.22] 0.58 [0.28, 0.88] 0.35 [-0.07, 0.77] 0.25 [0.16, 0.34]	
Chi 2021 Gao 2016 HouMY 2017 Ju 2022 Liu 2021 Liu 2021 LiuY 2021 Peng 2020 Sun 2019 Wang 2018 XuL 2021 Zhang 2014 Zhang 2016 ZhangY 2019 Zhao 2018 Zhao 2018	1.19 2.44 1.75 1.89 2.08 3.24 1.64 1.51 1.97 1.4 1.38 3.12 2.73 1.58	0.43 0.68 0.45 0.64 0.27 0.51 0.48 0.32 0.57 0.34 0.27 0.68 0.87	108 55 50 30 41 37 40 56 37 18 18 20 29 42 63	1.16 1.92 1.45 1.73 1.87 1.67 2.49 1.28 1.35 1.61 1.13 1.34 2.54 2.38	0.56 0.32 0.43 0.66 0.23 0.42 0.46 0.35 0.42 0.31 0.29 0.16 0.77 0.22	108 57 49 80 30 40 37 40 56 36 20 18 25 29 42 60	2.7% 1.9% 2.4% 2.5% 1.3% 2.0% 2.0% 2.0% 2.0% 2.2% 1.9% 2.2% 1.4% 1.0% 3.0%	$\begin{array}{c} 0.03 \ [-0.08, 0.14] \\ 0.52 \ [0.29, 0.75] \\ 0.30 \ [0.15, 0.45] \\ 0.16 \ [0.02, 0.30] \\ 0.02 \ [-0.31, 0.35] \\ 0.41 \ [0.30, 0.52] \\ 0.75 \ [0.54, 0.96] \\ 0.36 \ [0.15, 0.57] \\ 0.16 \ [0.04, 0.28] \\ 0.36 \ [0.13, 0.59] \\ 0.27 \ [0.06, 0.48] \\ 0.04 \ [-0.14, 0.22] \\ 0.58 \ [0.28, 0.88] \\ 0.35 \ [-0.07, 0.77] \\ 0.25 \ [0.16, 0.34] \\ 0.42 \ [0.36, 0.48] \end{array}$	
Chi 2021 Gao 2016 HouMY 2017 Ju 2022 Liu 2021 Liu 2021 LiuY 2021 Peng 2020 Sun 2019 Wang 2018 XuL 2021 Zhang 2014 Zhang 2014 Zhang 2018 Zhao 2018 Zhu 2014 Subtotal (95% CI)	1.19 2.44 1.75 1.89 2.08 3.24 1.64 1.51 1.97 1.4 1.38 3.12 2.73 1.58 1.38	0.43 0.68 0.45 0.64 0.27 0.51 0.48 0.32 0.57 0.34 0.27 0.68 0.87 0.21 0.18	108 55 50 30 41 37 40 56 37 18 18 20 29 42 63 805	1.16 1.92 1.45 1.73 1.87 1.67 2.49 1.28 1.35 1.61 1.13 1.34 2.54 2.38 1.33 0.96	0.56 0.32 0.43 0.66 0.23 0.42 0.46 0.35 0.42 0.31 0.29 0.16 0.77 0.22 0.17	108 57 49 80 30 40 37 40 56 36 20 18 25 29 42 60 808	2.7% 1.9% 2.4% 2.5% 1.3% 2.0% 2.0% 2.0% 2.0% 2.2% 1.4% 1.0% 2.8% 3.0% 39.4%	0.03 [-0.08, 0.14] 0.52 [0.29, 0.75] 0.30 [0.15, 0.45] 0.16 [0.02, 0.30] 0.02 [-0.31, 0.35] 0.41 [0.30, 0.52] 0.75 [0.54, 0.96] 0.36 [0.15, 0.57] 0.16 [0.04, 0.28] 0.36 [0.13, 0.59] 0.27 [0.06, 0.48] 0.04 [-0.14, 0.22] 0.58 [0.28, 0.88] 0.35 [-0.07, 0.77] 0.25 [0.16, 0.34]	
Chi 2021 Gao 2016 HouMY 2017 Ju 2022 Li 2012 Liu 2021 LiuY 2021 Peng 2020 Sun 2019 Wang 2018 XuL 2021 Zhang 2014 Zhang 2016 Zhang Y 2019 Zhao 2018	1.19 2.44 1.75 1.89 2.08 3.24 1.64 1.51 1.97 1.4 1.38 3.12 2.73 1.58 1.38 = 0.02; C	0.43 0.68 0.45 0.64 0.27 0.51 0.48 0.32 0.57 0.34 0.27 0.68 0.87 0.21 0.18 hi ² = 9	108 55 50 80 30 41 37 40 56 37 18 20 29 42 63 805 5.0.6, df	1.16 1.92 1.45 1.73 1.87 1.67 2.49 1.28 1.35 1.61 1.13 1.34 2.54 2.38 1.33 0.96	0.56 0.32 0.43 0.66 0.23 0.42 0.46 0.35 0.42 0.31 0.29 0.16 0.77 0.22 0.17	108 57 49 80 30 40 37 40 56 36 20 18 25 29 42 60 808	2.7% 1.9% 2.4% 2.5% 1.3% 2.0% 2.0% 2.0% 2.0% 2.2% 1.4% 1.0% 2.8% 3.0% 3.0%	$\begin{array}{c} 0.03 \ [-0.08, 0.14] \\ 0.52 \ [0.29, 0.75] \\ 0.30 \ [0.15, 0.45] \\ 0.16 \ [0.02, 0.30] \\ 0.02 \ [-0.31, 0.35] \\ 0.41 \ [0.30, 0.52] \\ 0.75 \ [0.54, 0.96] \\ 0.36 \ [0.15, 0.57] \\ 0.16 \ [0.04, 0.28] \\ 0.36 \ [0.13, 0.59] \\ 0.27 \ [0.06, 0.48] \\ 0.04 \ [-0.14, 0.22] \\ 0.58 \ [0.28, 0.88] \\ 0.35 \ [-0.07, 0.77] \\ 0.25 \ [0.16, 0.34] \\ 0.42 \ [0.36, 0.48] \end{array}$	
Chi 2021 Gao 2016 HouMY 2017 Ju 2022 Liu 2012 Liu 2021 Liu 2021 Peng 2020 Sun 2019 Wang 2018 XuL 2021 Zhang 2018 Zhang 2014 Zhang 2016 Zhang 2016 Zhao 2018 Zhu 2014 Subtotal (95% Cl) Heterogeneily: Tau ² = Test for overall effect: Total (95% Cl)	1.19 2.44 1.75 1.89 2.08 3.24 1.64 1.64 1.38 3.12 2.73 1.58 1.38 5.22 2.73 2.73 2.72 2.73	0.43 0.68 0.45 0.46 0.64 0.27 0.32 0.32 0.32 0.32 0.32 0.48 0.32 0.32 0.32 0.48 0.32 0.32 0.48 0.32 0.45 0.48 0.45 0.46 0.45 0.46 0.45 0.46 0.45 0.46 0.45 0.46 0.45 0.46 0.45 0.46 0.45 0.46 0.45 0.46 0.45 0.46 0.45 0.46 0.45 0.46 0.45 0.46 0.32 0.32 0.32 0.32 0.34 0.32 0.32 0.34 0.32 0.32 0.48 0.32 0.48 0.32 0.32 0.48 0.32 0.48 0.32 0.48	108 55 50 80 30 41 37 40 56 37 18 18 20 29 42 60 50 0.06, df 80 50.006, df 1895	1.16 1.92 1.45 1.73 1.67 2.49 1.28 1.35 1.61 1.13 1.34 2.54 2.38 1.33 0.96 *= 17 (P	0.56 0.32 0.43 0.66 0.23 0.42 0.46 0.35 0.42 0.31 0.29 0.16 0.77 0.22 0.17 < 0.00	108 57 49 80 30 40 37 40 56 36 20 18 25 29 42 60 808 808 1883	2.7% 1.9% 2.4% 2.5% 2.0% 2.0% 2.0% 2.0% 2.0% 2.2% 1.4% 1.0% 2.2% 1.4% 3.0% 39.4% * = 81%	$\begin{array}{c} 0.03 \ [-0.08, 0.14] \\ 0.52 \ [0.29, 0.75] \\ 0.30 \ [0.15, 0.45] \\ 0.16 \ [0.02, 0.30] \\ 0.02 \ [-0.31, 0.35] \\ 0.41 \ [0.30, 0.52] \\ 0.75 \ [0.54, 0.96] \\ 0.36 \ [0.15, 0.57] \\ 0.16 \ [0.04, 0.28] \\ 0.36 \ [0.13, 0.59] \\ 0.27 \ [0.06, 0.48] \\ 0.04 \ [-0.14, 0.22] \\ 0.58 \ [0.28, 0.88] \\ 0.35 \ [-0.07, 0.77] \\ 0.25 \ [0.16, 0.34] \\ 0.42 \ [0.36, 0.48] \end{array}$	
Chi 2021 Gao 2016 HouMY 2017 Ju 2022 Liu 2012 Liu 2021 LiuY 2021 Peng 2020 Sun 2019 Wang 2018 XuL 2021 Zhang 2014 Zhang 2014 Zhao 2018 Zhao 2018 Zhu 2014 Subtotal (95% Cl) Heterogeneity: Tau ² = Total (95% Cl)	1.19 2.44 1.75 1.89 2.08 3.24 1.64 1.51 1.97 1.4 1.38 3.12 2.73 1.58 1.38 : Z=7.02 : Z=7.02	$\begin{array}{c} 0.43\\ 0.68\\ 0.45\\ 0.46\\ 0.64\\ 0.27\\ 0.51\\ 0.48\\ 0.32\\ 0.57\\ 0.34\\ 0.27\\ 0.34\\ 0.27\\ 0.34\\ 0.18\\ 0.87\\ 0.21\\ 0.18\\ h ^2 = 9 Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q$	108 55 50 80 300 41 37 40 56 37 18 805 29 42 63 805 0.06, df 0.0001 1895 54.30, o	1.16 1.92 1.45 1.73 1.87 1.67 2.49 1.28 1.35 1.61 1.13 1.34 2.54 2.38 1.33 0.96 = 17 (P)	0.56 0.32 0.43 0.66 0.23 0.42 0.46 0.35 0.42 0.31 0.29 0.16 0.77 0.22 0.17 < 0.00	108 57 49 80 30 40 37 40 56 36 20 18 25 29 42 60 808 808 1883	2.7% 1.9% 2.4% 2.5% 2.0% 2.0% 2.0% 2.0% 2.0% 2.2% 1.4% 1.0% 2.2% 1.4% 3.0% 39.4% * = 81%	0.03 [-0.08, 0.14] 0.52 [0.29, 0.75] 0.30 [0.15, 0.45] 0.16 [0.02, 0.30] 0.02 [-0.31, 0.35] 0.41 [0.30, 0.52] 0.75 [0.54, 0.96] 0.36 [0.15, 0.57] 0.16 [0.04, 0.28] 0.36 [0.13, 0.59] 0.27 [0.06, 0.48] 0.04 [-0.14, 0.22] 0.58 [0.28, 0.88] 0.35 [-0.07, 0.77] 0.25 [0.16, 0.34] 0.42 [0.36, 0.48] 0.29 [0.21, 0.38]	
Chi 2021 Gao 2016 HouMY 2017 Ju 2022 Liu 2012 Liu 2021 Liu 2021 Peng 2020 Sun 2019 Wang 2018 XuL 2021 Zhang 2018 Zhang 2014 Zhang 2016 Zhang 2016 Zhao 2018 Zhu 2014 Subtotal (95% Cl) Heterogeneily: Tau ² = Test for overall effect: Total (95% Cl)	1.19 2.44 1.75 1.89 2.08 3.24 1.64 1.51 1.97 1.4 1.38 3.12 2.73 1.58 1.38 = 0.02; C : Z = 7.02	0.43 0.68 0.45 0.46 0.64 0.27 0.51 0.48 0.32 0.57 0.34 0.27 0.34 0.27 0.34 0.27 0.34 0.27 0.34 0.27 0.34 0.27 0.34 0.27 0.34 0.27 0.34 0.27 0.34 0.27 0.34 0.27 0.34 0.27 0.34 0.27 0.34 0.87 0.87 0.87 0.87 0.87 0.87 0.87 0.87 0.87 0.87 0.87 0.87 0.87 0.87 0.87 0.87 0.97 0.92 0.87 0.97 0.92 0.87 0.97	108 55 50 80 30 41 37 40 56 37 18 18 29 43 805 0.06, df 805 0.06, df 1895 54.30, (0.0000	1.16 1.92 1.45 1.73 1.87 2.49 1.28 1.35 1.61 1.13 1.34 2.54 2.38 1.33 0.96 '= 17 (P) 4f = 44 (1)	0.56 0.32 0.43 0.66 0.23 0.42 0.46 0.35 0.42 0.31 0.29 0.16 0.77 0.22 0.17 < 0.01	108 57 49 80 300 37 40 56 36 20 20 18 25 29 42 60 808 808 80001); F	2.7% 1.9% 2.4% 2.5% 1.3% 2.0% 2.0% 2.0% 2.0% 2.0% 2.0% 2.2% 1.4% 1.0% 2.8% 3.0% 3.9.4% ² = 81%	0.03 [-0.08, 0.14] 0.52 [0.29, 0.75] 0.30 [0.15, 0.45] 0.16 [0.02, 0.30] 0.02 [-0.31, 0.35] 0.41 [0.30, 0.52] 0.75 [0.54, 0.96] 0.36 [0.15, 0.57] 0.16 [0.04, 0.28] 0.36 [0.13, 0.59] 0.27 [0.06, 0.48] 0.04 [-0.14, 0.22] 0.58 [0.28, 0.88] 0.35 [-0.07, 0.77] 0.25 [0.16, 0.34] 0.42 [0.36, 0.48] 0.29 [0.21, 0.38]	-1 -0.5 0 0.5 1 Favours [experimental] Favours [control]

Subgroup analyses were conducted on the basis of intervention duration and frequency. In the analysis of intervention duration, the experimental group exhibited a significantly higher FEV1/FVC (%) than did the control group before 24 weeks of TCE [MD = 6.70, 95% CI (4.61, 8.80), p < 0.001]. Similarly, for interventions lasting 24 weeks or longer, the experimental group demonstrated a statistically significant improvement in FEV1/FVC (%) [MD = 5.27, 95% CI (3.88, 6.67), p < 0.001]. The subgroup analysis based on exercise frequency indicated that both groups in the experimental cohort, those exercising ≤ 5 times per week and those exercising > 5 times per week,

achieved significantly higher FEV1/FVC (%) than the control group, with statistically significant differences of [MD = 6.65, 95% CI (4.63, 8.67), p < 0.001] and [MD = 6.04, 95% CI (4.28, 7.79), p < 0.001], respectively (Figure 7).

3.3.5 6MWT

Among the included studies, 40 articles reported the effects of TCE on the 6MWT in patients with COPD (11, 13–15, 17–21, 23–25, 27–29, 31–34, 38, 40–45, 57, 59–65, 67, 68, 72–75). These studies investigated five types of exercises: Baduanjin, Taichi, Liuzijue,

Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% Cl	IV, Random, 95% Cl
1.1.1 Frequency≤5t	imes/wee	ek							
Cao 2016	1.43	0.42	52	1.23	0.28	50	2.5%	0.20 [0.06, 0.34]	——
Gu 2012	1.49	0.85	33	1.32	D.61	30	1.2%	0.17 [-0.19, 0.53]	
He 2020	1.49	0.62	45	1.31	0.58	45	1.8%	0.18 [-0.07, 0.43]	+
Li 2016	1.45	0.6	20	1.36	0.57	20	1.2%	0.09 [-0.27, 0.45]	
Li 2019	1.95	0.9	26	1.24	0.92	23	0.7%	0.71 [0.20, 1.22]	
Pan 2018	1.48		20	1.24		21	3.0%	0.24 [0.17, 0.31]	
Ren 2017	1.72	0.3	30	1.43		30	2.4%	0.29 [0.14, 0.44]	——
Xu 2021		0.32	132	1.31		130	2.9%	0.29 [0.22, 0.36]	
XuL 2021		0.34	18	1.13		20	2.0%	0.27 [0.06, 0.48]	
Yan 2023		0.35	30	1.78		30	2.4%	0.23 [0.07, 0.39]	
Yang 2023	2.56		40	2.18 1.52		40	2.2%	0.38 [0.20, 0.56]	
Yu 2019 Subtotal (95% CI)	1.75	0.16	45 491	1.52	J.1 Z	45 484	3.0% 25.3 %	0.23 [0.17, 0.29]	•
Subtotal (95% CI) Heterogeneity: Tau ² =	- 0.00.04			. 11 /0 -	0 6 21			0.25 [0.22, 0.28]	•
Test for overall effect					0.03)	, 1- = 03	20		
reactor overall effect	. 2 - 14.8	2 (I ⁻ 5 (
1.1.2 Frequency>5t	imes/wee	ek							
Cao 2022	1.42		29	1.15	0.32	31	2.3%	0.27 [0.11, 0.43]	
Chen 2008	1.19		21	0.95		19	2.2%	0.24 [0.06, 0.42]	
Chi 2021	1.19		108	1.16		108	2.7%	0.03 [-0.08, 0.14]	
Deng 2020	1.32		30	1.14		32	1.8%	0.18 [-0.07, 0.43]	+
Gao 2016	2.44	0.68	55	1.92	0.56	57	1.9%	0.52 [0.29, 0.75]	
Gao 2017	1.55	0.28	36	1.25	D.31	36	2.5%	0.30 [0.16, 0.44]	——
Hou 2017	1.92		25	1.74	0.28	23	2.3%	0.18 [0.00, 0.36]	<u> </u>
HouMY 2017	1.75	0.45	50	1.45	0.32	49	2.4%	0.30 [0.15, 0.45]	——
Hu 2020	1.4		42	1.35		42	1.8%	0.05 [-0.20, 0.30]	
Huang 2016	1.39		31	1.27		30	1.5%	0.12 [-0.18, 0.42]	
Huang 2021	1.97		38	1.68		38	2.6%	0.29 [0.16, 0.42]	
Jiang 2023	1.89		40	1.41		40	2.0%	0.48 [0.27, 0.69]	
Ju 2022		0.46	80	1.73		80	2.5%	0.16 [0.02, 0.30]	
Li 2012		0.64	30	1.87		30	1.3%	0.02 [-0.31, 0.35]	
Li 2024	1.59	0.3	40	1.35		40	2.6%	0.24 [0.12, 0.36]	
Liu 2020 Liu 2021		0.51 0.27	50 41	0.97 1.67		50 40	2.3% 2.7%	0.64 [0.47, 0.81]	
LiuY 2021	3.24		37	2.49		37	2.7%	0.41 [0.30, 0.52] 0.75 [0.54, 0.96]	
Ma 2022		0.22	41	1.89		41	2.8%	0.47 [0.37, 0.57]	
Peng 2020	1.64		40	1.28		40	2.0%	0.36 [0.15, 0.57]	
Sun 2019	1.51		56	1.35		56	2.6%	0.16 [0.04, 0.28]	
Sun 2021		0.18	40	1.21		40	2.9%	0.10 [0.02, 0.18]	
Wang 2018	1.97		37	1.61		36	1.9%	0.36 [0.13, 0.59]	
Wang 2022	1.69	0.41	40	1.42	0.36	40	2.3%	0.27 [0.10, 0.44]	—.—
Xia 2022	0.98		52	0.82		52	2.9%	0.16 [0.07, 0.25]	
Xiao 2023	2.21	0.25	58	1.55	0.24	58	2.8%	0.66 [0.57, 0.75]	
Zhang 2014	1.38		18	1.34		18	2.2%	0.04 [-0.14, 0.22]	-
Zhang 2016	3.12		20	2.54		25	1.4%	0.58 [0.28, 0.88]	
ZhangFR 2019	1.08		62	1.02		58	2.6%	0.06 [-0.06, 0.18]	+
ZhangY 2019	2.73		29	2.38		29	1.0%	0.35 [-0.07, 0.77]	
Zhao 2012	1.26		23	1.14		22	2.0%	0.12 [-0.09, 0.33]	+
Zhao 2018	1.58			1.33		42	2.8%	0.25 [0.16, 0.34]	
Zhu 2014 Subtatal (05% CI)	1.38			0.96	J.17	60 4200	3.0%	0.42 [0.36, 0.48]	
Subtotal (95% CI)	- 0.02.04		1404	w 22.75			74.7%	0.29 [0.22, 0.36]	▼
Heterogeneity: Tau ² =					< U.U	00001);	in= 87%		
Test for overall effect	. Z = 8.39	(P < U.	00001)					
Total (95% CI)			1895			1893	100.0 %	0.28 [0.23, 0.33]	▲
Heterogeneity: Tau ² =	= 0 02· CF			if = 44 (P	< 0.0				— · · · · · · ·
Test for overall effect					0.0		. = 00.0		-1 -0.5 0 0.5 1
Test for subaroup dif					= 0.3	3), l² =	0%		Favours [experimental] Favours [control]
		2	5.50.		0.0		- //		

Wuqinxi, and Yijinjing. The experimental group consisted of 1,701 participants, whereas the control group included 1,695 participants. The random-effects model showed no statistical heterogeneity among the Liuzijue, Wuqinxi, and Yijinjing groups (p = 0.28, $I^2 = 20\%$; p = 0.14, $I^2 = 43\%$), (p = 0.41, $I^2 = 0\%$). Each TCE group demonstrated significantly higher 6MWT results compared to the control group, specifically Baduanjin [MD = 45.35, 95% CI (37.39, 53.30), p < 0.001], Taichi [MD = 42.57, 95% CI (31.51, 53.64), p < 0.001], Liuzijue [MD = 39.18, 95% CI (30.75, 47.62), p < 0.001], Wuqinxi [MD = 45.72,

95% CI (38.34, 53.10), *p* < 0.004], and Yijinjing [MD = 15.98, 95% CI (11.72, 20.23), *p* < 0.001].

Subgroup analyses were conducted on the basis of intervention duration and frequency. In the analysis of intervention duration, the experimental group exhibited a significantly higher 6MWT than did the control group before 24 weeks of TCE [MD = 42.43, 95% CI (36.52, 48.35), p < 0.001]. Similarly, for interventions lasting 24 weeks or longer, the experimental group demonstrated a statistically significant improvement in 6MWT [MD = 40.62, 95% CI (36.52,

47.71), p < 0.001]. The subgroup analysis based on exercise frequency indicated that both groups in the experimental cohort presented statistical differences at frequencies of ≤ 5 times per week [MD = 44.76, 95% CI (35.65, 53.87), p < 0.001] and > 5 times per week [MD = 40.76, 95% CI (34.09, 47.42), p < 0.001] (Figure 8).

3.3.6 CAT

Among the included studies, 21 articles reported the effects of TCE on the CAT in patients with COPD (10, 13, 14, 16, 24, 25, 29, 32, 41–45, 48, 56, 57, 60, 61, 66, 70, 73). These studies encompassed four types of exercises: Baduanjin, Taichi, Liuzijue, and Wuqinxi. The

	-	erimenta			control			Mean Difference	Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% Cl	IV, Random, 95% Cl
1.2.1 Baduanjin									
Cao 2016	57.27	9.45		53.37	7.56	50	3.6%	3.90 [0.59, 7.21]	
Huang 2016		17.83	31		17.35	30	1.2%	8.00 [-0.83, 16.83]	
Liu 2013	60.96	20.4		57.53		40	1.1%	3.43 [-5.96, 12.82]	
Ma 2020	83.73	8.36		75.43	7.25	30	3.2%	8.30 [4.34, 12.26]	
Wang 2018	64.54	9.41	37	58.15	8.85	36	3.0%	6.39 [2.20, 10.58]	
Yang 2023	69.63	4.77	40	61.1	7.95	40	3.9%	8.53 [5.66, 11.40]	
Yu 2019	55.74	3.86	45	53.82	3.15	45	4.9%	1.92 [0.46, 3.38]	
Zhang 2019	85.98	9.01	30	80.11	8.24	30	2.9%	5.87 [1.50, 10.24]	
Zhu 2014	58.31			47.45		60	3.0%	10.86 [6.54, 15.18]	
Subtotal (95% CI)	00.01	10.20	368			361	26.9%	6.26 [3.71, 8.81]	
Heterogeneity: Tau ²	- 10.06-0	- hiz = 00		- 0 /D .	~ 0 0004			0.20 [0.1 1, 0.0 1]	-
Test for overall effect				- 0 (F	< 0.000	0,1 - 7	0.00		
1.2.2 Taichi									
Chen 2020	79.92	2.74	63	75.26	3.69	63	5.0%	4.66 [3.53, 5.79]	
Deng 2016	53.8	12.74	63	52.6	14.1	63	2.8%	1.20 [-3.49, 5.89]	
Du 2013	79.14	5.36		71.26	6.38	38	4.1%	7.88 [5.20, 10.56]	
Gu 2012	53.5	20.5	33	50.1	14.5	30	1.3%	3.40 [-5.31, 12.11]	
Hu 2020	50.2	16.7	42	48.2	16.5	42	1.7%	2.00 [-5.10, 9.10]	
Li 2016	50.3	16.9	20	48.3	16.6	20	1.0%	2.00 [-8.38, 12.38]	
Liu 2019	54.03	3.51	50	50.57	2.45	50	5.0%	3.46 [2.27, 4.65]	
Pan 2018	77.05	3.24	20	74.8	4.91	21	4.2%	2.25 [-0.29, 4.79]	+
Zhang 2014	57.54	6.93	18	57.16	7.23	18	2.8%	0.38 [-4.25, 5.01]	
ZhangY 2019	82.31	5.12	29	78.52	6.04	29	3.9%	3.79 [0.91, 6.67]	
Subtotal (95% CI)			374		/	374	31.6%	3.81 [2.59, 5.02]	•
Heterogeneity: Tau ²	= 1.28.01	hi ^z = 16 1		9 (P -	0.06\· IZ				
Test for overall effect				50 -	5.00), 1	10			
1.2.3 Liuzijue									
Cao 2022	57.23	9.76	29	46.73	12,86	31	2.2%	10.50 [4.75, 16.25]	
Chen 2008	48.33			38.21		19	1.2%	10.12 [1.06, 19.18]	
Chen 2016	49.27			42.15		34	1.2%		
								7.12 [0.48, 13.76]	
Deng 2020	59.62			53.27		32	0.8%	6.35 [-5.61, 18.31]	
Ji 2019	46.11			41.37		29	1.8%	4.74 [-2.13, 11.61]	
Jian 2021	58.34			57.25		27	1.2%	1.09 [-7.72, 9.90]	
Sun 2019	53.65	6.24		46.45	5.74	56	4.4%	7.20 [4.98, 9.42]	
Wang 2023	65.93	5.57		54.02	5.82	20	3.5%	11.91 [8.38, 15.44]	
XuL 2021	57.22	9.85	18	46.84	11.95	20	1.8%	10.38 [3.44, 17.32]	· · · · · · · · · · · · · · · · · · ·
Zhao 2012	46.6	10.94	23	40.7	10.66	22	2.0%	5.90 [-0.41, 12.21]	
Subtotal (95% CI)			287			290	20.6%	8.19 [6.39, 9.99]	◆
Heterogeneity: Tau ²	= 1.12: CI	hi ^z = 10 3		9 (P =	0.32): I ^z				
Test for overall effect					/, '				
1.2.4 Wuqinxi									
Gao 2017	55.08	8.16	36	44.61	9.89	36	3.0%	10.47 [6.28, 14.66]	<u> </u>
Liu 2020	50.61			45.03		50	1.4%	5.58 [-2.54, 13.70]	
Wei 2015	61.89	8.77		58.82	5.76	45	3.8%	3.07 [0.07, 6.07]	⊢ ⊷
Zang 2017	55.69	2.21		54.24	2.13	36	5.1%	1.45 [0.42, 2.48]	_ _ _
Subtotal (95% CI)	55.08	2.21	32 166	34.24	2.13	167	5.1% 13.4%	4.70 [0.74, 8.67]	
Heterogeneity: Tau ²			.96, df	= 3 (P :	= 0.0004			4.10 [0.14, 0.07]	
Test for overall effect	: Z = 2.33	(P = 0.0	2)						
1.2.5 Yijinjing	70 45	12.07	<i></i>	67.04	0.00	57	2.200	11 61 17 50 45 50	
Gao 2016	79.45			67.94		57		11.51 [7.50, 15.52]	
Zhang 2016	65.46	3.54		62.02	4.27	25	4.3%	3.44 [1.16, 5.72]	
Subtotal (95% CI)			75			82	7.5%	7.30 [-0.60, 15.20]	
Heterogeneity: Tau ² : Test for overall effect				= 1 (P :	= 0.0006	5); l² = 9	31%		
	,					4374	100.0%	E E 2 14 44 6 651	
Total (95% CI)	- 0.04- 01		1270		- 0.001		100.0%	5.53 [4.41, 6.65]	↓ ↓ ↓
Heterogeneity: Tau ²				= 34 (F	< U.UO(JU1); l²	= 75%		-20 -10 0 10
Test for overall effect									Favours [experimental] Favours [control]
Test for subaroup di									

		05	* * *		05	T 4 - 1		B/ D	B/ B 4 654 01
Study or Subgroup	Mean	SD	lotal	Mean	SD	lotal	weight	IV, Random, 95% Cl	IV, Random, 95% Cl
1.2.1 FEV1(%) <24we		44.00	24	20.24	40.70	40	4.00	40 40 14 00 40 40	
Chen 2008		11.82		38.21		19	1.2%	10.12 [1.06, 19.18]	
Chen 2016		14.73		42.15		34	1.9%	7.12 [0.48, 13.76]	
Chen 2020	79.92	2.74		75.26	3.69	63	5.0%	4.66 [3.53, 5.79]	
Deng 2020		25.49		53.27		32	0.8%	6.35 [-5.61, 18.31]	
Du 2013	79.14	5.36		71.26	6.38	38	4.1%	7.88 [5.20, 10.56]	
Gao 2017	55.08	8.16 20.5		44.61	9.89	36	3.0%	10.47 [6.28, 14.66]	
Gu 2012	53.5		33	50.1	14.5 16.5	30	1.3%	3.40 [-5.31, 12.11]	
Hu 2020	50.2	16.7	42	48.2		42	1.7%	2.00 [-5.10, 9.10]	
Huang 2016		17.83	31		17.35	30	1.2%	8.00 [-0.83, 16.83]	
Ji 2019		12.46		41.37		29	1.8%	4.74 [-2.13, 11.61]	
Jian 2021		17.38		57.25		27	1.2%	1.09 [-7.72, 9.90]	
Li 2016	50.3	16.9	20	48.3	16.6	20	1.0%	2.00 [-8.38, 12.38]	
Liu 2013	60.96	20.4		57.53		40	1.1%	3.43 [-5.96, 12.82]	
Liu 2020	50.61			45.03		50	1.4%	5.58 [-2.54, 13.70]	
Ma 2020 Dep 2010	83.73	8.36		75.43	7.25	30	3.2%	8.30 [4.34, 12.26]	
Pan 2018	77.05	3.24	20	74.8	4.91	21	4.2%	2.25 [-0.29, 4.79]	
Wang 2023	65.93	5.57		54.02	5.82	20	3.5%	11.91 [8.38, 15.44]	
Yang 2023	69.63	4.77	40	61.1	7.95	40	3.9%	8.53 [5.66, 11.40]	
Yu 2019 Subtotal (05% CI)	55.74	3.86	45 647	53.82	3.15	45	4.9%	1.92 [0.46, 3.38]	
Subtotal (95% CI)	C 07: 0			10.00	- 0 0000	646	46.3%	6.02 [4.31, 7.74]	•
Heterogeneity: Tau ² = Test for overall effect:				= 18 (P -	ະ ບ.ບບບເ	n); i*=	70%		
1.2.2 FEV1(%) ≥24w Cao 2016	57.27	9.45	52	53.37	7.56	50	3.6%	3.90 [0.59, 7.21]	
Cao 2022	57.23	9.76	29	46.73	12.86	31	2.2%	10.50 [4.75, 16.25]	
Deng 2016	53.8	12.7	63	52.6	14.1	63	2.8%	1.20 [-3.49, 5.89]	
Gao 2016	79.45	12.07		67.94	9.39	57	3.2%	11.51 [7.50, 15.52]	
Liu 2019	54.03	3.51		50.57	2.45	50	5.0%	3.46 [2.27, 4.65]	
Sun 2019	53.65	6.24		46.45	5.74	56	4.4%	7.20 [4.98, 9.42]	
Wang 2018	64.54	9.41		58.15	8.85	36	3.0%	6.39 [2.20, 10.58]	
Wei 2015	61.89	8.77		58.82	5.76	45	3.8%	3.07 [0.07, 6.07]	
XuL 2021	57.22	9.85		46.84		20	1.8%	10.38 [3.44, 17.32]	
Zang 2017	55.69	2.21		54.24	2.13	36	5.1%	1.45 [0.42, 2.48]	-
Zhang 2014	57.54	6.93		57.16	7.23	18	2.8%	0.38 [-4.25, 5.01]	
Zhang 2016	65.46	3.54		62.02	4.27	25	4.3%	3.44 [1.16, 5.72]	
Zhang 2019	85.98	9.01		80.11	8.24	30	2.9%	5.87 [1.50, 10.24]	
ZhangY 2019	82.31	5.12		78.52	6.04	29	3.9%	3.79 [0.91, 6.67]	
Zhao 2012		10.94	23		10.66	22	2.0%	5.90 [-0.41, 12.21]	
Zhu 2014	58.31	13.23		47.45	11.18	60	3.0%	10.86 [6.54, 15.18]	
Subtotal (95% CI)			623			628	53.7%	5.11 [3.58, 6.65]	
Heterogeneity: Tau ² =				= 15 (P ·	< 0.0000	01); l² =	78%		
Test for overall effect:	Z = 6.52	! (P < 0.)	00001)						
Total (95% CI)			1270				100.0%	5.53 [4.41, 6.65]	•
Heterogeneity: Tau ² =				= 34 (F	< 0.000	001); I²	= 75%		-20 -10 0 10
Test for overall effect:									Favours [experimental] Favours [control]
Test for subaroup diff	ferences	: Chi ^z =	0.61. d	f=1 (P	= 0.44).	$ ^{2} = 0\%$	6		

experimental group consisted of 802 participants, whereas the control group included 805 participants. The random-effects model showed no statistical heterogeneity among the Taichi and Wuqinxi groups (p = 0.13, $I^2 = 39\%$), (p = 0.33, $I^2 = 11\%$). Each TCE groups showed significantly lower CAT compared to the control group. The results for each group included Baduanjin [MD = -4.79, 95% CI (-5.68, -3.90), p < 0.001], Taichi [MD = -3.86, 95% CI (-4.48, -3.23), p < 0.001], Liuzijue [MD = -3.76, 95% CI (-5.01, -2.51), p < 0.001], and Wuqinxi [MD = -3.94, 95% CI (-5.38, -2.50), p < 0.001].

Subgroup analyses were performed on the basis of intervention duration and frequency. In the subgroup analysis based on intervention duration, the experimental group exhibited a significantly lower CAT than did the control group before 24 weeks of TCE [MD = -4.25, 95% CI (-5.02, -3.47), p < 0.001]. Similarly, for interventions lasting 24 weeks or longer, the experimental group

demonstrated a statistically significant improvement in CAT [MD = -4.14, 95% CI (-4.97, -3.32), p < 0.001]. The subgroup analysis based on exercise frequency indicated that both groups in the experimental cohort, those exercising ≤ 5 times per week and those exercising > 5 times per week, achieved significantly lower CAT than did the control group, with statistically significant differences of [MD = -4.68, 95% CI (-5.35, -4.01), p < 0.001] and [MD = -3.89, 95% CI (-4.65, -3.13), p < 0.001], respectively (Figure 9).

3.3.7 Anxiety

Among the 19 included studies (9, 10, 14, 21, 22, 24–26, 36, 42, 44, 48, 53–56, 65, 66, 69), the effects of TCE on anxiety in patients with COPD were reported. These studies involved four types of exercises: Baduanjin, Taichi, Liuzijue, and Wuqinxi. The experimental group consisted of 816 participants, whereas the control group

Study or Subarous		eriment			ontrol.	Total	Moinht	Mean Difference IV. Random. 95% Cl	Mean Difference
Study or Subgroup 1.2.1 Frequency 5t	Mean		Total	Mean	50	Total	weight	IV, Random, 95% CI	IV, Random, 95% Cl
Cao 2016	57.27	9.45	50	53.37	7.56	50	3.6%	3.90 [0.59, 7.21]	
Cao 2018 Chen 2020	79.92	9.40 2.74		75.26	3.69	63	5.0%	4.66 [3.53, 5.79]	
Gu 2012	53.5	20.5	33	50.1	14.5	30	1.3%	3.40 [-5.31, 12.11]	
Li 2016	50.3	16.9	20	48.3	16.6	20	1.3%	• • •	
Li 2016 Ma 2020	83.73	8.36		40.3	7.25	20 30	3.2%	2.00 [-8.38, 12.38]	
Pan 2020	77.05	3.24	20	75.43	4.91	21	4.2%	8.30 [4.34, 12.26] 2.25 [-0.29, 4.79]	
Wang 2023	65.93	5.57		54.02	5.82	20	4.2%	11.91 [8.38, 15.44]	
XuL 2021	57.22	9.85	18	46.84		20	1.8%		
Yang 2023	69.63	9.00	40	40.04	7.95	40	3.9%	10.38 [3.44, 17.32] 8.53 [5.66, 11.40]	
Subtotal (95% CI)	09.03	4.77	40 296	01.1	7.95	294	27.4%	6.32 [4.08, 8.56]	•
Heterogeneity: Tau ² =	7.05.01	hiz - 20		/	0 0000			0.52 [4.00, 0.50]	•
Test for overall effect				- o (r –	0.0002)	, = 74	4 70		
restion overall ellect	Z = 0.02	(r < 0.0	,0001)						
1.2.2 Frequency>5t	imoslwo	ok							
Cao 2022	57.23	9.76	20	46.73	17.96	31	2.2%	10.50 [4.75, 16.25]	
Cao 2022 Chen 2008		9.70		38.21		19	1.2%	10.12 [1.06, 19.18]	
Chen 2008		14.73		42.15		34	1.2%	7.12 [0.48, 13.76]	
Deng 2016	53.8	12.7	63	52.6	14.1	63	2.8%	1.20 [-3.49, 5.89]	
Deng 2020		25.49		53.27		32	0.8%	6.35 [-5.61, 18.31]	
Du 2013	79.14	5.36		71.26	6.38	38	4.1%	7.88 [5.20, 10.56]	
Gao 2016	79.45			67.94	9.39	57	3.2%	11.51 [7.50, 15.52]	
Gao 2017	55.08	8.16		44.61	9.89	36	3.0%	10.47 [6.28, 14.66]	
Hu 2020	50.2	16.7	42	48.2	16.5	42	1.7%	2.00 [-5.10, 9.10]	
Huang 2016		17.83	31		17.35	30	1.2%	8.00 [-0.83, 16.83]	
Ji 2019		12.46		41.37		29	1.8%	4.74 [-2.13, 11.61]	
Jian 2021		17.38		57.25		27	1.2%	1.09 [-7.72, 9.90]	
Liu 2013	60.96	20.4		57.53		40	1.1%	3.43 [-5.96, 12.82]	
Liu 2019	54.03	3.51		50.57	2.45	50	5.0%	3.46 [2.27, 4.65]	
Liu 2020		25.13		45.03		50	1.4%	5.58 [-2.54, 13.70]	
Sun 2019	53.65	6.24		46.45	5.74	56	4.4%	7.20 [4.98, 9.42]	
Wang 2018	64.54	9.41		58.15	8.85	36	3.0%	6.39 [2.20, 10.58]	
Wei 2015	61.89	8.77		58.82	5.76	45	3.8%	3.07 [0.07, 6.07]	
Yu 2019	55.74	3.86		53.82	3.15	45	4.9%	1.92 [0.46, 3.38]	_ _ _
Zang 2017	55.69	2.21		54.24	2.13	36	5.1%	1.45 [0.42, 2.48]	
Zhang 2014	57.54	6.93		57.16	7.23	18	2.8%	0.38 [-4.25, 5.01]	
Zhang 2016	65.46	3.54		62.02	4.27	25	4.3%	3.44 [1.16, 5.72]	—
Zhang 2019	85.98	9.01		80.11	8.24	30	2.9%	5.87 [1.50, 10.24]	
ZhangY 2019	82.31	5.12		78.52	6.04	29	3.9%	3.79 [0.91, 6.67]	
Zhao 2012		10.94	23		10.66	22	2.0%	5.90 [-0.41, 12.21]	+
Zhu 2014		13.23		47.45		60	3.0%	10.86 [6.54, 15.18]	
Subtotal (95% CI)			974			980	72.6%	5.23 [3.92, 6.55]	•
Heterogeneity: Tau ² =	= 6.16; Cl	hi² = 94.	59, df=	= 25 (P ·	< 0.0000	01); I ² =			
Test for overall effect						11.			
Total (95% CI)			1270			1274	100.0%	5.53 [4.41, 6.65]	•
Heterogeneity: Tau ² =	= 6.21; Cl	hi ^z = 136	5.97, df	= 34 (P	< 0.000	001); I ^z	= 75%		-20 -10 0 10
Test for overall effect	Z = 9.65	i (P < 0.0	00001)						
Test for subaroup dif	ferences	: Chi ^z =	0.67. d	f=1 (P	= 0.41).	l² = 0%	6		Favours [experimental] Favours [control]

included 807 participants. The studies utilized SMD to compile data on anxiety symptoms using assessment tools such as the SAS, HAM-A, and HADS. The random-effects model indicated that all TCE groups showed significantly lower anxiety than did the control group. The results for each group included Baduanjin [MD = -1.62, 95% CI (-2.31, -0.94), p < 0.001], Taichi [MD = -0.54, 95% CI (-1.28, 0.20), p < 0.001], Liuzijue [MD = -1.03, 95% CI (-1.46, -0.59), p < 0.001], and Wuqinxi [MD = -1.44, 95% CI (-2.35, -0.52), p < 0.001].

Subgroup analyses were conducted on the basis of intervention duration and frequency. In the analysis of intervention duration, the experimental group exhibited a significantly lower anxiety than did the control group before 24 weeks of TCE [MD = -1.38, 95% CI

(-1.93, -0.83), p < 0.001]. Similarly, for interventions lasting 24 weeks or longer, the experimental group demonstrated a statistically significant alleviation of anxiety [MD = -1.03, 95% CI (-1.31, -0.74), p < 0.001]. The subgroup analysis based on exercise frequency indicated that both groups in the experimental cohort presented significant differences at frequencies of \leq 5 times per week [MD = -1.45, 95% CI (-2.12, -0.79), p < 0.001] and > 5 times per week [MD = -1.07, 95% CI (-1.39, -0.75), p < 0.001] (Figure 10).

3.3.8 Depression

Among the 19 included studies (9, 10, 14, 21, 22, 24–26, 36, 42, 44, 48, 53–56, 65, 66, 69), the effects of TCE on depression in patients

with COPD were reported. These studies involved four types of exercises: Baduanjin, Taichi, Liuzijue, and Wuqinxi. The experimental group consisted of 816 participants, whereas the control group included 807 participants. The studies utilized SMD to compile data on anxiety symptoms using assessment tools such as the SDS, HAM-D, and HADS. The random-effects model indicated that all TCE groups showed significantly lower depression than did the

control group. The results for each group included Baduanjin [MD = -1.51, 95% CI (-2.10, -0.92), *p* < 0.001], Taichi [MD = -1.11, 95% CI (-2.06, 0.17), p < 0.001], Liuzijue [MD = -1.12, 95% CI (-1.50, -0.74), p < 0.001], and Wuqinxi [MD = -0.98, 95% CI (-1.66, -0.30), p < 0.001].

Subgroup analyses were conducted on the basis of intervention duration and frequency. In the analysis of intervention duration, the

Study or Subgroup		eriment			ontrol SD	Total		Mean Difference IV, Fixed, 95% Cl	Mean Difference IV, Fixed, 95% Cl
1.3.1 Baduanjin	mean	30	TUtai	wean	30	Tutai	weight	IV, FIXEU, 55% CI	IV, FIXEd, 35% CI
Hou 2017	2.58	0.43	25	2 20	0.37	23	1.6%	0.19 [-0.04, 0.42]	
Huang 2016	2.98	0.43	31		0.55	30		0.30 [-0.02, 0.62]	
Jiang 2023		0.29	40		0.26	40	5.5%	0.39 [0.27, 0.51]	
LiuY 2021	3.53	0.29	37	2.98		37	3.0%	0.55 [0.27, 0.51]	
Ma 2020		0.4	30		0.31	30	3.0%	0.19 [0.04, 0.34]	
Ma 2020 Ma 2022		0.33	41		0.24	41	5.4%	0.39 [0.27, 0.51]	
Wang 2018		0.29	37	2.02	0.27	36	0.8%		
Wang 2022		0.67	40	2.28		40	1.2%	0.37 [0.05, 0.69] 0.37 [0.11, 0.63]	
Xia 2022 Xia 2022		0.38	40 52	1.51		40 52	3.4%	0.24 [0.09, 0.39]	
Xia 2022 Xu 2021		0.30	132		0.41	130	5.4% 6.3%		
		0.45		2.55				0.32 [0.21, 0.43] 0.40 [0.16, 0.64]	
Yang 2023			40			40	1.4%		-
Yu 2019 75		0.17	45		0.12	45	21.5%		
Zhu 2014 Subtotal (05% CI)	2.20	1.34	63 613	1.63	1.08	60 604	0.4%	0.45 [0.02, 0.88]	
Subtotal (95% CI)	1011	6-101		01.17	200	004	54.9%	0.33 [0.30, 0.37]	•
Heterogeneity: Chi² = Test for overall effect:					20%				
restion overall ellect.	2-17.1	7 (F 5	0.0000	12					
1.3.2 Taichi									
Chi 2021	2.49	0.72	108	2.44	0.72	108	2.2%	0.05 [-0.14, 0.24]	
Gu 2012		1.03	33	2.72		30		0.07 [-0.41, 0.55]	
He 2020		0.68	45		0.86	45		0.55 [0.23, 0.87]	
Li 2012		0.79	30	3.16	0.7	30		0.05 [-0.33, 0.43]	
Li 2019		0.44	26		0.38	23		0.46 [0.23, 0.69]	
Liu 2021		0.27	41		0.22	40	6.9%	0.37 [0.26, 0.48]	
Pan 2018	2.73	0.19	20		0.14	21	7.6%		
Peng 2020		0.53	40	1.77	0.5	40	1.6%	0.25 [0.02, 0.48]	
Ren 2017		0.34	30		0.23	30	3.7%	0.28 [0.13, 0.43]	
ZhangY 2019		0.91	29	2.5	0.8	29		0.33 [-0.11, 0.77]	
Subtotal (95% CI)			402			396	25.5%		◆
Heterogeneity: Chi ² =	16.51, c	lf = 9 (F	= 0.06	i); l² = 4	5%				
Test for overall effect:	Z = 9.83) (P < 0	.00001)					
1.3.3 Liuzijue			~~		~	~ 4	4.000		
Chen 2016		0.69	33	1.61		34	1.0%	0.30 [0.02, 0.58]	
Ji 2019		0.39	28		0.44	29		0.12 [-0.10, 0.34]	
Ju 2022		0.32	80		0.35	80		0.21 [0.11, 0.31]	
Li 2024	2.87	0.4	40	2.59	0.31	40	3.2%	0.28 [0.12, 0.44]	
Subtotal (95% CI)		o (D	181		,	183	13.3%	0.22 [0.15, 0.30]	•
Heterogeneity: Chi² = Test for overall effect:					0				
restion overall ellect.	2 - 5.04	(.00001	,					
1.3.4 Wuqinxi									
Liu 2020	1.99	0.61	50	1.42	0.45	50	1.8%	0.57 [0.36, 0.78]	
Xiao 2023		0.35	58		0.38	58	4.5%	0.43 [0.30, 0.56]	
Subtotal (95% CI)			108			108	6.3%		•
Heterogeneity: Chi ² =	1.22, df	= 1 (P :	= 0.27);	² = 18	%				
Test for overall effect:									
T-4-1 (0.54) - Ch			100.1			1051	100		▲
Total (95% CI)			1304			1291	100.0%	0.31 [0.29, 0.34]	
Heterogeneity: Chi ² =					= 45%				-0.5 -0.25 0 0.25 0.5
Test for overall effect:				· ·	<i>.</i>		00.00		Favours [experimental] Favours [control]
Test for subaroup difi	ferences	: Chi² =	: 15.23.	df = 3	(P = 0.	002). I ²	= 80.3%		

Study or Subgroup	Mean	eriment SD		Mean	ontrol: SD	Total	Weight	Mean Difference IV, Random, 95% Cl	Mean Difference IV, Random, 95% Cl
1.4.1 Baduanjin									
Cao 2016	64.64	7.48	52	61.64	7.49	50	2.6%	3.00 [0.09, 5.91]	
Hou 2017	81.53	7.82	25	73.87	6.81	23	2.3%	7.66 [3.52, 11.80]	
Huang 2016	55.97	13.2	31	49.8	11.5	30	1.9%	6.17 [-0.04, 12.38]	
Jiang 2023	65.47	4.46	40	57.51	3.87	40	2.8%	7.96 [6.13, 9.79]	
Liu 2013	69.31	11.12	40	65.16	10.22	40	2.2%	4.15 [-0.53, 8.83]	<u> </u>
Ma 2020	73.46	8.26	30	66.54	7.34	30	2.4%	6.92 [2.97, 10.87]	
Peng 2020	80.68	11.96	40	70.73	13.68	40	2.0%	9.95 [4.32, 15.58]	
Wang 2018	63.22	8.05	37	59.28	7.13	36	2.5%	3.94 [0.45, 7.43]	
Xu 2021	68.26	5.32		57.17	4.83	130	2.9%	11.09 [9.86, 12.32]	
Yu 2019	77.81	4.86		74.23	3.9	41	2.8%	3.58 [1.67, 5.49]	
Zhang 2019	83.74	8.35		75.44	7.24	30	2.4%	8.30 [4.35, 12.25]	
Zhu 2014	57	10.78	63	45.94	10.28	60	2.4%	11.06 [7.34, 14.78]	
Subtotal (95% CI)			561			550	29.2%	6.98 [4.88, 9.07]	•
Heterogeneity: Tau ²	= 10.27: 0	Chi ² = 67	75. dt	= 11 (F	< 0.000	001): I ^z	= 84%		
Test for overall effect									
1.4.2 Taichi	40.00	12.04	100	40.00	11 44	100	250	00 × C × C 1 C 0 0	<u> </u>
Chi 2021		12.94		48.99		108	2.5%	0.83 [-2.43, 4.09]	·
Du 2013	61.05	4.82		54.39	5.04	38	2.7%	6.66 [4.41, 8.91]	
Gu 2012	50.1	14.5	33	48.3	10.9	30	1.9%	1.80 [-4.50, 8.10]	
He 2020		13.25		47.57		45	2.1%	4.07 [-1.35, 9.49]	
Hu 2020	49.7	14.5	42	49.5	16	42	1.8%	0.20 [-6.33, 6.73]	
Li 2012	59.37	3.14	30	59.24	2.92	30	2.8%	0.13 [-1.40, 1.66]	T
Li 2016	49.8	16.2	20	49.7	14.3	20	1.3%	0.10 [-9.37, 9.57]	
Li 2019		14.28		62.56		23	1.5%	8.88 [0.62, 17.14]	
Liu 2019	53.47	4.01	50	48.91	2.8	50	2.8%	4.56 [3.20, 5.92]	
Liu 2021	76.75		41		7.44	40	2.6%	5.38 [2.19, 8.57]	
Ren 2017	55	2.34	30	45	3.43	30	2.8%	10.00 [8.51, 11.49] 0.61 [-6.41, 7.63]	
Zhang 2014 Subtotal (95% Cl)	48.02	11.32	18 479	48.01	10.13	18 474	1.7% 26.5%	3.89 [1.36, 6.42]	•
Heterogeneity: Tau ²	- 1 4 41.0			- 11 /0	~ 0 000			5.05 [1.50, 0.42]	•
Cao 2022 Chen 2008	62.27 56.95	11.66 6.81	29 21	55.23	13.47 11.12	31 19	1.8% 2.0%	7.04 [0.68, 13.40] 6.90 [1.11, 12.69]	
Chen 2016		10.63		54.96		34	2.0%	2.78 [-2.72, 8.28]	
Deng 2020		14.76	30	56.59		32	1.6%	4.13 [-3.40, 11.66]	
				70.15	7.14	49	2.5%		
	80.2	9.75	50					10.00 [0.00, 10.41]	
HouMY 2017	80.2	9.75 12.28	50 28	49.04		29	1.8%	10.05 [6.69, 13.41] 3.83 [-2.58, 10.24]	
HouMY 2017 Ji 2019	80.2	12.28	28			29 80	1.8% 2.8%	3.83 [-2.58, 10.24]	
HouMY 2017	80.2 52.87	12.28	28 80	49.04	12.42			3.83 [-2.58, 10.24] 5.22 [3.53, 6.91]	
HouMY 2017 Ji 2019 Ju 2022	80.2 52.87 57.44 60.31	12.28 5.22	28 80	49.04 52.22	12.42 5.69 4.72	80	2.8%	3.83 [-2.58, 10.24]	
HouMY 2017 Ji 2019 Ju 2022 Liu 2018	80.2 52.87 57.44 60.31	12.28 5.22 5.07 11.79	28 80 37	49.04 52.22 59.99	12.42 5.69 4.72	80 37	2.8% 2.7%	3.83 [-2.58, 10.24] 5.22 [3.53, 6.91] 0.32 [-1.91, 2.55]	
HouMY 2017 Ji 2019 Ju 2022 Liu 2018 XuL 2021	80.2 52.87 57.44 60.31 62.18	12.28 5.22 5.07 11.79 3.91	28 80 37 18 30	49.04 52.22 59.99 56.16	12.42 5.69 4.72 14.55	80 37 20	2.8% 2.7% 1.5%	3.83 [-2.58, 10.24] 5.22 [3.53, 6.91] 0.32 [-1.91, 2.55] 6.02 [-2.37, 14.41]	
HouMY 2017 Ji 2019 Ju 2022 Liu 2018 XuL 2021 Yan 2023 Zhao 2018 Subtotal (95% CI)	80.2 52.87 57.44 60.31 62.18 68.26 82.92	12.28 5.22 5.07 11.79 3.91 8.42	28 80 37 18 30 42 398	49.04 52.22 59.99 56.16 60.53 72.81	12.42 5.69 4.72 14.55 4.3 8.94	80 37 20 30 42 403	2.8% 2.7% 1.5% 2.8% 2.4% 24.0 %	3.83 [-2.58, 10.24] 5.22 [3.53, 6.91] 0.32 [-1.91, 2.55] 6.02 [-2.37, 14.41] 7.73 [5.65, 9.81]	
HouMY 2017 Ji 2019 Ju 2022 Liu 2018 XuL 2021 Yan 2023 Zhao 2018 Subtotal (95% CI) Heterogeneity: Tau ² :	80.2 52.87 57.44 60.31 62.18 68.26 82.92 = 8.94; C	12.28 5.22 5.07 11.79 3.91 8.42 hi ² = 39.	28 80 37 18 30 42 398 95, df=	49.04 52.22 59.99 56.16 60.53 72.81	12.42 5.69 4.72 14.55 4.3 8.94	80 37 20 30 42 403	2.8% 2.7% 1.5% 2.8% 2.4% 24.0 %	3.83 [-2.58, 10.24] 5.22 [3.53, 6.91] 0.32 [-1.91, 2.55] 6.02 [-2.37, 14.41] 7.73 [5.65, 9.81] 10.11 [6.40, 13.82]	
HouMY 2017 Ji 2019 Ju 2022 Liu 2018 XuL 2021 Yan 2023 Zhao 2018 Subtotal (95% CI)	80.2 52.87 57.44 60.31 62.18 68.26 82.92 = 8.94; C	12.28 5.22 5.07 11.79 3.91 8.42 hi ² = 39.	28 80 37 18 30 42 398 95, df=	49.04 52.22 59.99 56.16 60.53 72.81	12.42 5.69 4.72 14.55 4.3 8.94	80 37 20 30 42 403	2.8% 2.7% 1.5% 2.8% 2.4% 24.0 %	3.83 [-2.58, 10.24] 5.22 [3.53, 6.91] 0.32 [-1.91, 2.55] 6.02 [-2.37, 14.41] 7.73 [5.65, 9.81] 10.11 [6.40, 13.82]	
HouMY 2017 Ji 2019 Ju 2022 Liu 2018 XuL 2021 Yan 2023 Zhao 2018 Subtotal (95% CI) Heterogeneity: Tau ² Test for overall effect 1.4.4 Wuqinxi	80.2 52.87 57.44 60.31 62.18 68.26 82.92 = 8.94; C t: Z = 5.15	12.28 5.22 5.07 11.79 3.91 8.42 hi ² = 39. i (P < 0.0	28 80 37 18 30 42 398 95, df= 00001)	49.04 52.22 59.99 56.16 60.53 72.81	12.42 5.69 4.72 14.55 4.3 8.94 ≺ 0.0001	80 37 20 30 42 403 1); I ² = 7	2.8% 2.7% 1.5% 2.8% 2.4% 24.0 %	3.83 [-2.58, 10.24] 5.22 [3.53, 6.91] 0.32 [-1.91, 2.55] 6.02 [-2.37, 14.41] 7.73 [5.65, 9.81] 10.11 [6.40, 13.82] 5.91 [3.66, 8.15]	
HouMY 2017 Ji 2019 Ju 2022 Liu 2018 XuL 2021 Yan 2023 Zhao 2018 Subtotal (95% CI) Heterogeneity: Tau ² : Test for overall effect 1.4.4 Wuqinxi Gao 2017	80.2 52.87 57.44 60.31 62.18 68.26 82.92 = 8.94; C t: Z = 5.15 55.31	12.28 5.22 5.07 11.79 3.91 8.42 hi ² = 39. 5 (P < 0.0	28 80 37 18 30 42 398 95, df= 00001) 36	49.04 52.22 59.99 56.16 60.53 72.81 = 10 (P 43.55	12.42 5.69 4.72 14.55 4.3 8.94 ≺ 0.0001 8.52	80 37 20 30 42 403 1); I ² = 3 36	2.8% 2.7% 1.5% 2.8% 2.4% 24.0% 75%	3.83 [-2.58, 10.24] 5.22 [3.53, 6.91] 0.32 [-1.91, 2.55] 6.02 [-2.37, 14.41] 7.73 [5.65, 9.81] 10.11 [6.40, 13.82] 5.91 [3.66, 8.15]	
Hould Y 2017 Ji 2019 Ju 2022 Liu 2018 XuL 2021 Yan 2023 Zhao 2018 Subtotal (95% CI) Heterogeneity: Tau ² : Test for overall effect 1.4.4 Wuqinxi Gao 2017 He 2015	80.2 52.87 57.44 60.31 62.18 68.26 82.92 = 8.94; C t: Z = 5.16 55.31 58.97	12.28 5.22 5.07 11.79 3.91 8.42 hi ² = 39. 5 (P < 0.0 9.41 5.63	28 80 37 18 30 42 398 95, df= 00001) 36 48	49.04 52.22 59.99 56.16 60.53 72.81 = 10 (P 43.55 54.31	12.42 5.69 4.72 14.55 4.3 8.94 ≺ 0.0001 8.52 6.45	80 37 20 30 42 403 1); I ² = 7 36 45	2.8% 2.7% 1.5% 2.8% 2.4% 24.0% 25%	3.83 [-2.58, 10.24] 5.22 [3.53, 6.91] 0.32 [-1.91, 2.55] 6.02 [-2.37, 14.41] 7.73 [5.65, 9.81] 10.11 [6.40, 13.82] 5.91 [3.66, 8.15] 11.76 [7.61, 15.91] 4.66 [2.19, 7.13]	
Hould Y 2017 Ji 2019 Ju 2022 Liu 2018 XuL 2021 Yan 2023 Zhao 2018 Subtotal (95% CI) Heterogeneity: Tau ² : Test for overall effect 1.4.4 Wuqinxi Gao 2017 He 2015 Liu 2020	80.2 52.87 57.44 60.31 62.18 68.26 82.92 = 8.94; C t: Z = 5.15 55.31 58.97 79.16	12.28 5.22 5.07 11.79 3.91 8.42 hi ² = 39. 5 (P < 0.0 9.41 5.63 13.9	28 80 37 18 30 42 398 95, df= 00001) 36 48 50	49.04 52.22 59.99 56.16 60.53 72.81 = 10 (P 43.55 54.31 65.72	12.42 5.69 4.72 14.55 4.3 8.94 ≺ 0.0001 8.52 6.45 13.17	80 37 20 30 42 403 1); ² = 7 36 45 50	2.8% 2.7% 1.5% 2.8% 2.4% 24.0% 75% 2.3% 2.7% 2.1%	3.83 [-2.58, 10.24] 5.22 [3.53, 6.91] 0.32 [-1.91, 2.55] 6.02 [-2.37, 14.41] 7.73 [5.65, 9.81] 10.11 [6.40, 13.82] 5.91 [3.66, 8.15] 11.76 [7.61, 15.91] 4.66 [2.19, 7.13] 13.44 [8.13, 18.75]	
Hou MY 2017 Ji 2019 Ju 2022 Liu 2018 XuL 2021 Yan 2023 Zhao 2018 Subtotal (95% CI) Heterogeneity: Tau ² : Test for overall effect 1.4.4 Wuqinxi Gao 2017 He 2015 Liu 2020 Sun 2021	80.2 52.87 57.44 60.31 62.18 68.26 82.92 = 8.94; C t: Z = 5.15 55.31 58.97 79.16 58.52	12.28 5.22 5.07 11.79 3.91 8.42 hi ² = 39. 5 (P < 0.0 9.41 5.63 13.9 8.09	28 80 37 18 30 42 398 95, df= 00001) 36 48 50 48	49.04 52.22 59.99 56.16 60.53 72.81 10 (P 43.55 54.31 65.72 55.52	12.42 5.69 4.72 14.55 4.3 8.94 ≺ 0.0001 × 0.0001 8.52 6.45 13.17 8.33	80 37 20 42 403 1); ² = 7 36 45 50 40	2.8% 2.7% 1.5% 2.8% 2.4% 24.0% 75% 2.3% 2.7% 2.1% 2.5%	3.83 [-2.58, 10.24] 5.22 [3.53, 6.91] 0.32 [-1.91, 2.55] 6.02 [-2.37, 14.41] 7.73 [5.65, 9.81] 10.11 [6.40, 13.82] 5.91 [3.66, 8.15] 11.76 [7.61, 15.91] 4.66 [2.19, 7.13] 13.44 [8.13, 18.76] 3.00 [-0.60, 6.60]	• •
Hou MY 2017 Ji 2019 Ju 2022 Liu 2018 XuL 2021 Yan 2023 Zhao 2018 Subtotal (95% CI) Heterogeneity: Tau ² : Test for overall effect 1.4.4 Wuqinxi Gao 2017 He 2015 Liu 2020 Sun 2021 Wei 2015	80.2 52.87 57.44 60.31 62.18 88.26 82.92 = 8.94; C t: Z = 5.15 55.31 58.51 79.16 58.52 58.97	12.28 5.22 5.07 11.79 3.91 8.42 hi ² = 39. 5 (P < 0.0 9.41 5.63 13.9 8.09 5.63	28 80 37 18 30 42 398 95, df= 00001) 36 48 50 40 40 48	49.04 52.22 59.99 56.16 60.53 72.81 10 (P 43.55 54.31 65.72 55.52 54.31	12.42 5.69 4.72 14.55 4.3 8.94 < 0.0001 8.52 6.45 13.17 8.33 6.45	80 37 20 42 403)); ² = 7 36 45 50 40 45	2.8% 2.7% 1.5% 2.8% 2.4% 24.0% 25% 2.3% 2.7% 2.1% 2.5% 2.7%	3.83 [-2.58, 10.24] 5.22 [3.53, 6.91] 0.32 [-1.91, 2.55] 6.02 [-2.37, 14.41] 7.73 [5.65, 9.81] 10.11 [6.40, 13.82] 5.91 [3.66, 8.15] 11.76 [7.61, 15.91] 4.66 [2.19, 7.13] 13.44 [8.13, 18.75] 3.00 [-0.60, 6.60] 4.66 [2.19, 7.13]	
HouMY 2017 Ji 2019 Ju 2022 Liu 2018 XuL 2021 Yan 2023 Zhao 2018 Subtotal (95% CI) Heterogeneity: Tau ² : Test for overall effect 1.4.4 Wuqinxi Gao 2017 He 2015 Liu 2020 Sun 2021 Wei 2015 Xiao 2023	80.2 52.87 57.44 60.31 62.18 68.26 82.92 = 8.94; C t: Z = 5.15 55.31 58.97 79.16 58.52	12.28 5.22 5.07 11.79 3.91 8.42 hi ² = 39. 5 (P < 0.0 9.41 5.63 13.9 8.09	28 80 37 18 30 42 398 95, df= 00001) 36 48 50 40 48 58	49.04 52.22 59.99 56.16 60.53 72.81 10 (P 43.55 54.31 65.72 55.52	12.42 5.69 4.72 14.55 4.3 8.94 ≺ 0.0001 × 0.0001 8.52 6.45 13.17 8.33	80 37 20 42 403)); ² = 7 36 45 50 40 45 58	2.8% 2.7% 1.5% 2.8% 24.0% 24.0% 75% 2.3% 2.7% 2.1% 2.5% 2.7% 2.7% 2.7%	3.83 [-2.58, 10.24] 5.22 [3.53, 6.91] 0.32 [-1.91, 2.55] 6.02 [-2.37, 14.41] 7.73 [5.65, 9.81] 10.11 [6.40, 13.82] 5.91 [3.66, 8.15] 11.76 [7.61, 15.91] 4.66 [2.19, 7.13] 13.44 [8.13, 18.75] 3.00 [-0.60, 6.60] 4.66 [2.19, 7.13] 19.89 [17.79, 21.99]	
Hould Y 2017 Ji 2019 Ju 2022 Liu 2018 XuL 2021 Yan 2023 Zhao 2018 Subtotal (95% CI) Heterogeneity: Tau ² Test for overall effect 1.4.4 Wuqinxi Gao 2017 He 2015 Liu 2020 Sun 2021 Wei 2015 Xiao 2023 Subtotal (95% CI)	80.2 52.87 57.44 60.31 62.18 68.26 82.92 = 8.94; C t: Z = 5.15 55.31 58.97 79.16 58.52 58.97 72.31	12.28 5.22 5.07 11.79 3.91 8.42 hi [≠] = 39. 5 (P < 0.0 9.41 5.63 13.9 8.09 5.63 5.18	28 80 37 18 30 42 398 95, df= 00001) 36 48 50 40 48 58 280	49.04 52.22 59.99 56.16 60.53 72.81 = 10 (P 43.55 54.31 65.72 55.52 54.31 52.42	12.42 5.69 4.72 14.55 4.3 8.94 < 0.0001 < 0.0001 < 0.52 6.45 13.17 8.33 6.45 6.33	80 37 20 30 42 403 1); ² = 5 36 45 50 40 45 58 274	2.8% 2.7% 1.5% 2.8% 24.0% 24.0% 25% 2.3% 2.7% 2.1% 2.5% 2.7% 2.7% 2.7% 15.0%	3.83 [-2.58, 10.24] 5.22 [3.53, 6.91] 0.32 [-1.91, 2.55] 6.02 [-2.37, 14.41] 7.73 [5.65, 9.81] 10.11 [6.40, 13.82] 5.91 [3.66, 8.15] 11.76 [7.61, 15.91] 4.66 [2.19, 7.13] 13.44 [8.13, 18.75] 3.00 [-0.60, 6.60] 4.66 [2.19, 7.13]	
Hou MY 2017 Ji 2019 Ju 2022 Liu 2018 XuL 2021 Yan 2023 Zhao 2018 Subtotal (95% CI) Heterogeneity: Tau ² : Test for overall effect 1.4.4 Wuqinxi Gao 2017 He 2015 Liu 2020 Sun 2021 Wei 2015 Xiao 2023 Subtotal (95% CI) Heterogeneity: Tau ² :	80.2 52.87 57.44 60.31 62.18 68.26 82.92 = 8.94; C t: Z = 5.16 55.31 58.97 79.16 58.52 58.97 72.31 = 60.96; 0	12.28 5.22 5.07 11.79 3.91 8.42 $hi^{2} = 39.$ 5 (P < 0.0 9.41 5.63 13.9 8.09 5.63 5.18 Chi ² = 13	28 80 37 18 30 42 398 95, df= 00001) 36 48 50 48 50 48 50 48 58 280 37.49, 1	49.04 52.22 59.99 56.16 60.53 72.81 = 10 (P 43.55 54.31 65.72 55.52 54.31 52.42	12.42 5.69 4.72 14.55 4.3 8.94 < 0.0001 < 0.0001 < 0.52 6.45 13.17 8.33 6.45 6.33	80 37 20 30 42 403 1); ² = 5 36 45 50 40 45 58 274	2.8% 2.7% 1.5% 2.8% 24.0% 24.0% 25% 2.3% 2.7% 2.1% 2.5% 2.7% 2.7% 2.7% 15.0%	3.83 [-2.58, 10.24] 5.22 [3.53, 6.91] 0.32 [-1.91, 2.55] 6.02 [-2.37, 14.41] 7.73 [5.65, 9.81] 10.11 [6.40, 13.82] 5.91 [3.66, 8.15] 11.76 [7.61, 15.91] 4.66 [2.19, 7.13] 13.44 [8.13, 18.75] 3.00 [-0.60, 6.60] 4.66 [2.19, 7.13] 19.89 [17.79, 21.99]	
Hou MY 2017 Ji 2019 Ju 2022 Liu 2018 XuL 2021 Yan 2023 Zhao 2018 Subtotal (95% CI) Heterogeneity: Tau ² Test for overall effect 1.4.4 Wuqinxi Gao 2017 He 2015 Liu 2020 Sun 2021 Wei 2015 Xiao 2023 Subtotal (95% CI)	80.2 52.87 57.44 60.31 62.18 68.26 82.92 = 8.94; C t: Z = 5.16 55.31 58.97 79.16 58.52 58.97 72.31 = 60.96; 0	12.28 5.22 5.07 11.79 3.91 8.42 $hi^{2} = 39.$ 5 (P < 0.0 9.41 5.63 13.9 8.09 5.63 5.18 Chi ² = 13	28 80 37 18 30 42 398 95, df= 00001) 36 48 50 48 50 48 50 48 58 280 37.49, 1	49.04 52.22 59.99 56.16 60.53 72.81 = 10 (P 43.55 54.31 65.72 55.52 54.31 52.42	12.42 5.69 4.72 14.55 4.3 8.94 < 0.0001 < 0.0001 < 0.52 6.45 13.17 8.33 6.45 6.33	80 37 20 30 42 403 1); ² = 5 36 45 50 40 45 58 274	2.8% 2.7% 1.5% 2.8% 24.0% 24.0% 25% 2.3% 2.7% 2.1% 2.5% 2.7% 2.7% 2.7% 15.0%	3.83 [-2.58, 10.24] 5.22 [3.53, 6.91] 0.32 [-1.91, 2.55] 6.02 [-2.37, 14.41] 7.73 [5.65, 9.81] 10.11 [6.40, 13.82] 5.91 [3.66, 8.15] 11.76 [7.61, 15.91] 4.66 [2.19, 7.13] 13.44 [8.13, 18.75] 3.00 [-0.60, 6.60] 4.66 [2.19, 7.13] 19.89 [17.79, 21.99]	
Hou MY 2017 Ji 2019 Ju 2022 Liu 2018 XuL 2021 Yan 2023 Zhao 2018 Subtotal (95% Cl) Heterogeneity: Tau ² : Test for overall effect 1.4.4 Wuqinxi Gao 2017 He 2015 Liu 2020 Sun 2021 Wei 2015 Xiao 2023 Subtotal (95% Cl) Heterogeneity: Tau ² : Test for overall effect 1.4.5 Yijinjing	80.2 52.87 57.44 60.31 62.18 88.26 82.92 = 8.94; C t: Z = 5.15 55.31 58.97 79.16 58.97 72.31 = 60.96; 0 t: Z = 2.92	12.28 5.22 5.07 11.79 3.91 8.42 $hi^2 = 39.$ i (P < 0.0) 9.41 5.63 13.99 8.09 5.63 5.18 $Chi^2 = 13$ i (P = 0.0)	28 80 37 18 30 42 398 95, df= 95, df= 95, df= 48 50 40 48 50 40 40 40 37.49, (37.49, (37.49, (30, 4))	49.04 52.22 59.99 56.16 60.53 72.81 = 10 (P 43.55 54.31 65.72 55.52 54.31 52.42 df = 5 (F	12.42 5.69 4.72 14.55 4.3 8.94 < 0.0001 8.52 6.45 13.17 8.33 6.45 6.33	80 37 20 30 42 403 36 45 50 40 40 45 58 274 274	2.8% 2.7% 1.5% 2.4% 24.0% 75% 2.3% 2.7% 2.7% 2.7% 2.7% 2.7% 15.0% = 96%	3.83 [-2.58, 10.24] 5.22 [3.53, 6.91] 0.32 [-1.91, 2.55] 6.02 [-2.37, 14.41] 7.73 [5.65, 9.81] 10.11 [6.40, 13.82] 5.91 [3.66, 8.15] 4.66 [2.19, 7.13] 13.44 [8.13, 18.75] 3.00 [-0.60, 6.60] 4.66 [2.19, 7.13] 19.89 [17.79, 21.99] 9.54 [3.13, 15.95]	
Hou MY 2017 Ji 2019 Ju 2022 Liu 2018 XuL 2021 Yan 2023 Zhao 2018 Subtotal (95% CI) Heterogeneity: Tau ² Test for overall effect 1.4.4 Wuqinxi Gao 2017 He 2015 Liu 2020 Sun 2021 Wei 2015 Xiao 2023 Subtotal (95% CI) Heterogeneity: Tau ² Test for overall effect 1.4.5 Yijinjing Gao 2016	80.2 52.87 57.44 60.31 82.18 68.26 82.92 = 8.94; C t: Z = 5.15 55.31 58.97 79.16 58.52 58.97 72.31 = 60.96; (t: Z = 2.92 66.15	12.28 5.22 5.07 11.79 3.91 8.42 $hi^2 = 39.5$ i (P < 0.0) 9.41 5.63 13.9 8.09 5.63 5.18 $Chi^2 = 10.0$ $e^2 = 0.0$ 6.09	28 80 37 18 30 42 398 95, df= 00001) 36 40 40 48 58 280 07.49, 004)	49.04 52.22 59.99 56.16 60.53 72.81 = 10 (P 43.55 54.31 65.72 55.52 54.31 52.42 3f = 5 (F 61.85	12.42 5.69 4.72 14.55 4.3 8.94 < 0.0001 8.52 6.45 13.17 8.33 6.45 6.33 < < 0.0000 10.37	80 37 20 30 42 403 36 45 50 50 40 45 58 274 001); ² = ; 57	2.8% 2.7% 1.5% 2.4% 24.0% 75% 2.3% 2.7% 2.7% 2.7% 2.7% 2.7% 15.0% = 96%	3.83 [-2.58, 10.24] 5.22 [3.53, 6.91] 0.32 [-1.91, 2.55] 6.02 [-2.37, 14.41] 7.73 [5.65, 9.81] 10.11 [6.40, 13.82] 5.91 [3.66, 8.15] 11.76 [7.61, 15.91] 4.66 [2.19, 7.13] 13.44 [8.13, 18.75] 3.00 [-0.60, 6.60] 4.66 [2.19, 7.13] 19.89 [17.79, 21.99] 9.54 [3.13, 15.95]	
Hould Y 2017 Ji 2019 Ju 2022 Liu 2018 XuL 2021 Yan 2023 Zhao 2018 Subtotal (95% CI) Heterogeneity: Tau ²⁺ Test for overall effect 1.4.4 Wuqinxi Gao 2017 He 2015 Liu 2020 Sun 2021 Wei 2015 Xiao 2023 Subtotal (95% CI) Heterogeneity: Tau ²⁺ Test for overall effect 1.4.5 Yijinjing Gao 2016 Zhang 2016	80.2 52.87 57.44 60.31 62.18 88.26 82.92 = 8.94; C t: Z = 5.15 55.31 58.97 79.16 58.97 72.31 = 60.96; 0 t: Z = 2.92	12.28 5.22 5.07 11.79 3.91 8.42 $hi^2 = 39.5$ i (P < 0.0) 9.41 5.63 13.9 8.09 5.63 5.18 $Chi^2 = 10.0$ $e^2 = 0.0$ 6.09	28 80 37 18 30 42 398 95, df= 00001) 36 48 58 280 40 48 58 280 (37.49, 1) (004)	49.04 52.22 59.99 56.16 60.53 72.81 = 10 (P 43.55 54.31 65.72 55.52 54.31 52.42 df = 5 (F	12.42 5.69 4.72 14.55 4.3 8.94 < 0.0001 8.52 6.45 13.17 8.33 6.45 6.33	80 37 20 30 42 403 36 45 50 36 45 50 40 45 58 8 274 20 37 40 57 25	2.8% 2.7% 1.5% 2.8% 2.4% 24.0% 75% 2.3% 2.7% 2.3% 2.7% 2.5% 2.7% 2.7% 15.0% = 96%	3.83 [-2.58, 10.24] 5.22 [3.53, 6.91] 0.32 [-1.91, 2.55] 6.02 [-2.37, 14.41] 7.73 [5.65, 9.81] 10.11 [6.40, 13.82] 5.91 [3.66, 8.15] 11.76 [7.61, 15.91] 4.66 [2.19, 7.13] 13.44 [8.13, 18.76] 3.00 [-0.60, 6.60] 4.66 [2.19, 7.13] 19.89 [17.79, 21.99] 9.54 [3.13, 15.95] 4.30 [1.16, 7.44] 4.55 [2.16, 6.94]	
Hould Y 2017 Ji 2019 Ju 2022 Liu 2018 XuL 2021 Yan 2023 Zhao 2018 Subtotal (95% CI) Heterogeneity: Tau ² : Test for overall effect 1.4.4 Wuqinxi Gao 2017 He 2015 Xiao 2023 Subtotal (95% CI) Heterogeneity: Tau ² Test for overall effect 1.4.5 Yijinjing Gao 2016 Zhang 2016 Subtotal (95% CI)	80.2 52.87 57.44 60.31 62.18 68.26 82.92 = 8.94; C t: Z = 5.15 55.31 58.52 58.97 72.31 = 60.96; t: Z = 2.92 66.15 66.09	12.28 5.22 5.07 11.79 3.91 8.42 $h^2 = 39.$ 5.63 13.99 5.63 5.18 $Ch^2 = 13$ $(P = 0.0)^2$ $(P = 0.0)^2$ (P =	28 80 37 18 39 398 95, df= 00001) 36 48 50 40 48 85 280 37.49, 1004) 55 20 75	49.04 52.22 59.99 56.16 60.53 72.81 = 10 (P 43.55 54.31 55.52 54.31 55.52 54.31 52.42 3f = 5 (F 61.85 61.54	12.42 5.69 4.72 14.55 4.3 8.94 < 0.0001 8.52 6.45 6.33 C < 0.000 10.37 3.48	80 37 20 30 42 403 36 45 50 40 45 50 40 45 50 40 45 50 40 45 50 40 27 4 57 25 82	2.8% 2.7% 1.5% 2.4% 24.0% 75% 2.3% 2.7% 2.7% 2.7% 2.7% 2.7% 15.0% = 96%	3.83 [-2.58, 10.24] 5.22 [3.53, 6.91] 0.32 [-1.91, 2.55] 6.02 [-2.37, 14.41] 7.73 [5.65, 9.81] 10.11 [6.40, 13.82] 5.91 [3.66, 8.15] 11.76 [7.61, 15.91] 4.66 [2.19, 7.13] 13.44 [8.13, 18.75] 3.00 [-0.60, 6.60] 4.66 [2.19, 7.13] 19.89 [17.79, 21.99] 9.54 [3.13, 15.95]	
HouMY 2017 Ji 2019 Ju 2022 Liu 2018 XuL 2021 Yan 2023 Zhao 2018 Subtotal (95% CI) Heterogeneity: Tau ² : Test for overall effect 1.4.4 Wuqinxi Gao 2017 He 2015 Xiao 2023 Subtotal (95% CI) Heterogeneity: Tau ² : Test for overall effect 1.4.5 Yijinjing Gao 2016 Zhang 2016 Subtotal (95% CI) Heterogeneity: Tau ² : Subtotal (95% CI)	80.2 52.87 57.44 60.31 62.18 68.26 82.92 = 8.94; C t: Z = 5.15 55.31 55.31 58.52 58.97 72.31 = 60.96; (t: Z = 2.92 66.15 66.09 = 0.00; C	12.28 5.22 5.07 11.79 3.91 8.42 $hi^2 = 39.5$ i (P < 0.0) 9.41 5.63 13.99 5.63 5.18 $Chi^2 = 13$ i (P = 0.0) 6.09 4.49 $hi^2 = 0.0$	28 80 37 18 30 42 398 95, df= 00001) 36 48 50 40 48 88 280 37.49, 1004) 55 520 75 22, df=	49.04 52.22 59.99 56.16 60.53 72.81 43.55 54.31 65.72 55.52 54.31 52.42 df = 5 (F 61.85 61.54 1 (P = 0	12.42 5.69 4.72 14.55 4.3 8.94 < 0.0001 8.52 6.45 6.33 C < 0.000 10.37 3.48	80 37 20 30 42 403 36 45 50 40 45 50 40 45 50 40 45 50 40 17 7 7 8 27 4 2 8 2 7 4 2 5 8 2 8 2 4 3 6 4 5 5 0 4 2 4 5 5 0 4 2 4 5 5 6 4 5 5 5 6 4 5 5 5 6 4 5 5 5 6 4 5 5 5 6 4 5 5 5 6 4 5 5 5 6 4 5 5 5 6 5 6 4 5 5 5 6 5 5 6 5 5 5 6 5 5 5 6 5 7 4 5 5 5 5 5 5 5 5 5 5 5 5 5	2.8% 2.7% 1.5% 2.8% 2.4% 24.0% 75% 2.3% 2.7% 2.3% 2.7% 2.5% 2.7% 2.7% 15.0% = 96%	3.83 [-2.58, 10.24] 5.22 [3.53, 6.91] 0.32 [-1.91, 2.55] 6.02 [-2.37, 14.41] 7.73 [5.65, 9.81] 10.11 [6.40, 13.82] 5.91 [3.66, 8.15] 11.76 [7.61, 15.91] 4.66 [2.19, 7.13] 13.44 [8.13, 18.76] 3.00 [-0.60, 6.60] 4.66 [2.19, 7.13] 19.89 [17.79, 21.99] 9.54 [3.13, 15.95] 4.30 [1.16, 7.44] 4.55 [2.16, 6.94]	
Hou MY 2017 Ji 2019 Ju 2022 Liu 2018 XuL 2021 Yan 2023 Zhao 2018 Subtotal (95% CI) Heterogeneity: Tau ²⁺ Test for overall effect 1.4.4 Wuqinxi Gao 2017 He 2015 Liu 2020 Sun 2021 Wei 2015 Liu 2020 Sun 2021 Wei 2015 Xiao 2023 Subtotal (95% CI) Heterogeneity: Tau ²⁺ Test for overall effect 1.4.5 Yijinjing Gao 2016 Zhang 2016	80.2 52.87 57.44 60.31 62.18 68.26 82.92 = 8.94; C t: Z = 5.15 55.31 55.31 58.52 58.97 72.31 = 60.96; (t: Z = 2.92 66.15 66.09 = 0.00; C	12.28 5.22 5.07 11.79 3.91 8.42 $hi^2 = 39.5$ i (P < 0.0) 9.41 5.63 13.99 5.63 5.18 $Chi^2 = 13$ i (P = 0.0) 6.09 4.49 $hi^2 = 0.0$	28 80 37 18 30 42 398 95, df= 00001) 36 48 50 40 48 88 280 37.49, 1004) 55 520 75 22, df=	49.04 52.22 59.99 56.16 60.53 72.81 43.55 54.31 65.72 55.52 54.31 52.42 df = 5 (F 61.85 61.54 1 (P = 0	12.42 5.69 4.72 14.55 4.3 8.94 < 0.0001 8.52 6.45 6.33 C < 0.000 10.37 3.48	80 37 20 30 42 403 36 45 50 40 45 50 40 45 50 40 45 50 40 17 7 7 8 27 4 2 8 2 7 4 2 5 8 2 8 2 4 3 6 4 5 5 0 4 2 4 5 5 0 4 2 4 5 5 6 4 5 5 5 6 4 5 5 5 6 4 5 5 5 6 4 5 5 5 6 4 5 5 5 6 4 5 5 5 6 4 5 5 5 6 5 6 4 5 5 5 6 5 5 6 5 5 5 6 5 5 5 6 5 7 4 5 5 5 5 5 5 5 5 5 5 5 5 5	2.8% 2.7% 1.5% 2.8% 2.4% 24.0% 75% 2.3% 2.7% 2.3% 2.7% 2.5% 2.7% 2.7% 15.0% = 96%	3.83 [-2.58, 10.24] 5.22 [3.53, 6.91] 0.32 [-1.91, 2.55] 6.02 [-2.37, 14.41] 7.73 [5.65, 9.81] 10.11 [6.40, 13.82] 5.91 [3.66, 8.15] 11.76 [7.61, 15.91] 4.66 [2.19, 7.13] 13.44 [8.13, 18.76] 3.00 [-0.60, 6.60] 4.66 [2.19, 7.13] 19.89 [17.79, 21.99] 9.54 [3.13, 15.95] 4.30 [1.16, 7.44] 4.55 [2.16, 6.94]	
Hou MY 2017 Ji 2019 Ju 2022 Liu 2018 XuL 2021 Yan 2023 Zhao 2018 Subtotal (95% CI) Heterogeneity: Tau ² Test for overall effect 1.4.4 Wuqinxi Gao 2017 He 2015 Liu 2020 Sun 2021 Wei 2015 Liu 2020 Subtotal (95% CI) Heterogeneity: Tau ² : Test for overall effect 1.4.5 Yijinjing Gao 2016 Zhang 2016 Subtotal (95% CI) Heterogeneity: Tau ² : Test for overall effect 1.4.5 Yijinjing	$\begin{array}{c} 80.2\\ 52.87\\ 57.44\\ 60.31\\ 62.18\\ 68.26\\ 82.92\\ = 8.94; C\\ t; Z = 5.16\\ 55.31\\ 58.97\\ 79.16\\ 58.52\\ 58.97\\ 72.31\\ = 60.96; (\\ t; Z = 2.92\\ 66.15\\ 66.09\\ = 0.00; C\\ t; Z = 4.59\end{array}$	12.28 5.22 5.07 11.79 3.91 8.42 $h^2 = 39.5$ 5.63 5.18 $Ch^2 = 100$ $Ch^2 = 1000$ $Ch^2 = 10000$ $Ch^2 = 100000000000000000000000000000000000$	28 80 37 18 30 42 398 95, df= 00001) 36 48 80 40 40 48 58 0 004) 57 20 75 20 75 20 75 2, df= 00001) 1793	49.04 52.22 59.99 66.16 60.53 72.81 = 10 (P 43.55 54.31 65.72 55.52 54.31 52.42 3f = 5 (F 61.85 61.54 1 (P = 0	12.42 5.69 4.72 14.55 4.3 8.94 < 0.0001 8.52 6.45 13.17 8.33 6.45 6.33 < 0.000 10.37 3.48 .90); I [≠] =	80 37 20 42 403 36 45 58 274 1001); ² = ; 57 25 82 50%	2.8% 2.7% 1.5% 2.8% 2.4% 24.0% 75% 2.3% 2.7% 2.5% 2.7% 2.5% 2.7% 5.3% 2.6% 2.7% 5.3%	3.83 [-2.58, 10.24] 5.22 [3.53, 6.91] 0.32 [-1.91, 2.55] 6.02 [-2.37, 14.41] 7.73 [5.65, 9.81] 10.11 [6.40, 13.82] 5.91 [3.66, 8.15] 11.76 [7.61, 15.91] 4.66 [2.19, 7.13] 13.44 [8.13, 18.76] 3.00 [-0.60, 6.60] 4.66 [2.19, 7.13] 19.89 [17.79, 21.99] 9.54 [3.13, 15.95] 4.30 [1.16, 7.44] 4.55 [2.16, 6.94]	
Houly 2017 Ji 2019 Ju 2022 Liu 2018 XuL 2021 Yan 2023 Zhao 2018 Subtotal (95% CI) Heterogeneity: Tau ² : Test for overall effect 1.4.4 Wuqinxi Gao 2017 He 2015 Liu 2020 Sun 2021 Wei 2015 Xiao 2023 Subtotal (95% CI) Heterogeneity: Tau ² : Test for overall effect 1.4.5 Yijinjing Gao 2016 Zhang 2016 Zhang 2016 Subtotal (95% CI) Heterogeneity: Tau ² : Test for overall effect	$\begin{array}{c} 80.2\\ 52.87\\ 57.44\\ 60.31\\ 62.18\\ 68.26\\ 82.92\\ = 8.94; C\\ t; Z = 5.16\\ 55.31\\ 58.97\\ 79.16\\ 58.52\\ 58.97\\ 72.31\\ = 60.96; (t; Z = 2.92\\ 66.15\\ 66.09\\ = 0.00; C\\ t; Z = 4.59\\ = 18.05; (c; z = 4.59)\\ = 18.05; (c; z =$	12.28 5.22 5.07 11.79 3.91 8.42 $h ^2 = 39.5$ 5.63 13.99 5.63 5.18 $Ch ^2 = 13$ $(P = 0.0)^2$ $h ^2 = 0.0^2$ $h ^2 = 0.0^2$	28 80 37 18 30 42 398 95, df= 00001) 36 48 50 00 40 48 58 280 77.49, 1 004) 55 20 75 20 75 20, df= 100001) 17733 24.90, 1	49.04 52.22 59.99 56.16 60.53 72.81 = 10 (P 43.55 54.31 55.52 54.31 55.52 54.31 52.42 3f = 5 (F 61.85 61.54 1 (P = 0	12.42 5.69 4.72 14.55 4.3 8.94 < 0.0001 8.52 6.45 13.17 8.33 6.45 6.33 < 0.000 10.37 3.48 .90); I [≠] =	80 37 20 42 403 36 45 58 274 1001); ² = ; 57 25 82 50%	2.8% 2.7% 1.5% 2.8% 2.4% 24.0% 75% 2.3% 2.7% 2.5% 2.7% 2.5% 2.7% 5.3% 2.6% 2.7% 5.3%	3.83 [-2.58, 10.24] 5.22 [3.53, 6.91] 0.32 [-1.91, 2.55] 6.02 [-2.37, 14.41] 7.73 [5.65, 9.81] 10.11 [6.40, 13.82] 5.91 [3.66, 8.15] 11.76 [7.61, 15.91] 4.66 [2.19, 7.13] 13.44 [8.13, 18.75] 3.00 [-0.60, 6.60] 4.66 [2.19, 7.13] 19.89 [17.79, 21.99] 9.54 [3.13, 15.95] 4.30 [1.16, 7.44] 4.55 [2.16, 6.94] 4.46 [2.55, 6.36]	

Church and Carls and and	-	eriment			Control	T-4-1	187-1-1-4	Mean Difference	Mean Difference
Study or Subgroup 1.4.1 FEV1/FVC <24	Mean	SD	lotal	Mean	SD	Total	weight	IV, Random, 95% Cl	IV, Random, 95% Cl
Chen 2008	56.95	6.81	21	50.05	11 1 2	19	2.0%	6 00 11 11 12 601	
Chen 2008		10.63	33	54.96		34	2.0%	6.90 [1.11, 12.69]	
Deng 2020		14.76	30	56.59		34	1.6%	2.78 [-2.72, 8.28]	
Du 2013	61.05	4.82	36	54.39	5.04	38	2.7%	4.13 [-3.40, 11.66] 6.66 [4.41, 8.91]	
Gao 2017	55.31	9.41	36	43.55	8.52	36	2.7%	11.76 [7.61, 15.91]	
Gu 2012	50.1	14.5	33	48.3	10.9	30	1.9%	1.80 [-4.50, 8.10]	
He 2020		13.25		47.57		45	2.1%	4.07 [-1.35, 9.49]	
Hou 2017	81.53	7.82	25	73.87	6.81	23	2.3%	7.66 [3.52, 11.80]	
Hu 2020	49.7	14.5	42	49.5	16	42	1.8%	0.20 [-6.33, 6.73]	
Huang 2016	55.97	13.2	31	49.8	11.5	30	1.9%	6.17 [-0.04, 12.38]	
Ji 2019		12.28	28	49.04		29	1.8%	3.83 [-2.58, 10.24]	
Jiang 2023	65.47	4.46	40	57.51	3.87	40	2.8%	7.96 [6.13, 9.79]	
Li 2016	49.8	16.2	20	49.7	14.3	20	1.3%	0.10 [-9.37, 9.57]	
Li 2019	71.44	14.28	26	62.56	15.09	23	1.5%	8.88 [0.62, 17.14]	
Liu 2013	69.31	11.12	40	65.16	10.22	40	2.2%	4.15 [-0.53, 8.83]	+
Liu 2018	60.31	5.07	37	59.99	4.72	37	2.7%	0.32 [-1.91, 2.55]	+-
Liu 2020	79.16	13.9	50	65.72	13.17	50	2.1%	13.44 [8.13, 18.75]	
Ma 2020	73.46	8.26	30	66.54	7.34	30	2.4%	6.92 [2.97, 10.87]	
Ren 2017	55	2.34	30	45	3.43	30	2.8%	10.00 [8.51, 11.49]	
Sun 2021	58.52	8.09	40	55.52	8.33	40	2.5%	3.00 [-0.60, 6.60]	<u>+</u>
Xiao 2023	72.31	5.18		52.42	6.33	58		19.89 [17.79, 21.99]	
Xu 2021	68.26	5.32		57.17	4.83	130	2.9%	11.09 [9.86, 12.32]	
Yan 2023	68.26	3.91	30	60.53	4.3	30	2.8%	7.73 [5.65, 9.81]	
Yu 2019	77.81	4.86		74.23	3.9	41	2.8%	3.58 [1.67, 5.49]	
Subtotal (95% CI) Heterogeneity: Tau ² :			934			927	53.9%	6.70 [4.61, 8.80]	-
1.4.2 FEV1/FVC ≥24 Cao 2016	weeks 64.64	7.48	52	61.64	7.49	50	2.6%	3.00 (0.09, 5.91)	
Cao 2022		11.66		55.23		31	1.8%	7.04 [0.68, 13.40]	
Chi 2021		12.94		48.99		108	2.5%	0.83 [-2.43, 4.09]	_ _
Gao 2016	66.15	6.09		61.85		57	2.6%	4.30 [1.16, 7.44]	——
He 2015	58.97	5.63		54.31	6.45	45	2.7%	4.66 [2.19, 7.13]	
HouMY 2017	80.2	9.75	50	70.15	7.14	49	2.5%	10.05 [6.69, 13.41]	
Ju 2022	57.44	5.22	80	52.22	5.69	80	2.8%	5.22 [3.53, 6.91]	
Li 2012	59.37	3.14	30		2.92	30	2.8%	0.13 [-1.40, 1.66]	+
Liu 2019	53.47	4.01	50	48.91	2.8	50	2.8%	4.56 [3.20, 5.92]	
Liu 2021	76.75	7.18	41	71.37	7.44	40	2.6%	5.38 [2.19, 8.57]	
Peng 2020		11.96		70.73		40	2.0%	9.95 [4.32, 15.58]	
Wang 2018	63.22	8.05	37		7.13	36	2.5%	3.94 [0.45, 7.43]	
Wei 2015	58.97	5.63	48	54.31	6.45	45	2.7%	4.66 [2.19, 7.13]	
XuL 2021		11.79		56.16		20	1.5%	6.02 [-2.37, 14.41]	
Zhang 2014 Zhang 2016		11.32	18		10.13	18	1.7%	0.61 [-6.41, 7.63]	
Zhang 2016 Zhang 2019	66.09 92.74	4.49 8.35	20	61.54 75.44	3.48	25 30	2.7%	4.55 [2.16, 6.94] 9 30 (4 35, 12 35)	
Zhang 2019 Zhao 2018	83.74 82.92	8.35 8.42	30 42	72.81	7.24 8.94	30 42	2.4% 2.4%	8.30 [4.35, 12.25] 10.11 [6.40, 13.82]	
Zhu 2014		0.42 10.78	42 63	45.94		42 60	2.4%	11.06 [7.34, 14.78]	
Subtotal (95% CI)	57	10.70	859	40.04	10.20	856	46.1%	5.27 [3.88, 6.67]	● ●
Heterogeneity: Tau ²	= 6.48 0	hi² = 78		= 18 (P ·	< 0 000			0121 [0100, 0107]	· ·
Test for overall effect					0.0000		. 1 70		
Total (95% CI)	40.05	0.6.12	1793				100.0%	6.13 [4.71, 7.56]	◆
Heterogeneity: Tau ² : Test for overall effect					,r' < 0.0l	0001);1	= 90%		-20 -10 0 10 20
Test for subaroup di					= 0.27)	$ ^{2} = 19$	1%		Favours [experimental] Favours [control]
					0.217.				

experimental group exhibited a significantly lower depression than the control group before 24 weeks of TCE [MD = -1.47, 95% CI (-1.89, -1.05), p < 0.001]. Similarly, for interventions lasting 24 weeks or longer, the experimental group demonstrated a statistically significant alleviation of depression [MD = -0.82, 95% CI (-1.10, -0.54), p < 0.001]. The subgroup analysis based on exercise frequency indicated that both groups in the experimental cohort presented significant differences at frequencies of ≤ 5 times per week [MD = -1.29, 95% CI (-1.72, -0.87), p < 0.001] and > 5 times per week [MD = -2.24, 95% CI (-1.76, -0.71), *p* < 0.001] (Figure 11).

3.4 Publication bias and sensitivity analysis

Given the restricted literature included, this study exclusively focused on bias in the test outcomes for FEV1 and FEV1/FVC (%). A

Study or Subgroup	Mean	erimenta SD		Mean	ontrol: SD	Total	Weight	Mean Difference IV, Random, 95% Cl	Mean Difference IV, Random, 95% Cl
1.4.1 Frequency <5t		ek							
Cao 2016	64.64	7.48	52	61.64	7.49	50	2.6%	3.00 [0.09, 5.91]	
Gu 2012	50.1	14.5	33	48.3	10.9	30	1.9%	1.80 [-4.50, 8.10]	
He 2015	58.97	5.63		54.31	6.45	45	2.7%	4.66 [2.19, 7.13]	——
He 2020		13.25		47.57		45	2.1%	4.07 [-1.35, 9.49]	
Hou 2017	81.53	7.82		73.87	6.81	23	2.3%	7.66 [3.52, 11.80]	
Li 2016	49.8	16.2	20	49.7	14.3	20	1.3%	0.10 [-9.37, 9.57]	
Li 2019	71.44	14.28	26	62.56	15.09	23	1.5%	8.88 [0.62, 17.14]	
Ma 2020	73.46	8.26	30	66.54	7.34	30	2.4%	6.92 [2.97, 10.87]	
Ren 2017	55	2.34	30	45	3.43	30	2.8%	10.00 [8.51, 11.49]	
Xu 2021	68.26	5.32	132	57.17	4.83	130	2.9%	11.09 [9.86, 12.32]	
XuL 2021	62.18	11.79	18	56.16	14.55	20	1.5%	6.02 [-2.37, 14.41]	
Yan 2023	68.26	3.91	30	60.53	4.3	30	2.8%	7.73 [5.65, 9.81]	
Subtotal (95% CI)			489			476	26.6%	6.65 [4.63, 8.67]	•
Heterogeneity: Tau ² :	= 7.99; C	hi² = 55.3	35, df=	= 11 (P	< 0.0000	01); I ² =	80%		
Test for overall effect	: Z = 6.45	(P < 0.0	0001)						
1.4.2 Frequency>5t	imes/we	ek							
Cao 2022		11.66		55.23		31	1.8%	7.04 [0.68, 13.40]	
Chen 2008	56.95	6.81		50.05		19	2.0%	6.90 [1.11, 12.69]	<u> </u>
Chen 2016		10.63			12.32	34	2.0%	2.78 [-2.72, 8.28]	
Chi 2021		12.94		48.99		108	2.5%	0.83 [-2.43, 4.09]	
Deng 2020		14.76		56.59		32	1.6%	4.13 [-3.40, 11.66]	
Du 2013	61.05	4.82		54.39	5.04	38	2.7%	6.66 [4.41, 8.91]	
Gao 2016	66.15	6.09		61.85		57	2.6%	4.30 [1.16, 7.44]	
Gao 2017	55.31	9.41		43.55	8.52	36	2.3%	11.76 [7.61, 15.91]	
HouMY 2017	80.2	9.75		70.15	7.14	49	2.5%	10.05 [6.69, 13.41]	
Hu 2020	49.7	14.5	42	49.5	16	42	1.8%	0.20 [-6.33, 6.73]	
Huang 2016	55.97	13.2	31	49.8	11.5	30	1.9%	6.17 [-0.04, 12.38]	
Ji 2019		12.28		49.04		29	1.8%	3.83 [-2.58, 10.24]	
Jiang 2023	65.47	4.46		57.51	3.87	40	2.8%	7.96 [6.13, 9.79]	
Ju 2022	57.44	5.22		52.22 59.24	5.69 2.92	80	2.8%	5.22 [3.53, 6.91]	
Li 2012 Liu 2013	59.37	3.14 11.12		59.24 65.16		30 40	2.8% 2.2%	0.13 [-1.40, 1.66]	
Liu 2018	60.31	5.07	37		4.72	37	2.2%	4.15 [-0.53, 8.83]	
Liu 2019	53.47	4.01		48.91	4.72	50	2.7%	0.32 [-1.91, 2.55] 4.56 [3.20, 5.92]	
Liu 2020	79.16	13.9		65.72		50	2.0%	4.56 [5.20, 5.92]	
Liu 2020	76.75	7.18	41		7.44	40	2.6%	5.38 [2.19, 8.57]	——
Peng 2020		11.96		70.73		40	2.0%	9.95 [4.32, 15.58]	
Sun 2021	58.52	8.09		55.52	8.33	40	2.5%	3.00 [-0.60, 6.60]	<u> </u>
Wang 2018	63.22	8.05		59.28	7.13	36	2.5%	3.94 [0.45, 7.43]	
Wei 2015	58.97	5.63		54.31	6.45	45	2.7%	4.66 [2.19, 7.13]	
Xiao 2023	72.31	5.18		52.42	6.33	58		19.89 [17.79, 21.99]	–
Yu 2019	77.81	4.86		74.23	3.9	41	2.8%	3.58 [1.67, 5.49]	
Zhang 2014		11.32		48.01		18	1.7%	0.61 [-6.41, 7.63]	
Zhang 2016	66.09	4.49		61.54	3.48	25	2.7%	4.55 [2.16, 6.94]	
Zhang 2019	83.74	8.35		75.44	7.24	30	2.4%	8.30 [4.35, 12.25]	
Zhao 2018	82.92	8.42		72.81	8.94	42	2.4%	10.11 [6.40, 13.82]	
Zhu 2014		10.78	63		10.28	60	2.4%	11.06 [7.34, 14.78]	
Subtotal (95% CI)			1304			1307	73.4%	6.04 [4.28, 7.79]	•
Heterogeneity: Tau ²	= 20.51; (Chi r = 32	2.86, (df = 30 ((P < 0.00	0001);1	l² = 91%		
Test for overall effect									
Total (95% CI)			1793				100.0%	6.13 [4.71, 7.56]	▲ ▲ ▲ ▲
Heterogeneity: Tau ² :					(P < 0.00	0001); I	l² = 90%	-	-20 -10 0 10 2
Test for overall effect		•							Favours [experimental] Favours [control]
Test for subaroup di	fferences	: Chi² = I	0.20. d	f=1 (P	= 0.65).	l² = 0%	6		

visual inspection of the funnel plot indicated symmetry (Figure 12). To further validate these findings, the Egger's test was conducted, yielding $p \ge 0.05$ (p = 0.984), (p = 0.495). Consequently, no significant publication bias or other biases were observed. The results of sensitivity analysis showed that excluding individual studies did not lead to significant changes in the groups or outcomes. Consequently, the findings of the sensitivity analysis support the reliability of the study results (Supplementary Table S2).

4 Discussion

In this study, 67 RCTs involving 5,475 cases were included, with a focus on five exercise methods: Baduanjin, Taichi, Liuzijue, Wuqinxi, and Yijinjing. These results indicate that TCE significantly improves lung function and mental health in COPD patients. Sensitivity analysis found no substantial changes, suggesting that the included studies are relatively stable, the funnel plots and the Egger's

Study or Subgroup	Exp Mean	erimental SD	l Total	C Mean	ontrol SD	Total	Weight	Mean Difference IV, Random, 95% Cl	Mean Difference IV, Random, 95% Cl
1.5.1 Baduanjin	mean	50	Total	mean	50	Total	weight	IV, Random, 95% CI	IV, Random, 95% Ci
Hou 2017	437.29	15.87	25	400.35	16.16	23	3.4%	36.94 [27.87, 46.01]	
			38						
Huang 2021	396.56	31.42			30.23	38	3.0%	42.69 [28.83, 56.55]	
Jiang 2023	418.56	33.29		386.73	35.25	40	2.9%	31.83 [16.80, 46.86]	
Liu 2013	432.38	50.25		383.78	58.59	40	2.2%	48.60 [24.68, 72.52]	
Ma 2020	412.36	41.24	30	352.52	35.63	30	2.6%	59.84 [40.34, 79.34]	
Ma 2022	398.41	27.32	41		25.39	41	3.2%	44.18 [32.76, 55.60]	
Wang 2018	362.95	36.43		347.05	30.51	36	2.9%	15.90 [0.50, 31.30]	
Wang 2022	343.67	54.82	40		48.07	40	2.3%	35.52 [12.93, 58.11]	
Xu 2021	312.78	30.52	132	255.62	28.78	130	3.5%	57.16 [49.98, 64.34]	
Yang 2023	400.1	40.78	40	370.5	32.09	40	2.9%	29.60 [13.52, 45.68]	
Yao 2022	317.95	120.46	42	232.49	123.19	38	0.8%	85.46 [31.97, 138.95]	
Yu 2019	382.37	80.32	45	302.52	75.57	45	1.7%	79.85 [47.63, 112.07]	
Zhang 2019	412.35	41.25	30	352.53	35.62	30	2.6%	59.82 [40.32, 79.32]	
Zhu 2014	398.17	43.86	63	342.18	30.93	60	3.1%	55.99 [42.63, 69.35]	
Subtotal (95% CI)			643			631	37.2%	45.35 [37.39, 53.30]	◆
Heterogeneity: Tau ²	= 147.58; (Chi ² = 48.1	71.df=	= 13 (P <	0.00001); i ž = 73	3%		
Test for overall effect									
1.5.2 Taichi									
Chen 2020	501.57	36.29		468.64	36.14	63	3.1%	32.93 [20.28, 45.58]	
Deng 2016	491	54.3	63	447.8	52.2	63	2.6%	43.20 [24.60, 61.80]	
Du 2013	320.78	10.79	36	290.45	9.64	38	3.6%	30.33 [25.66, 35.00]	
Gu 2012	497	77	33	414	100	30		83.00 [38.61, 127.39]	
He 2020	551.28	101.42	45	467.54	103.53	45	1.2%	83.74 [41.40, 126.08]	
Li 2016	526	88	20	468	90	20	0.8%	58.00 [2.83, 113.17]	
Liu 2019	397.58	30.48	50	365.96	27.17	50	3.2%	31.62 [20.30, 42.94]	
Liu 2021	424.86	33.21	41	346.37	35.73	40	2.9%	78.49 [63.46, 93.52]	
Pan 2018	518.2	21.74	20	494.19	27.37	21	2.9%	24.01 [8.92, 39.10]	
Peng 2020	429.1	56	40	384	92.4	40	1.6%	45.10 [11.62, 78.58]	
Ren 2017	595.2	82.03	30	570.12	62.03	30	1.4%	25.08 [-11.72, 61.88]	
Zhang 2014	292.13	57.35	18	269.14	50.23	18	1.5%	22.99 [-12.23, 58.21]	
Subtotal (95% CI)			459			458	26.2%	42.57 [31.51, 53.64]	•
Test for overall effect 1.5.3 Liuzijue	t: Z = 7.54 (P < 0.000,	JO1)						
Ju 2022	389.65	77.55	80	339.56	65.56	80	2.4%	50.09 [27.84, 72.34]	
Sun 2019	410.21	51.32	56	365.45	52.32	56	2.6%	44.76 [25.57, 63.95]	
Wang 2023	367.28	17.51	20	324.13	18.5	20	3.3%	43.15 [31.99, 54.31]	
XuL 2021	579.44	76.96	18	532.75	54.69	20	1.2%	46.69 [3.81, 89.57]	
Yan 2023	398.4	35.33	30	358.26	31.22	30	2.8%	40.14 [23.27, 57.01]	
ZhangFR 2019	361.15	52.17	62	347.09	70.22	58	2.4%	14.06 [-8.19, 36.31]	+
Zhao 2012	373.84	50.53	23	348.75	59.82	22	1.7%	25.09 [-7.33, 57.51]	<u>+</u>
Subtotal (95% CI)			289			286	16.2%	39.18 [30.75, 47.62]	•
Heterogeneity: Tau ² Test for overall effect				(P = 0.28	3); I² = 20	%			
1.5.4 Wuqinxi		_					_		
Chen 2017	446.72	67.5		408.82	72.11	58	2.1%	37.90 [12.58, 63.22]	
Gao 2017	417.56	19.73		368.67	22.86	36	3.4%	48.89 [39.03, 58.75]	
Liu 2020	357.92	45.79		326.34	34.74	50	2.9%	31.58 [15.65, 47.51]	
Xiao 2023		51.12		425.16	49.74	58		62.37 [44.01, 80.73]	——
	283.36	11.62		238.11	12.39	36		45.25 [39.54, 50.96]	
Zang 2017			235			238	14.6%	45.72 [38.34, 53.10]	◆
Zang 2017 Subtotal (95% CI)	- 27 96° CI			(P = 0.14	4); I² = 43	%			
Zang 2017		, (i × 0.00							
Zang 2017 Subtotal (95% CI) Heterogeneity: Tau ² :		/(- 0.00				57	2.1%	26.90 [0.66, 53.14]	<u>├──</u>
Zang 2017 Subtotal (95% Cl) Heterogeneity: Tau ² Test for overall effect		76.14	55	403.2	64.88				
Zang 2017 Subtotal (95% Cl) Heterogeneity: Tau ² : Test for overall effect 1.5.5 Yijinjing Gao 2016	t: Z = 12.15				6.89 b4	25	3.7%	15.68 [11.37.19.99]	
Zang 2017 Subtotal (95% CI) Heterogeneity: Tau ² Test for overall effect 1.5.5 Yijinjing	t: Z = 12.15 430.1	76.14		403.2 282.55		25 82	3.7% 5.7 %	15.68 [11.37, 19.99] 15.98 [11.72, 20.23]	•
Zang 2017 Subtotal (95% CI) Heterogeneity: Tau ² : Test for overall effect 1.5.5 Yijinjing Gao 2016 Zhang 2016 Subtotal (95% CI)	t: Z = 12.15 430.1 298.23	76.14 7.67	20 75	282.55	6.89				•
Zang 2017 Subtotal (95% Cl) Heterogeneity: Tau ² Test for overall effect 1.5.5 Yijinjing Gao 2016 Zhang 2016	t: Z = 12.15 430.1 298.23 = 0.00; Chi	76.14 7.67 i² = 0.68, c	20 75 df=1 (282.55	6.89				•
Zang 2017 Subtotal (95% Cl) Heterogeneity: Tau ² Test for overall effect 1.5.5 Yijinjing Gao 2016 Zhang 2016 Subtotal (95% Cl) Heterogeneity: Tau ² Test for overall effect	t: Z = 12.15 430.1 298.23 = 0.00; Chi	76.14 7.67 i ² = 0.68, c (P < 0.000	20 75 df = 1 ()01)	282.55	6.89	82	5.7%	15.98 [11.72, 20.23]	•
Zang 2017 Subtotal (95% CI) Heterogeneity: Tau ² . Test for overall effect 1.5.5 Yijinjing Gao 2016 Zhang 2016 Subtotal (95% CI) Heterogeneity: Tau ² . Test for overall effect Total (95% CI)	t: Z = 12.15 430.1 298.23 = 0.00; Chi t: Z = 7.36 (76.14 7.67 i ² = 0.68, c (P < 0.000	20 75 df = 1 ()01) 1701	282.55 (P = 0.41)	6.89 ; I² = 0%	82 1695	5.7%		•
Zang 2017 Subtotal (95% Cl) Heterogeneity: Tau ² Test for overall effect 1.5.5 Yijinjing Gao 2016 Zhang 2016 Subtotal (95% Cl) Heterogeneity: Tau ² Test for overall effect	t: Z = 12.15 430.1 298.23 = 0.00; Chi t: Z = 7.36 (= 217.73; (76.14 7.67 i ² = 0.68, c (P < 0.000 Chi ² = 245	20 75 df = 1 (001) 1701 5.52, df	282.55 (P = 0.41)	6.89 ; I² = 0%	82 1695	5.7%	15.98 [11.72, 20.23]	-100 -50 0 50 100

Study or Subgroup		erimental	Total	Mean	ontrol SD	Total	Weight	IV, Random, 95% CI	Mean Difference IV, Random, 95% Cl
1.5.1 6MWT <24w		30	Total	Mean	30	Total	weigin	W, Kandolli, 55% Cl	IV, Kandolli, 95% Cl
Chen 2020	501.57	36.29	63	468.64	36.14	63	3.1%	32.93 [20.28, 45.58]	
Du 2013	320.78	10.79	36	290.45	9.64	38	3.6%	30.33 [25.66, 35.00]	+
Gao 2017	417.56	19.73		368.67	22.86	36	3.4%	48.89 [39.03, 58.75]	
Gu 2012	417.30	77	33	414	100	30	1.1%	83.00 [38.61, 127.39]	
He 2020	551.28			467.54		45	1.2%	83.74 [41.40, 126.08]	
Hou 2017	437.29	15.87	25	400.35	16.16	23	3.4%	36.94 [27.87, 46.01]	-
Huang 2021	396.56	31.42	38	353.87	30.23	38	3.0%	42.69 [28.83, 56.55]	
Jiang 2023	418.56	33.29	40	386.73	35.25	40	2.9%	31.83 [16.80, 46.86]	
Li 2016	526	88	20	468	90	20	0.8%	58.00 [2.83, 113.17]	
Liu 2013	432.38	50.25		383.78	58.59	40	2.2%	48.60 [24.68, 72.52]	
Liu 2020	357.92	45.79		326.34	34.74	50	2.9%	31.58 [15.65, 47.51]	
Ma 2020	412.36	41.24		352.52	35.63	30	2.6%	59.84 [40.34, 79.34]	
Ma 2022	398.41	27.32		354.23	25.39	41	3.2%	44.18 [32.76, 55.60]	
Pan 2018	518.2	21.74		494.19	27.37	21	2.9%	24.01 [8.92, 39.10]	
Ren 2017	595.2	82.03		570.12	62.03	30	1.4%	25.08 [-11.72, 61.88]	+
Wang 2022	343.67	54.82		308.15	48.07	40	2.3%	35.52 [12.93, 58.11]	——
Wang 2023	367.28	17.51		324.13	18.5	20	3.3%	43.15 [31.99, 54.31]	
Xiao 2023	487.53	51.12	58	425.16	49.74	58	2.7%	62.37 [44.01, 80.73]	
Xu 2021	312.78	30.52	132	255.62	28.78	130	3.5%	57.16 [49.98, 64.34]	+
Yan 2023	398.4	35.33	30	358.26	31.22	30	2.8%	40.14 [23.27, 57.01]	
Yang 2023	400.1	40.78	40	370.5	32.09	40	2.9%	29.60 [13.52, 45.68]	
Yao 2022	317.95			232.49		38		85.46 [31.97, 138.95]	
Yu 2019	382.37	80.32		302.52	75.57	45	1.7%	79.85 [47.63, 112.07]	
ZhangFR 2019 Subtotal (95% CI)	361.15	52.17	62 1016	347.09	70.22	58 1004	2.4% 60.2%	14.06 [-8.19, 36.31] 42.43 [36.52, 48.35]	_ _
1.5.2 6MWT ≥24w									
Chen 2017	446.72	67.5	59	408.82	72.11	58	2.1%	37.90 [12.58, 63.22]	
Deng 2016	491	54.3	63	447.8	52.2	63	2.6%	43.20 [24.60, 61.80]	
Gao 2016	430.1	76.14	55	403.2	64.88	57	2.1%	26.90 [0.66, 53.14]	
Ju 2022	389.65	77.55	80	339.56	65.56	80	2.4%	50.09 [27.84, 72.34]	
Liu 2019	397.58	30.48		365.96	27.17	50	3.2%	31.62 [20.30, 42.94]	
Liu 2021	424.86	33.21		346.37	35.73	40	2.9%	78.49 [63.46, 93.52]	
Peng 2020	429.1	56	40	384	92.4	40	1.6%	45.10 [11.62, 78.58]	
Sun 2019	410.21	51.32		365.45	52.32	56	2.6%	44.76 [25.57, 63.95]	
Wang 2018	362.95 579.44	36.43 76.96		347.05 532.75	30.51 54.69	36 20	2.9% 1.2%	15.90 [0.50, 31.30]	
XuL 2021 Zang 2017	283.36	11.62		238.11	54.69 12.39	20	3.6%	46.69 [3.81, 89.57] 45.25 [39.54, 50.96]	+
Zang 2017 Zhang 2014	283.36	57.35		269.14	50.23	30 18	3.6%	45.25 [39.54, 50.96] 22.99 [-12.23, 58.21]	
Zhang 2014 Zhang 2016	292.13	7.67		282.55	6.89	25	3.7%	15.68 [11.37, 19.99]	+
Zhang 2019	412.35	41.25		352.53	35.62	30	2.6%	59.82 [40.32, 79.32]	
Zhao 2012	373.84	50.53		348.75	59.82	22	1.7%	25.09 [-7.33, 57.51]	
Zhu 2014	398.17	43.86		342.18	30.93	60	3.1%	55.99 [42.63, 69.35]	
Subtotal (95% CI)			685			691	39.8%	40.62 [29.75, 51.49]	◆
Heterogeneity: Tau ² Test for overall effe			.31, df	= 15 (P <	< 0.0000 ⁻				
Total (95% CI)			1701			1695	100.0%	42.12 [36.52, 47.71]	•
Heterogeneity: Tau ^a				= 39 (P <	< 0.0000°	1); I² = 8	34%	-	-100 -50 0 50 100
Test for overall effective Test for subgroup d				1 (P = 0.)	77), j² = 0)%			Favours [experimental] Favours [control]

test indicated no publication bias in this study. However, owing to the unique characteristics of different exercise methods, heterogeneity is relatively high, which may lead to greater clinical variability. Therefore, we categorized the different exercise methods for analysis. Subgroup analysis did not significantly reduce heterogeneity, possibly because of age differences, blinding methods, and varying degrees of outcome improvement. A deeper exploration of potential sources of heterogeneity is warranted. Specifically, cultural perceptions of TCE may influence participant motivation and adherence. In regions where TCE is embedded in daily life and traditional health practices, such as in China, patients may perceive these exercises as familiar, credible, and low-barrier interventions. In contrast, in Western contexts, a lack of cultural familiarity or skepticism toward traditional practices may lead to lower adherence or different expectations. Moreover, regional disparities in healthcare infrastructure, instructor qualifications, and educational forms may further contribute to variations in intervention veracity and patient outcomes. These contextual factors, though often unreported, likely represent significant sources of heterogeneity across studies. Thus, higher-quality evidence may be needed to confirm our findings (76). The subgroup analysis clearly suggested that traditional Chinese exercises can improve various lung function parameters in COPD patients to different extents, thus alleviating disease symptoms and enhancing their quality of life.

COPD is a multifaceted systemic disease that has become a major global public health issue. It not only causes damage to lung function

Study or Subgroup	Mean	erimental SD	Total		ontrol SD	Total	Weight	Mean Difference IV, Random, 95% Cl	Mean Difference IV, Random, 95% Cl
1.5.1 Frequency <5t									
Chen 2017	446.72	67.5	59	408.82	72.11	58	2.1%	37.90 [12.58, 63.22]	<u> </u>
Chen 2020	501.57	36.29		468.64	36.14	63	3.1%	32.93 [20.28, 45.58]	
Gu 2012	497	77	33	414	100	30	1.1%		
He 2020		101.42		467.54	103.53	45	1.2%	83.74 [41.40, 126.08]	
Li 2016	526	88	20	468	90	20	0.8%	58.00 [2.83, 113.17]	
Ma 2020	412.36	41.24		352.52	35.63	30	2.6%	59.84 [40.34, 79.34]	
Pan 2018	518.2	21.74		494.19	27.37	21	2.9%	24.01 [8.92, 39.10]	—.—
Ren 2017	595.2	82.03		570.12	62.03	30	1.4%	25.08 [-11.72, 61.88]	
Wang 2023	367.28	17.51		324.13	18.5	20	3.3%	43.15 [31.99, 54.31]	
Xu 2021	312.78	30.52		255.62	28.78	130	3.5%	57.16 [49.98, 64.34]	
XuL 2021	579.44	76.96		532.75	54.69	20	1.2%	46.69 [3.81, 89.57]	
Yan 2023	398.4	35.33	30	358.26	31.22	30	2.8%	40.14 [23.27, 57.01]	
Yang 2023	400.1	40.78	40	370.5	32.09	40	2.9%	29.60 [13.52, 45.68]	
Yao 2022	317.95			232.49		38	0.8%	85.46 [31.97, 138.95]	
Subtotal (95% CI)			582			575	29.8%	44.76 [35.65, 53.87]	•
Heterogeneity: Tau ² :	= 152.10: 0	; 2hi² = 37.	80. df=	= 13 (P =	0.0003):	l ² = 669		• / •	
Test for overall effect					//				
1.5.2 Frequency>5t	imes/weel	k							
Deng 2016	491	54.3	63	447.8	52.2	63	2.6%	43.20 [24.60, 61.80]	
Du 2013	320.78	10.79	36	290.45	9.64	38	3.6%	30.33 [25.66, 35.00]	+
Gao 2016	430.1	76.14	55	403.2	64.88	57	2.1%	26.90 [0.66, 53.14]	
Gao 2017	417.56	19.73	36	368.67	22.86	36	3.4%	48.89 [39.03, 58.75]	
Hou 2017	437.29	15.87	25	400.35	16.16	23	3.4%	36.94 [27.87, 46.01]	
Huang 2021	396.56	31.42	38	353.87	30.23	38	3.0%	42.69 [28.83, 56.55]	
Jiang 2023	418.56	33.29	40	386.73	35.25	40	2.9%	31.83 [16.80, 46.86]	
Ju 2022	389.65	77.55	80	339.56	65.56	80	2.4%	50.09 [27.84, 72.34]	
Liu 2013	432.38	50.25	40	383.78	58.59	40	2.2%	48.60 [24.68, 72.52]	
Liu 2019	397.58	30.48	50	365.96	27.17	50	3.2%	31.62 [20.30, 42.94]	
Liu 2020	357.92	45.79	50	326.34	34.74	50	2.9%	31.58 [15.65, 47.51]	——
Liu 2021	424.86	33.21	41	346.37	35.73	40	2.9%	78.49 [63.46, 93.52]	
Ma 2022	398.41	27.32	41	354.23	25.39	41	3.2%	44.18 [32.76, 55.60]	
Peng 2020	429.1	56	40	384	92.4	40	1.6%	45.10 [11.62, 78.58]	
Sun 2019	410.21	51.32	56	365.45	52.32	56	2.6%	44.76 [25.57, 63.95]	
Wang 2018	362.95	36.43		347.05	30.51	36	2.9%	15.90 [0.50, 31.30]	<u> </u>
Wang 2022	343.67	54.82	40	308.15	48.07	40	2.3%	35.52 [12.93, 58.11]	
Xiao 2023	487.53	51.12	58	425.16	49.74	58	2.7%	62.37 [44.01, 80.73]	
Yu 2019	382.37	80.32	45	302.52	75.57	45	1.7%		
Zang 2017	283.36	11.62		238.11	12.39	36	3.6%	45.25 [39.54, 50.96]	+
Zhang 2014	292.13	57.35		269.14	50.23	18	1.5%	22.99 [-12.23, 58.21]	
Zhang 2016	298.23	7.67		282.55	6.89	25	3.7%	15.68 [11.37, 19.99]	-
Zhang 2019	412.35	41.25		352.53	35.62	30	2.6%	59.82 [40.32, 79.32]	——
ZhangFR 2019	361.15	52.17		347.09	70.22	58	2.4%	14.06 [-8.19, 36.31]	<u>+</u>
Zhao 2012	373.84	50.53	23	348.75	59.82	22	1.7%	25.09 [-7.33, 57.51]	+
Zhu 2014	398.17	43.86		342.18	30.93	60	3.1%	55.99 [42.63, 69.35]	
Subtotal (95% CI)			1119			1120	70.2%	40.76 [34.09, 47.42]	◆
Heterogeneity: Tau ² :	= 216.93: 0	; hi ^z = 183		= 25 (P ·	< 0.0000 ⁻				
Test for overall effect				0					
Total (95% Cl)			1701			1695	100.0%	42.12 [36.52, 47.71]	◆
Heterogeneity: Tau ² :	= 217.73; C	¦hi² = 245	i.52, dt	'= 39 (P ·	< 0.0000°	1); I² = 8	34%	-	-100 -50 0 50 100
Test for overall effect	: Z = 14.75	(P < 0.00	001)						Favours [experimental] Favours [control]
Test for subaroup dif	fferences: (Chi² = 0.4	8. df=	1 (P = 0.	49). I² = 0)%			ravours (experimental) ravours (control)

but also leads to peripheral muscle dysfunction, negatively impacting physical and mental health (77). Previous research has confirmed the significant health benefits of traditional Chinese exercise, indicating that regular practice can enhance aerobic capacity, strengthen respiratory muscles, improve physical fitness, regulate breathing functions, enhance gas exchange efficiency, slow the decline in lung function, and promote health-related quality of life and mental wellbeing. Since COPD requires long-term exercise rehabilitation interventions, the study of the effects of TCE on health outcomes has continued to expand and become a key focus for many COPD patients. TCEs are an essential part of nonpharmacological therapies and involves a series of relaxed and controlled postures that integrate breathing control with functional movements. These exercises stimulate the body's functional reserves following illness and promote recovery after acute conditions. They are not limited by space and do not require any special equipment or settings. With repeated practice over time, traditional Chinese exercises support maximum functional recovery, enhance neuroplasticity and proprioception, and help remodel cardiopulmonary dynamics and muscle tone. As a form of aerobic exercise, the mechanisms by which traditional Chinese exercises improve lung function in COPD

~	Experiment		Control			Mean Difference	Mean Difference
Study or Subgroup	Mean SD	Total Mean	SD	Total	Weight	IV, Random, 95% Cl	IV, Random, 95% Cl
1.6.1 Baduanjin Dong 2020	9.44 2.12	40 13.84	2.38	40	6.2%	-4.40 [-5.39, -3.41]	-
Huang 2021	15.28 3.16	38 21.36		38	5.0%	-6.08 [-7.53, -4.63]	_ _
Jiang 2023	11.24 3.51	40 13.57		40	4.3%	-2.33 [-4.08, -0.58]	
LiuY 2021	14.13 1.7	37 20.46	2.05	37	6.6%	-6.33 [-7.19, -5.47]	
XuL 2021	6.39 2.3	18 10.4		20	3.8%	-4.01 [-6.00, -2.02]	
Yang 2023	10.23 1.67	40 14.43		40	6.3%	-4.20 [-5.14, -3.26]	
Yao 2022 Subtatal (05% CI)	6.33 1.05	42 11.64	2.33	38	6.7%	-5.31 [-6.12, -4.50]	
Subtotal (95% CI) Heterogeneity: Tau ² :	- 1.05: Chiz - 26	255	- 0.000	253	38.9%	-4.79 [-5.68, -3.90]	•
Test for overall effect			- 0.000.	2), 1 – 7	/ 70		
1.6.2 Taichi							
Chen 2020	14.54 1.14	63 18.54	1.54	63	7.4%	-4.00 [-4.47, -3.53]	-
Du 2013	28.08 6.55	36 31.75	4.23	38	2.9%	-3.67 [-6.20, -1.14]	
Liu 2019	20.34 1.97	50 23.86		50	6.6%	-3.52 [-4.37, -2.67]	
Pan 2018	10.65 9.59	20 19.14		21		-8.49 [-15.03, -1.95]	
Peng 2020 Peng 2017	15.03 3.88	40 17.18		40	4.5%	-2.15 [-3.80, -0.50]	
Ren 2017 Zhang 2014	10.91 3.23 10.14 3.13	30 15.92 18 14.21	2.03 1.94	30 18	5.2% 4.4%	-5.01 [-6.38, -3.64] -4.07 [-5.77, -2.37]	
Subtotal (95% CI)	10.14 3.13	257	1.04	260	4.4 % 31.6%	-3.86 [-4.48, -3.23]	◆
Heterogeneity: Tau ² : Test for overall effect		78, df = 6 (P =	0.13); I ^z			, ,	
1.6.3 Liuzijue							
Chen 2016	17.08 5.19	33 20.98		34	3.1%	-3.90 [-6.28, -1.52]	——
Ju 2022	12.11 1.83	80 15.77	1.68	80	7.3%	-3.66 [-4.20, -3.12]	-
Liu 2018 Wang 2022	20.16 1.56	37 22.54		37	6.6% 2.4%	-2.38 [-3.24, -1.52]	
Wang 2023 Subtotal (95% CI)	18.67 1.84	20 25 170	4.59	20 171	3.4% 20.4%	-6.33 [-8.50, -4.16] - 3.76 [-5.01, -2.51]	•
Heterogeneity: Tau ² : Test for overall effect		.42, df = 3 (P =	= 0.004)				
1.6.4 Wuqinxi	15.01 15	10 00 00					
He 2015 Sun 2021	15.61 4.2	48 20.02		45	3.9%	-4.41 [-6.35, -2.47]	
	16.11 7.63 25.43 5.72	40 17.56		40 36	1.8%	-1.45 [-5.02, 2.12] -4 37 [-6 52 -2 22]	
Zang 2017 Subtotal (95% CI)	16.11 7.63 25.43 5.72	40 17.56 32 29.8 120		40 36 121	1.8% 3.5% 9.1 %	-1.45 [-5.02, 2.12] -4.37 [-6.52, -2.22] - 3.94 [-5.38, -2.50]	• T
Zang 2017	25.43 5.72 = 0.19; Chi ² = 2.2	32 29.8 120 25, df = 2 (P =	2.58	36 121	3.5%	-4.37 [-6.52, -2.22]	•
Zang 2017 Subtotal (95% CI) Heterogeneity: Tau²:	25.43 5.72 = 0.19; Chi ² = 2.2	32 29.8 120 25, df = 2 (P =	2.58	36 121 = 11%	3.5%	-4.37 [-6.52, -2.22]	•
Zang 2017 Subtotal (95% CI) Heterogeneity: Tau² - Test for overall effect	25.43 5.72 = 0.19; Chi ² = 2.2 : Z = 5.36 (P < 0. = 0.95; Chi ² = 81 : Z = 15.38 (P < 0	32 29.8 120 25, df = 2 (P = 00001) 802 .09, df = 20 (F 0.00001)	2.58 0.33); l² P < 0.00(36 121 = 11% 805 D01); I ² =	3.5% 9.1% 100.0% : 75%	-4.37 [-6.52, -2.22] -3.94 [-5.38, -2.50]	
Zang 2017 Subtotal (95% Cl) Heterogeneity: Tau ² : Test for overall effect Total (95% Cl) Heterogeneity: Tau ² : Test for overall effect Test for subgroup dit	25.43 5.72 = 0.19; Chi ² = 2.2 : Z = 5.36 (P < 0. = 0.95; Chi ² = 81 : Z = 15.38 (P < (ferences: Chi ² = Experiment Mean SD	32 29.8 120 25, df = 2 (P = 00001) 802 .09, df = 20 (F 0.00001) 3.23. df = 3 (f	2.58 0.33); i ² ⁹ < 0.00(P = 0.36 :ontrol	36 121 := 11% 805 001); ² =), ² = 7,1	3.5% 9.1% 100.0% = 75% 0%	-4.37 [-6.52, -2.22] -3.94 [-5.38, -2.50]	
Zang 2017 Subtotal (95% Cl) Heterogeneity: Tau ² : Test for overall effect Total (95% Cl) Heterogeneity: Tau ² : Test for overall effect Test for subdroup dif	25.43 5.72 = 0.19; Chi ² = 2.2 : Z = 5.36 (P < 0. = 0.95; Chi ² = 81 : Z = 15.38 (P < (ferences: Chi ² = Experiment Mean SD	32 29.8 120 25, df = 2 (P = 00001) 802 .09, df = 20 (F 0.00001) 3.23. df = 3 (I al C	2.58 0.33); i ² ⁹ < 0.00(P = 0.36 :ontrol	36 121 := 11% 805 001); ² =), ² = 7,1	3.5% 9.1% 100.0% = 75% 0%	-4.37 [-6.52, -2.22] -3.94 [-5.38, -2.50] -4.20 [-4.74, -3.66] Mean Difference	Favours [experimental] Favours [control Mean Difference
Zang 2017 Subtotal (95% CI) Heterogeneity: Tau ² : Test for overall effect Total (95% CI) Heterogeneity: Tau ² : Test for overall effect Test for subdroup dif Study or Subgroup 1.6.1 CAT < 24weeks Chen 2016 Chen 2020	25.43 5.72 = 0.19; Chi ² = 2.1 : $Z = 5.36$ (P < 0. = 0.95; Chi ² = 81 : $Z = 15.38$ (P < 0. = 1.5, 2.5, 2.5, 2.5, 2.5, 2.5, 2.5, 2.5, 2	32 29.8 120 25, df = 2 (P = 00001) 802 .09, df = 20 (F .00, df = 20 (F .00001) 3.23. df = 3 (I al C Total Mean 33 20.98 63 18.54	2.58 0.33); ² < 0.000 P = 0.36 Control SD 4.73 1.54	36 121 = 11% 805 001); ² =), ² = 7,1 <u>Total</u> <u>34</u> 63	3.5% 9.1% 100.0% = 75% D% <u>Weight</u> 3.1% 7.4%	-4.37 [-6.52, -2.22] -3.94 [-5.38, -2.50] -4.20 [-4.74, -3.66] Mean Difference <u>IV. Random, 95% C1</u> -3.90 [-6.28, -1.52] -4.00 [-4.47, -3.53]	Favours [experimental] Favours [control Mean Difference
Zang 2017 Subtotal (95% Cl) Heterogeneity: Tau ² Test for overall effect Total (95% Cl) Heterogeneity: Tau ² : Test for overall effect Test for subgroup diffect Study or Subgroup 1.6.1 CAT 24 weeks<br Chen 2016 Chen 2020 Du 2013	25.43 5.72 = 0.19; Chi ² = 2.2 : Z = 5.36 (P < 0. : Z = 15.38 (P < 10. : Z = 15.38 (P < 10.	32 29.8 120 2 25. df = 2 (P = 00001) 802 .09, df = 20 (F .00001) 3.23. df = 3 (I al C Total Mean 33 20.98 63 18.54 36 31.75	2.58 0.33); ² < 0.000 P = 0.36 Control SD 4.73 1.54 4.23	36 121 = 11% 805 001); ² = 7,1), ² = 7,1 <u>Total</u> 34 63 38	3.5% 9.1% 100.0% = 75% 0% <u>Weight</u> 3.1% 7.4% 2.9%	-4.37 [-6.52, -2.22] -3.94 [-5.38, -2.50] -4.20 [-4.74, -3.66] Mean Difference IV. Random, 95% CI -3.90 [-6.28, -1.52] -4.00 [-4.47, -3.53] -3.67 [-6.20, -1.14]	Favours [experimental] Favours [control Mean Difference
Zang 2017 Subtotal (95% Cl) Heterogeneity: Tau ² : Test for overall effect Total (95% Cl) Heterogeneity: Tau ² : Test for overall effect Test for subgroup 1.6.1 CAT <24weeks Chen 2016 Chen 2020 Du 2013 Huang 2021	25.43 5.72 = 0.19; Chi ² = 2.3 : Z = 5.36 (P < 0. = 0.95; Chi ² = 81 : Z = 15.38 (P < (ferences: Chi ² = <u>Mean SD ²</u> 17.08 5.19 14.54 1.14 28.08 6.55 15.28 3.16	32 29.8 120 25, df = 2 (P = 00001) 802 .09, df = 20 (F 0.00001) 3.23. df = 3 (I 0.00001) 3.23. df = 3 (I 0.00001) al C Total Mean 33 20.98 63 18.54 36 31.75 38 21.36	2.58 0.33); ² ² < 0.000 P = 0.36 <u>SD</u> 4.73 1.54 4.23 3.29	36 121 = 11% 805 001); ² =), ² = 7,1 <u>Total</u> 34 63 38 38 38	3.5% 9.1% 9.1% 75% 0% <u>Weight</u> 3.1% 7.4% 2.9% 5.0%	-4.37 [-6.52, -2.22] -3.94 [-5.38, -2.50] -4.20 [-4.74, -3.66] Mean Difference IV, Random, 95% CI -3.90 [-6.28, -1.52] -4.00 [-4.47, -3.53] -3.67 [-6.20, -1.14] -6.08 [-7.53, -4.63]	Favours [experimental] Favours [control Mean Difference
Zang 2017 Subtotal (95% CI) Heterogeneity: Tau ² : Test for overall effect Total (95% CI) Heterogeneity: Tau ² : Test for overall effect Test for subgroup 1.6.1 CAT <24weeks Chen 2016 Chen 2020 Du 2013 Huang 2021 Jiang 2023	25.43 5.72 = 0.19; Chi ² = 2.3 : Z = 5.36 (P < 0. = 0.95; Chi ² = 81 : Z = 15.38 (P < 0. = 15.38 (P < 0. Mean SD = 100 = 17.08 5.19 14.54 1.14 28.08 6.55 15.28 3.16 11.24 3.51	32 29.8 120 25, df = 2 (P = 00001) 802 .09, df = 20 (F .00001) 3.23. df = 3 (I al C Total Mean 33 20.98 63 18.54 36 31.75 38 21.36 40 13.57	2.58 0.33); ² ² < 0.000 ² < 0.000 ² = 0.36 ³ Control SD 4.73 1.54 4.23 3.29 4.42	36 121 = 11% 805 001); ² =), ² = 7,1 <u>Total</u> 34 63 38 38 40	3.5% 9.1% 100.0% = 75% 0% Weight 3.1% 7.4% 5.0% 4.3%	-4.37 [-6.52, -2.22] -3.94 [-5.38, -2.50] -4.20 [-4.74, -3.66] Mean Difference IV, Random, 95% Cl -3.90 [-6.28, -1.52] -4.00 [-4.47, -3.53] -3.67 [-6.20, -1.14] -6.08 [-7.53, -4.63] -2.33 [-4.08, -0.58]	Favours [experimental] Favours [control Mean Difference
Zang 2017 Subtotal (95% Cl) Heterogeneity: Tau ² : Test for overall effect Total (95% Cl) Heterogeneity: Tau ² : Test for overall effect Test for subgroup 1.6.1 CAT <24weeks Chen 2016 Chen 2020 Du 2013 Huang 2021 Jiang 2023 Liu 2018	25.43 5.72 = 0.19; Chi ² = 2.2 : Z = 5.36 (P < 0. = 0.95; Chi ² = 81 : Z = 15.38 (P < 1 ferences: Chi ² = Experimenta Mean SD 17.08 5.19 17.08 5.19 17.454 1.14 28.08 6.55 15.28 3.16 11.24 3.51 20.16 1.56	32 29.8 120 20 55, df = 2 (P = 00001) 802 .09, df = 20 (F .00001) 3.23. df = 3 (I al C Total Mean 33 20.98 63 18.54 36 31.75 38 21.36 40 13.57 37 22.54	2.58 0.33); ² ² < 0.000 P = 0.36 control SD 4.73 1.54 4.23 3.29 4.42 2.17	36 121 = 11% 805 001); ² = 7,1 <u>Total 1</u> 34 63 38 40 37	3.5% 9.1% 9.1% 100.0% = 75% 0% <u>Weight</u> 3.1% 7.4% 5.0% 4.3% 6.6%	-4.37 [6.52, -2.22] -3.94 [-5.38, -2.50] -4.20 [-4.74, -3.66] Mean Difference IV. Random, 95% CI -3.90 [-6.28, -1.52] -4.00 [-4.47, -3.53] -3.67 [-6.20, -1.14] -6.08 [-7.53, -4.63] -2.33 [-4.08, -0.58] -2.38 [-3.24, -1.52]	Favours [experimental] Favours [control Mean Difference
Zang 2017 Subtotal (95% CI) Heterogeneity: Tau ²⁺ : Test for overall effect Total (95% CI) Heterogeneity: Tau ²⁺ : Test for overall effect Test for subgroup 1.6.1 CAT < 24weeks Chen 2016 Chen 2016 Chen 2020 Du 2013 Huang 2021 Jiang 2023 Liu 2018 Pan 2018	25.43 5.72 = 0.19; Chi ² = 2.3 : Z = 5.36 (P < 0. = 0.95; Chi ² = 81 : Z = 15.38 (P < (ferences: Chi ² = Experimenta Mean SD $^{-1}$ 17.08 5.19 14.54 1.14 28.08 6.55 15.28 3.16 11.24 3.51 20.16 1.56	32 29.8 120 25. df = 2 (P = 00001) 300001) 802 .09, df = 20 (F 0.00001) 3.23. df = 3 (I al C Total Mean 33 20.98 63 18.54 36 31.75 38 21.36 40 13.57 37 22.54 20 19.14	2.58 0.33); ² < 0.000 P = 0.36 control <u>SD</u> 4.73 1.54 4.23 3.29 4.42 2.17 11.71	36 121 *= 11% 805 001); * =). * = 7.1 <u>Total 1</u> 34 63 38 38 38 40 37 21	3.5% 9.1% 9.1% 100.0% 75% 0% Weight 3.1% 7.4% 2.9% 5.0% 4.3% 6.6% 0.6%	-4.37 [6.52, -2.22] -3.94 [-5.38, -2.50] -4.20 [-4.74, -3.66] Mean Difference IV, Random, 95% CI -3.90 [6.28, -1.52] -4.00 [-4.47, -3.53] -3.67 [-6.20, -1.14] -6.08 [-7.53, -4.63] -2.38 [-7.53, -4.63] -2.38 [-2.34, -1.52] -8.49 [-15.03, -1.95]	Favours [experimental] Favours [control Mean Difference
Zang 2017 Subtotal (95% Cl) Heterogeneity: Tau ² : Test for overall effect Total (95% Cl) Heterogeneity: Tau ² : Test for overall effect Test for subgroup 1.6.1 CAT <24weeks Chen 2016 Chen 2020 Du 2013 Huang 2021 Jiang 2023 Liu 2018	25.43 5.72 = 0.19; Chi ² = 2.2 : Z = 5.36 (P < 0. = 0.95; Chi ² = 81 : Z = 15.38 (P < 1 ferences: Chi ² = Experimenta Mean SD 17.08 5.19 17.08 5.19 17.454 1.14 28.08 6.55 15.28 3.16 11.24 3.51 20.16 1.56	32 29.8 120 20 55, df = 2 (P = 00001) 802 .09, df = 20 (F .00001) 3.23. df = 3 (I al C Total Mean 33 20.98 63 18.54 36 31.75 38 21.36 40 13.57 37 22.54	2.58 0.33); ² ² < 0.000 P = 0.36 control SD 4.73 1.54 4.23 3.29 4.42 2.17	36 121 = 11% 805 001); ² = 7,1 <u>Total 1</u> 34 63 38 40 37	3.5% 9.1% 9.1% 100.0% = 75% 0% <u>Weight</u> 3.1% 7.4% 5.0% 4.3% 6.6%	-4.37 [-6.52, -2.22] -3.94 [-5.38, -2.50] -4.20 [-4.74, -3.66] Mean Difference IV, Random, 95% CI -3.90 [-6.28, -1.52] -4.00 [-4.47, -3.53] -3.67 [-6.20, -1.14] -6.08 [-7.53, -4.63] -2.33 [-4.08, -0.58] -2.33 [-4.08, -0.58] -2.38 [-3.24, -1.52] -8.49 [-15.03, -1.95] -8.49 [-15.03, -1.95]	Favours [experimental] Favours [control Mean Difference
Zang 2017 Subtotal (95% CI) Heterogeneity: Tau ² : Test for overall effect Total (95% CI) Heterogeneity: Tau ² : Test for overall effect Test for subaroup diffect Test for subaroup diffect Study or Subgroup 1.6.1 CAT <24weeks Chen 2016 Chen 2020 Du 2013 Huang 2021 Jiang 2023 Liu 2018 Pan 2018 Ren 2017	25.43 5.72 = 0.19; Chi ² = 2.3 : Z = 5.36 (P < 0. = 0.95; Chi ² = 81 : Z = 15.38 (P < (ferences: Chi ² = Experiment: Mean SD ⁵ 17.08 5.19 14.54 1.14 28.08 6.55 15.28 3.16 11.24 3.51 20.16 1.56 10.65 9.59 10.91 3.23	32 29.8 120 25, df = 2 (P = 00001) 802 .09, df = 20 (F = 0.00001) 3.23. df = 3 (I .04 al C Total Mean 33 20.98 63 18.54 36 31.75 38 21.36 40 13.57 37 22.54 20 19.14 30 15.92	2.58 0.33); ² < 0.000 P = 0.36 control <u>SD</u> 4.73 1.54 4.23 3.29 4.42 2.17 11.71 2.03	36 121 = 11% 805 001); ² = 7,1 Total 34 63 38 38 40 37 21 30	3.5% 9.1% 9.1% 100.0% = 75% 0% Weight 3.1% 7.4% 2.9% 5.0% 4.3% 6.6% 0.6% 5.2%	-4.37 [6.52, -2.22] -3.94 [-5.38, -2.50] -4.20 [-4.74, -3.66] Mean Difference IV, Random, 95% CI -3.90 [6.28, -1.52] -4.00 [-4.47, -3.53] -3.67 [-6.20, -1.14] -6.08 [-7.53, -4.63] -2.38 [-7.53, -4.63] -2.38 [-2.34, -1.52] -8.49 [-15.03, -1.95]	Favours [experimental] Favours [control Mean Difference
Zang 2017 Subtotal (95% CI) Heterogeneity: Tau ² : Test for overall effect Total (95% CI) Heterogeneity: Tau ² : Test for overall effect Test for subaroup dif Study or Subgroup 1.6.1 CAT <24weeks Chen 2016 Chen 2020 Du 2013 Huang 2021 Jiang 2023 Liu 2018 Ren 2017 Sun 2021 Wang 2023 Yang 2023	25.43 5.72 = 0.19; Chi ² = 2.3 : Z = 5.36 (P < 0. = 0.95; Chi ² = 81 : Z = 15.38 (P < (ferences: Chi ² = Experimenta: Mean SD 14.54 1.14 20.08 5.19 14.54 1.14 20.08 1.52 3.16 11.24 3.51 20.16 1.56 10.65 9.59 10.91 3.23 16.17 7.84 10.23 1.67	32 29.8 120 25, df = 2 (P = 00001) 802 .09, df = 20 (F 0.00001) 3.23. df = 3 (I 0.00001) 3.23. df = 3 (I 0.00001) al C Total Mean 33 20.98 63 18.54 38 21.36 40 13.57 37 22.54 20 19.14 30 15.92 40 17.56 20 2 40 14.43	2.58 0.33); P 0 < 0.001 P = 0.36 control \$D 4.73 1.54 4.23 3.29 4.42 2.17 11.71 2.03 8.62 2.17 2.54	36 121 '= 11% 805 2001); ² = 7.1 Total 1 7 10 34 63 38 38 38 38 40 37 21 30 40 20 40	3.5% 9.1% 9.1% 100.0% 5.75% 0% Weight 3.1% 7.4% 2.9% 5.0% 4.3% 6.6% 5.2% 1.8% 3.4% 6.3%	-4.37 [6.52, -2.22] -3.94 [-5.38, -2.50] -4.20 [-4.74, -3.66] -4.20 [-4.74, -3.66] -3.90 [-6.28, -1.52] -4.00 [-4.47, -3.53] -3.67 [-6.20, -1.14] -6.08 [-7.53, -4.63] -2.33 [-4.09, -0.58] -2.33 [-5.02, -1.12] -6.33 [-5.02, -4.16] -4.20 [-5.14, -3.26]	Favours [experimental] Favours [control Mean Difference
Zang 2017 Subtotal (95% CI) Heterogeneity: Tau ² : Test for overall effect Total (95% CI) Heterogeneity: Tau ² : Test for overall effect Test for subgroup 1.6.1 CAT <24weeks Chen 2016 Chen 2020 Du 2013 Huang 2021 Jiang 2023 Liu 2018 Pan 2018 Pan 2018 Pan 2017 Sun 2021 Wang 2023 Yang 2023 Yang 2023 Yang 2023	25.43 5.72 = 0.19; Chi ² = 2.3 : Z = 5.36 (P < 0. = 0.95; Chi ² = 81 : Z = 15.38 (P < (ferences: Chi ² = Experimenta Mean SD 17.08 5.19 14.54 1.14 28.08 6.55 15.28 3.16 11.24 3.51 12.0.16 1.56 10.65 9.59 10.91 3.23 16.11 7.63	32 29.8 120 120 56, df = 2 (P = 00001) 9 802 .09, df = 20 (F = 00001) 3.23, df = 3 (I 3 al C Total Mean 33 20.98 63 18.54 36 31.75 38 21.36 40 13.57 37 22.54 20 19.14 30 15.92 40 17.56 20 25 40 14.43 34 21.164	2.58 0.33); ² < 0.000 P = 0.36 control SD 4.73 1.54 4.23 3.29 4.23 3.29 4.73 1.54 4.23 3.29 4.73 1.54 4.23 3.29 4.93 4.95 4.55 4.5	36 121 = 11% 805 001); = = 7.1 7011 34 63 38 40 37 21 38 38 40 37 21 30 40 30 40 38	3.5% 9.1% 100.0% 5.75% 0% Weight 3.1% 7.4% 2.9% 6.6% 6.6% 5.2% 1.8% 3.4% 6.3% 6.3%	-4.37 [6.52, -2.22] -3.94 [-5.38, -2.50] -4.20 [-4.74, -3.66] Mean Difference IV, Random, 95% Cl -3.90 [-6.28, -1.52] -4.00 [-4.47, -3.53] -3.67 [-6.20, -1.14] -6.08 [-7.53, -4.63] -2.33 [-4.08, -0.58] -2.38 [-3.24, -1.52] -8.49 [-15.03, -1.95] -5.01 [-6.38, -3.64] -1.45 [-5.02, 2.12] -6.33 [-6.50, -4.16] -4.20 [-5.14, -3.26]	Favours [experimental] Favours [control Mean Difference
Zang 2017 Subtotal (95% CI) Heterogeneity: Tau ² : Test for overall effect Total (95% CI) Heterogeneity: Tau ² : Test for overall effect Test for subaroup diffect Test for subaroup diffect Study or Subgroup 1.6.1 CAT <24weeks Chen 2016 Chen 2020 Du 2013 Huang 2021 Jiang 2023 Liu 2018 Pan 2018 Pan 2018 Ren 2017 Sun 2021 Wang 2023 Yang 2023 Yang 2023 Yao 2022 Subtotal (95% CI)	25.43 5.72 = 0.19; Chi ² = 2.2 : Z = 5.36 (P < 0. : Z = 15.38 (P < 1. : Z = 15.38 (P	32 29.8 120 25. df = 2 (P = 00001) 300001) 802 0.09, df = 20 (F 0.00001) 3.23. df = 3 (I al C Total Mean 33 20.98 63 18.54 36 31.75 38 21.36 40 13.57 37 22.54 20 19.14 30 15.92 40 17.56 20 25 40 14.43 42 11.64 439 11.64	2.58 0.33); P 0 < 0.001 P = 0.36 control SD 4.73 1.54 4.23 3.29 4.22 7.11.71 10.73 8.62 4.59 2.54 2.33	36 121 = 11% 805 2001); ² = 7.1 34 63 38 38 40 37 21 30 0 20 40 37 21 33 40 37 21 38 40 37 21 40 50 50 50 50 50 50 50 50 50 5	3.5% 9.1% 100.0% 7.75% 0% Weight 3.1% 5.0% 4.3% 5.2% 1.6% 5.2% 3.4% 6.3% 6.7% 5.3%	-4.37 [6.52, -2.22] -3.94 [-5.38, -2.50] -4.20 [-4.74, -3.66] -4.20 [-4.74, -3.66] -3.90 [-6.28, -1.52] -4.00 [-4.47, -3.53] -3.67 [-6.20, -1.14] -6.08 [-7.53, -4.63] -2.33 [-4.09, -0.58] -2.33 [-5.02, -1.12] -6.33 [-5.02, -4.16] -4.20 [-5.14, -3.26]	Favours [experimental] Favours [control Mean Difference
Zang 2017 Subtotal (95% CI) Heterogeneity: Tau ² : Test for overall effect Total (95% CI) Heterogeneity: Tau ² : Test for overall effect Test for subgroup 1.6.1 CAT <24weeks Chen 2016 Chen 2020 Du 2013 Huang 2021 Jiang 2023 Liu 2018 Pan 2018 Pan 2018 Pan 2017 Sun 2021 Wang 2023 Yang 2023 Yang 2023 Yang 2023	25.43 5.72 = 0.19; Chi ² = 2.3 : Z = 5.36 (P < 0. = 0.95; Chi ² = 81 : Z = 15.38 (P < (ferences: Chi ² = Experimenta Mean SD 17.08 5.19 14.54 1.14 28.08 6.55 15.28 3.16 11.24 3.51 20.16 1.56 10.65 9.59 10.91 3.23 16.17 7.84 10.23 1.67 6.33 1.05 = 1.11; Chi ² = 45.	32 29.8 120 25, df = 2 (P = 00001) 802 .09, df = 20 (F = 0.00001) 3.23. df = 3 (I al Control Mean 33 33 20.98 63 18.54 36 31.75 37 22.54 40 13.57 37 22.54 40 15.92 40 17.56 20 24 41.64 439 02, df = 11 (P	2.58 0.33); P 0 < 0.001 P = 0.36 control SD 4.73 1.54 4.23 3.29 4.22 7.11.71 10.73 8.62 4.59 2.54 2.33	36 121 = 11% 805 2001); ² = 7.1 34 63 38 38 40 37 21 30 0 20 40 37 21 33 40 37 21 38 40 37 21 40 50 50 50 50 50 50 50 50 50 5	3.5% 9.1% 100.0% 7.75% 0% Weight 3.1% 5.0% 4.3% 5.2% 1.6% 5.2% 3.4% 6.3% 6.7% 5.3%	-4.37 [6.52, -2.22] -3.94 [-5.38, -2.50] -4.20 [-4.74, -3.66] Mean Difference IV, Random, 95% Cl -3.90 [-6.28, -1.52] -4.00 [-4.47, -3.53] -3.67 [-6.20, -1.14] -6.08 [-7.53, -4.63] -2.33 [-4.08, -0.58] -2.38 [-3.24, -1.52] -8.49 [-15.03, -1.95] -5.01 [-6.38, -3.64] -1.45 [-5.02, 2.12] -6.33 [-6.50, -4.16] -4.20 [-5.14, -3.26]	Favours [experimental] Favours [control Mean Difference
Zang 2017 Subtotal (95% CI) Heterogeneity: Tau ²⁺ : Test for overall effect Total (95% CI) Heterogeneity: Tau ²⁺ : Test for overall effect Test for subgroup 1.6.1 CAT <24weeks Chen 2016 Chen 2016 Chen 2020 Du 2013 Huang 2021 Jiang 2023 Liu 2018 Pan 2018 Ren 2017 Sun 2021 Wang 2023 Yang 2024 Subtotal (95% CI) Heterogeneity: Tau ² = Test for overall effect: 1.6.2 CAT ≥24weeks	25.43 5.72 = 0.19; Chi ² = 2.3 : Z = 5.36 (P < 0. = 0.95; Chi ² = 81 : Z = 15.38 (P < (ferences: Chi ² = Experimenta Mean SD ⁻¹ 3 17.08 5.19 14.54 1.14 28.08 6.55 15.28 3.16 11.24 3.51 20.16 1.56 10.65 9.59 10.91 3.23 16.11 7.63 18.67 1.84 10.23 1.67 6.33 1.05 : 1.11; Chi ² = 45. Z = 10.73 (P < 0	32 29.8 120 25. df = 2 (P = 00001) 802 .09, df = 20 (F = 0.00001) 3.23. df = 3 (I .09, df = 20 (F = 0.00001) 3.23. df = 3 (I .09, df = 20 (F = 0.00001) 3.23. df = 3 (I .09, df = 1.00001) 3.20.98 63 18.54 63 18.54 .06 31.75 38 21.36 40 13.57 40 13.57 .72 2.54 20 19.14 .00 15.92 40 17.56 .20 25 40 14.43 .42 11.64 439 .02, df = 11 (P .00001) .00001)	2.58 0.33); P 0.33); P 0.000 0 0 0 0 0 0 0 0 0 0 0 0	36 121 = 11% 805 5001); ² = 7.1 Total 1 7 34 63 38 38 38 38 38 38 38 30 37 37 21 30 40 37 37 40 37 40 50 10 10 10 10 10 10 10 10 10 1	3.5% 9.1% 100.0% 7.5% 0% Weight 3.1% 7.4% 5.0% 4.3% 0.6% 5.2% 1.8% 6.3% 6.3% 6.3% 5.3% 7.6%	-4.37 [6.52, -2.22] -3.94 [-5.38, -2.50] -4.20 [-4.74, -3.66] Mean Difference IV, Random, 95% Cl -3.90 [-6.28, -1.52] -4.00 [-4.47, -3.53] -3.67 [-6.20, -1.14] -6.08 [-7.53, -4.63] -2.38 [-7.53, -4.63] -2.38 [-7.54, -1.56] -2.38 [-7.54, -1.56] -5.01 [-6.38, -3.64] -5.01 [-6.38, -3.64] -6.33 [-6.50, -4.16] -6.33 [-6.50, -4.16] -5.31 [-6.12, -4.50] -4.25 [-5.02, -3.47]	Favours [experimental] Favours [control Mean Difference
Zang 2017 Subtotal (95% CI) Heterogeneity: Tau ² : Test for overall effect Total (95% CI) Heterogeneity: Tau ² : Test for overall effect Test for subaroup diffect Test for subaroup diffect Study or Subgroup 1.6.1 CAT <24weeks Chen 2016 Chen 2020 Du 2013 Huang 2021 Jiang 2023 Liang 2023 Liang 2023 Yang 2024 Yang 2024 Yang 2024 Yang 2024 Yang 2025 Yang 2025 Yang 2026 Yang 2026 Yang 2026 Yang 2026 Yang 2026 Yang 2026 Yang 2026 Yang 2027 Yang 2027 Ya	25.43 5.72 = 0.19; Chi ² = 2.1 : Z = 5.36 (P < 0. : Z = 5.36 (P < 0. : Z = 15.38 (P < 1. : Z = 15.38 (1 < 1.58 (1 +	32 29.8 120 25, df = 2 (P = 00001) 802 .009, df = 20 (F 0.00001) 3.23. df = 3 (I al Control Mean 33 33 20.98 63 18.54 33 20.98 63 18.54 40 13.57 37 22.54 40 15.92 40 17.56 40 14.43 42 11.64 439 02, df = 11 (P 0.0001) 13.84	2.58 0.33); P < 0.000 P = 0.36 control 5D 4.73 1.54 4.23 3.29 4.42 2.17 1.71 2.03 8.62 2.54 2.33 < 0.000 2.38	36 121 11% 805 001); ² = 7.1 701 10, ² = 7.1 34 63 38 38 38 30 40 30 40 38 439 001); ² = 40 38 40 30 40 30 40 30 40 30 40 30 40 40 30 40 40 40 40 40 40 40 40 40 4	3.5% 9.1% 100.0% 3.1% 7.4% 2.9% 4.3% 6.6% 5.0% 4.3% 6.6% 5.2% 1.8% 5.2% 1.8% 5.3,3% 7.6%	-4.37 [-6.52, -2.22] -3.94 [-5.38, -2.50] -4.20 [-4.74, -3.66] -4.20 [-4.74, -3.66] -3.90 [-6.28, -1.52] -4.00 [-4.47, -3.53] -3.67 [-6.20, -1.14] -6.08 [-7.53, -4.63] -2.38 [-3.24, -1.52] -8.49 [-15.03, -1.95] -5.01 [-6.38, -3.64] -1.45 [-5.02, 2.12] -6.33 [-8.0, -4.16] -4.20 [-5.14, -3.26] -5.31 [-6.12, -4.50] -4.25 [-5.02, -3.47]	Favours [experimental] Favours [contro] Mean Difference
Zang 2017 Subtotal (95% CI) Heterogeneity: Tau ² : Test for overall effect Total (95% CI) Heterogeneity: Tau ² : Test for overall effect Test for subgroup 1.6.1 CAT <24weeks Chen 2016 Chen 2020 Du 2013 Huang 2021 Jiang 2023 Liu 2018 Pan 2018 Pan 2018 Ren 2017 Sun 2021 Wang 2023 Yang 2023 Yang 2023 Yabor 2023 Subtotal (95% CI) Heterogeneity: Tau ² = Test for overall effect: 1.6.2 CAT ≥24weeks Dong 2020 He 2015	25.43 5.72 = 0.19; Chi ² = 2.2; : Z = 5.36 (P < 0. : Z = 15.38 (P < 1) : Z = 15.38 (P < 1) : Z = 15.38 (P < 1) : T = 10.73 (P <	32 29.8 120 5c, df = 2 (P = 00001) 802 .09, df = 20 (F .00001) 3.23. df = 3 (I al C Total Mean 33 20.98 63 18.54 36 31.75 38 21.36 40 13.57 37 22.54 20 19.14 30 15.92 40 17.56 20 25 40 14.43 90 2, df = 11 (P .00001) 40 40 13.84 48 20.02	2.58 0.33); P = 0.36 control 50 2.54 2.54 2.33 < 0.000 2.38 5.27	36 121 = 11% 805 5001); ² = 7.1 Total 1 7 7 1 34 63 38 38 38 38 38 40 37 21 30 40 20 40 20 40 9 40 9 40 5 40 40 40 40 40 40 40 40 40 40	3.5% 9.1% 100.0% 7.75% 0% Weight 3.1% 7.4% 2.9% 5.0% 4.3% 0.6% 0.6% 0.6% 0.6% 0.6% 5.2% 3.4% 6.3% 5.33%	-4.37 [6.52, -2.22] -3.94 [-5.38, -2.50] -4.20 [-4.74, -3.66] Mean Difference IV. Random, 95% CI -3.90 [-6.28, -1.52] -4.00 [-4.47, -3.53] -3.67 [-6.20, -1.14] -6.08 [-7.53, -4.63] -2.33 [-4.08, -0.58] -2.38 [-3.24, -1.52] -8.49 [-15.03, -1.95] -5.01 [-6.38, -3.64] -1.45 [-5.02, 2.12] -6.33 [-8.50, -4.16] -4.20 [-5.14, -4.50] -4.25 [-5.02, -3.47] -4.40 [-5.39, -3.41] -4.41 [-6.35, -2.47]	Favours [experimental] Favours [contro] Mean Difference
Zang 2017 Subtotal (95% CI) Heterogeneity: Tau ²⁺ : Test for overall effect Total (95% CI) Heterogeneity: Tau ²⁺ : Test for overall effect Test for subdroup diffect Test for subdroup diffect Study or Subgroup 1.6.1 CAT <24weeks Chen 2016 Chen 2020 Du 2013 Huang 2021 Jiang 2023 Liu 2018 Pan 2018 Pan 2018 Pan 2018 Ren 2017 Sun 2021 Wang 2023 Yaog 2023 Yaog 2023 Subtotal (95% CI) Heterogeneity: Tau ² = Test for overall effect: 1.6.2 CAT ≥24weeks Dong 2020 He 2015 Ju 2022	25.43 5.72 = 0.19; Chi ² = 2.2; Z = 5.36 (P < 0. = 0.95; Chi ² = 81; Z = 15.38 (P < (ferences: Chi ² = Experimenta Mean SD 17.08 5.19 14.54 1.14 28.08 6.55 15.28 3.16 11.24 3.51 20.16 1.56 10.65 9.59 10.91 3.23 16.11 7.63 16.11 7.63 16.11 7.63 16.11 7.63 1.67 6.33 1.05 = 1.11; Chi ² = 45, Z = 10.73 (P < 0 9.44 2.12 15.61 4.2 12.11 1.83	32 29.8 120 25. df = 2 (P = 00001) 300001) 802 0.09, df = 20 (F 0.09, df = 20 (F 0.00001) 3.23. df = 3 (I al C Total Mean 33 20.98 63 18.54 36 31.75 38 21.36 40 13.57 37 22.54 20 19.14 30 15.92 40 17.56 40 14.43 42 11.64 439 02, df = 11 (P .00001) 40 13.84 48 20.02 80 40 13.84 439	2.58 0.33); P 0.33); P 0.000 P = 0.36 control SD 4.73 3.29 4.23 3.29 4.23 3.29 4.22 1.54 4.23 3.29 4.23 8.62 2.54 2.33 < 0.000 2.38 5.27 1.68	36 121 = 11% 805 5001); = = 7.1 700 100 100 100 100 100 100 10	3.5% 9.1% 100.0% 7.75% 0% Weight 3.1% 5.0% 4.3% 5.2% 1.6% 6.7% 6.3% 6.7% 6.3% 6.7% 6.3% 6.7% 7.6%	-4.37 [6.52, -2.22] -3.94 [-5.38, -2.50] -4.20 [-4.74, -3.66] Mean Difference IV. Random, 95% Cl -3.90 [-6.28, -1.52] -4.00 [-4.47, -3.53] -3.67 [-6.20, -1.14] -6.08 [-7.53, -4.63] -2.38 [-7.53, -4.63] -2.38 [-3.24, -1.52] -8.49 [-15.03, -1.95] -5.01 [-6.38, -3.64] -1.45 [-5.02, 2.12] -6.33 [-8.50, -4.16] -4.20 [-5.14, -3.26] -5.31 [-6.12, -4.50] -4.25 [-5.02, -3.47] -4.40 [-5.39, -3.41] -4.41 [-6.35, -2.47] -3.66 [-4.20, -3.12]	Favours [experimental] Favours [control
Zang 2017 Subtotal (95% CI) Heterogeneity: Tau ² : Test for overall effect Total (95% CI) Heterogeneity: Tau ² : Test for overall effect Test for subgroup 1.6.1 CAT <24weeks Chen 2016 Chen 2020 Du 2013 Huang 2023 Liu 2018 Pan 2018 Ren 2017 Sun 2021 Wang 2023 Yang 2024 Heterogeneity: Tau ² Heterogeneity: Tau ² Yang 2025 Ju 2022 Liu 2019	25.43 5.72 = 0.19; Chi ² = 2.1 : Z = 5.36 (P < 0. = 0.95; Chi ² = 81 : Z = 15.38 (P < (ferences: Chi ² = Experimenta Mean SD 14.54 1.14 28.08 6.55 15.28 3.16 11.24 3.51 20.16 1.56 10.65 9.59 10.91 3.23 16.11 7.63 18.67 1.84 10.23 1.67 6.33 1.05 = 1.11; Chi ² = 45. Z = 10.73 (P < 0 S 9.44 2.12 15.61 4.2 20.34 1.97	32 29.8 120 25, df = 2 (P = 25, df = 2 (P = 00001) 802 .09, df = 20 (F 0.0001) 3.23. df = 3 (I al C Total Mean 33 20.98 63 18.54 36 31.75 37 22.54 40 13.57 37 22.54 40 15.92 40 17.56 20 24 11.64 439 002, df = 11 (P 0.00001) 40 40 13.84 48 20.02 80 15.77 50 23.86	2.58 0.33); P < 0.000 P = 0.36 control 50 4.73 3.29 4.29 2.54 2.33 < 0.000 2.38 5.27 1.64 2.38 5.27 1.64 2.33 2.38 5.27 1.68 5.27 1.68 5.27 1.6	36 121 = 11% 805 001); ² = 7. Total 7 34 63 38 38 38 38 30 40 30 40 30 40 38 439 001); ² = 40 50 50 50 50 50 50 50 50 50 5	3.5% 9.1% 100.0% 7.5% 0% Weight 3.1% 7.4% 6.6% 6.3% 6.3% 6.3% 6.3% 6.3% 6.7% 3.3% 6.6%	-4.37 [6.52, -2.22] -3.94 [-5.38, -2.50] -4.20 [-4.74, -3.66] -4.20 [-4.74, -3.66] -3.90 [6.28, -1.52] -4.00 [-4.77, -3.53] -3.67 [6.20, -1.14] -6.08 [-7.53, -4.63] -2.38 [-3.24, -1.52] -8.49 [-15.03, -1.95] -5.01 [6.38, -3.64] -1.45 [-5.02, -1.12] -6.33 [-8.50, -4.16] -4.20 [-5.14, -3.26] -5.31 [-6.12, -4.50] -4.25 [-5.02, -3.47] -4.40 [-5.39, -3.41] -4.40 [-5.39, -3.41] -4.40 [-5.39, -3.41] -3.52 [-4.37, -2.67]	Favours [experimental] Favours [control
Zang 2017 Subtotal (95% CI) Heterogeneity: Tau ² : Test for overall effect Total (95% CI) Heterogeneity: Tau ² : Test for overall effect Test for subgroup 1.6.1 CAT <24weeks Chen 2016 Chen 2020 Du 2013 Huang 2021 Jiang 2023 Liu 2018 Pan 2018 Pan 2018 Pan 2018 Ren 2017 Sun 2021 Wang 2023 Yab 2023 Subtotal (95% CI) Heterogeneity: Tau ² = Test for overall effect: 1.6.2 CAT ≥24weeks Dong 2020 He 2015 Ju 2021 Liu 2019 Liu 2019 Liu 2021	25.43 5.72 = 0.19; Chi ² = 2.2; Z = 5.36 (P < 0. = 0.95; Chi ² = 81; Z = 15.38 (P < (ferences: Chi ² = Experimenta Mean SD 17.08 5.19 14.54 1.14 28.08 6.55 15.28 3.16 11.24 3.51 20.16 1.56 10.65 9.59 10.91 3.23 16.11 7.63 16.11 7.63 16.11 7.63 16.11 7.63 1.67 6.33 1.05 = 1.11; Chi ² = 45, Z = 10.73 (P < 0 9.44 2.12 15.61 4.2 12.11 1.83	32 29.8 120 25. df = 2 (P = 00001) 300001) 802 0.09, df = 20 (F 0.09, df = 20 (F 0.00001) 3.23. df = 3 (I al C Total Mean 33 20.98 63 18.54 36 31.75 38 21.36 40 13.57 37 22.54 20 19.14 30 15.92 40 17.56 40 14.43 42 11.64 439 02, df = 11 (P .00001) 40 13.84 48 20.02 80 40 13.84 439	2.58 0.33); P 0.33); P 0.000 P = 0.36 control SD 4.73 3.29 4.23 3.29 4.23 3.29 4.22 1.54 4.23 3.29 4.23 8.62 2.54 2.33 < 0.000 2.38 5.27 1.68	36 121 = 11% 805 5001); = = 7.1 700 100 100 100 100 100 100 10	3.5% 9.1% 100.0% 7.75% 0% Weight 3.1% 5.0% 4.3% 5.2% 1.6% 6.7% 6.3% 6.7% 6.3% 6.7% 6.3% 6.7% 7.6%	-4.37 [6.52, -2.22] -3.94 [-5.38, -2.50] -4.20 [-4.74, -3.66] Mean Difference IV, Random, 95% CI -3.90 [-6.28, -1.52] -4.00 [-4.47, -3.53] -3.67 [-6.20, -1.14] -6.08 [-7.53, -4.63] -2.33 [-4.08, -0.58] -2.38 [-3.24, -1.52] -8.49 [-15.03, -1.95] -5.01 [-6.33, -3.64] -4.20 [-5.14, -3.26] -5.31 [-6.12, -4.50] -4.25 [-5.02, -3.47] -4.40 [-5.39, -3.41] -4.41 [-6.55, -2.47] -3.62 [-4.27, -2.67]	Favours [experimental] Favours [control
Zang 2017 Subtotal (95% CI) Heterogeneity: Tau ² : Test for overall effect Total (95% CI) Heterogeneity: Tau ² : Test for overall effect Test for subgroup 1.6.1 CAT <24weeks Chen 2016 Chen 2020 Du 2013 Huang 2023 Liu 2018 Pan 2018 Ren 2017 Sun 2021 Wang 2023 Yang 2024 Heterogeneity: Tau ² Heterogeneity: Tau ² Yang 2025 Ju 2022 Liu 2019	25.43 5.72 = 0.19; Chi ² = 2.2; Z = 5.36 (P < 0. = 0.95; Chi ² = 81; Z = 15.38 (P < 1); Transformed and the second se	32 29.8 120 5c, df = 2 (P = 00001) 802 .09, df = 20 (F .00001) 3.23. df = 3 (I al C Total Mean 33 20.98 63 18.54 36 31.75 38 21.36 40 13.57 37 22.54 20 19.14 30 15.92 40 17.56 20 25 40 14.43 902, df = 11 (P .00001) 40 40 13.84 48 20.02 80 15.77 50 23.63 37 20.46	2.58 0.33); P = 0.36 control 50 4.73 1.54 4.23 3.29 4.42 2.17 11.71 2.03 8.62 4.54 2.33 < 0.000 2.38 5.27 1.68 2.33 2.05	36 121 = 11% 805 5001); ² = 7.1 Total 1 7 7 1 7 1 34 63 38 38 38 38 38 40 37 21 20 40 20 40 20 40 20 40 20 40 50 38 40 50 37 37 40 50 50 37 50 50 50 50 50 50 50 50 50 50	3.5% 9.1% 100.0% 7.75% 0% Weight 3.1% 7.4% 2.9% 5.0% 4.3% 4.6% 0.8% 3.4% 6.3% 5.2% 3.4% 6.3% 5.3% 7.6%	-4.37 [6.52, -2.22] -3.94 [-5.38, -2.50] -4.20 [-4.74, -3.66] -4.20 [-4.74, -3.66] -3.90 [6.28, -1.52] -4.00 [-4.77, -3.53] -3.67 [6.20, -1.14] -6.08 [-7.53, -4.63] -2.38 [-3.24, -1.52] -8.49 [-15.03, -1.95] -5.01 [6.38, -3.64] -1.45 [-5.02, -1.12] -6.33 [-8.50, -4.16] -4.20 [-5.14, -3.26] -5.31 [-6.12, -4.50] -4.25 [-5.02, -3.47] -4.40 [-5.39, -3.41] -4.40 [-5.39, -3.41] -4.40 [-5.39, -3.41] -3.52 [-4.37, -2.67]	Favours [experimental] Favours [contro] Mean Difference
Zang 2017 Subtotal (95% CI) Heterogeneity: Tau ² : Test for overall effect Total (95% CI) Heterogeneity: Tau ² : Test for overall effect Test for subgroup 1.6.1 CAT <24weeks Chen 2016 Chen 2020 Du 2013 Huang 2021 Jiang 2023 Liu 2018 Pan 2018 Ren 2017 Sun 2021 Wang 2023 Yang 2023 Yabag 2023 Subtotal (95% CI) Heterogeneity: Tau ² = Test for overall effect: 1.6.2 CAT ≥24weeks Dong 2020 He 2015 Ju 2022 Liu 2019 Liu 2019 Liu 2021	25.43 5.72 = 0.19; Chi ² = 2.2; Z = 5.36 (P < 0. = 0.95; Chi ² = 81; Z = 15.38 (P < 1); Z = 15.38 (P < 1); Experimenta Mean SD 17.08 5.19 14.54 1.14 28.08 6.55 15.28 3.16 10.45 9.59 10.91 3.23 10.61 1.56 10.85 9.59 10.91 3.23 10.61 1.56 10.81 1.56 10.81 1.67 6.33 1.05 = 1.11; Chi ² = 45. Z = 10.73 (P < 0) 9.44 2.12 15.61 4.2 12.11 1.83 20.34 1.97 14.13 1.7 15.03 3.88	32 29.8 120 25. df = 2 (P = 00001) 300001) 802 0.09, df = 20 (F 0.00001) 3.23. df = 3 (I al C Total Mean 33 20.98 63 18.54 36 31.75 38 21.36 40 13.57 37 22.54 40 15.92 40 14.43 42 11.64 439 02, df = 11 (P 0.00001) 40 40 13.84 48 20.02 80 15.77 50 23.86 37 20.46 40 17.18	2.58 0.33); P 0.33); P 0.33]; P 0.34]; P 0.35]; P	36 121 = 11% 805 5001); = = 7.1 700 100 100 100 100 100 100 10	3.5% 9.1% 100.0% 7.75% 0% Weight 3.1% 5.0% 4.3% 5.2% 0.6% 5.2% 3.4% 6.3% 6.7% 5.3.3% 7.6%	-4.37 [6.52, -2.22] -3.94 [-5.38, -2.50] -4.20 [-4.74, -3.66] Mean Difference IV. Random, 95% CI -3.90 [-6.28, -1.52] -4.00 [-4.47, -3.53] -3.67 [-6.20, -1.14] -6.08 [-7.53, -4.63] -2.38 [-3.24, -1.52] -8.49 [-15.03, -1.95] -5.01 [-6.38, -3.64] -1.45 [-5.02, 2.12] -6.33 [-8.50, -4.16] -5.31 [-6.12, -4.50] -5.31 [-6.12, -4.50] -4.25 [-5.02, -3.47] -4.40 [-5.39, -3.41] -4.41 [-6.35, -2.47] -3.66 [-4.20, -3.12] -3.52 [-4.37, -2.67] -6.33 [-7, 19, -5.47] -2.15 [-3.80, -0.50]	Favours [experimental] Favours [control

Heterogeneity: Tau² = 1.10; Chi² = 36.07, df = 8 (P < 0.0001); l² = 78% Test for overall effect: Z = 9.83 (P < 0.00001)

FIGURE 9 (Continued)

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-10 -5 0 5 10 Favours (experimental) Favours (control)

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Study or Subgroup		eriment		Mean	Control	Tetal	Mainht	Mean Difference IV, Random, 95% Cl	Mean Difference IV. Random, 95% Cl
1.6.1 Frequency <51			Total	mean	50	Total	weight	IV, Random, 95% CI	IV, Kandom, 95% Ci
Chen 2020	14.54		60	18.54	1.54	60	7.4%	-4.00 [-4.47, -3.53]	+
Pan 2018	14.54			18.54		63 21			
								-8.49 [-15.03, -1.95]	
Ren 2017	10.91			15.92	2.03	30	5.2%		
Wang 2023	18.67		20	25 10.4	4.59	20	3.4%		
XuL 2021	6.39	2.3	18		3.83 2.54	20	3.8%		
Yang 2023	10.23			14.43 11.64	2.54	40	6.3%		
Yao 2022 Subtotal (95% CI)	0.33	1.05	233	11.64	2.33	38 232	6.7% 33.5%		•
	- 0.00.0	hiz - 4 C			0.040			-4.06 [-5.55, -4.01]	•
Heterogeneity: Tau ² Test for overall effect					= 0.04),	17 = 55%	70		
rest for overall ellect	1. Z = 13.7	0 (F <	0.0000						
1.6.2 Frequency>5	times/we	ek							
Chen 2016	17.08	5.19	33	20.98	4.73	34	3.1%	-3.90 [-6.28, -1.52]	
Dong 2020	9.44	2.12	40	13.84	2.38	40	6.2%	-4.40 [-5.39, -3.41]	
Du 2013	28.08	6.55	36	31.75	4.23	38	2.9%	-3.67 [-6.20, -1.14]	
He 2015	15.61	4.2	48	20.02	5.27	45	3.9%	-4.41 [-6.35, -2.47]	<u> </u>
Huang 2021	15.28	3.16	38	21.36	3.29	38	5.0%	-6.08 [-7.53, -4.63]	—
Jiang 2023	11.24	3.51	40	13.57	4.42	40	4.3%	-2.33 [-4.08, -0.58]	
Ju 2022	12.11	1.83	80	15.77	1.68	80	7.3%	-3.66 [-4.20, -3.12]	-
Liu 2018	20.16	1.56	37	22.54	2.17	37	6.6%	-2.38 [-3.24, -1.52]	
Liu 2019	20.34	1.97	50	23.86	2.33	50	6.6%	-3.52 [-4.37, -2.67]	-
LiuY 2021	14.13	1.7	37	20.46	2.05	37	6.6%	-6.33 [-7.19, -5.47]	-
Peng 2020	15.03	3.88	40	17.18	3.64	40	4.5%	-2.15 [-3.80, -0.50]	
Sun 2021	16.11	7.63	40	17.56	8.62	40	1.8%	-1.45 [-5.02, 2.12]	
Zang 2017	25.43	5.72	32	29.8	2.58	36	3.5%	-4.37 [-6.52, -2.22]	_ —
Zhang 2014	10.14	3.13	18	14.21	1.94	18	4.4%	-4.07 [-5.77, -2.37]	<u> </u>
Subtotal (95% CI)			569			573	66.5%	-3.89 [-4.65, -3.13]	◆
Heterogeneity: Tau ²	= 1.44; C	hi² = 63	.66, df	'= 13 (P	< 0.000	001); I ^z a	= 80%		
Test for overall effect	t: Z = 10.0)2 (P <	0.0000)1)					
Total (95% CI)			802			805	100.0%	-4.20 [-4.74, -3.66]	•
Heterogeneity: Tau ²	= 0.95; C	hi² = 81		= 20 (P	< 0.000				
Test for overall effect									-10 -5 0 5 10
Test for subaroup di					P = 0.12), ² = 51	7.9%		Favours [experimental] Favours [control]

patients may include reducing the spasmodic state of small arteries, preventing bronchial airway obstruction and increasing ventilation, improving lung oxygen diffusion, and increasing partial oxygen pressure. Unlike modern exercise forms such as high-intensity interval training, resistance training, or structured gym-based rehabilitation, TCEs focus on low-impact, rhythmical movements combined with breath control and mental focus. Modern exercises that emphasize physical intensity and measurable performance outcomes, often require specific facilities, equipment, or professional supervision, which can present barriers to access for older adults or those in low-resource settings. In contrast, TCEs emphasize balance, relaxation, and internal energy regulation, are low-cost, low-impact, adaptable to a wide range of physical conditions, and can be practiced independently in various environments, including at home or in community parks. Moreover, TCEs typically place greater emphasis on harmonizing the body and mind, cultivating relaxation, and promoting emotional resilience. These psychological benefits are often under-addressed in conventional exercise. For patients with COPD, who frequently experience anxiety and depression, the Physical and psychological recovery ability of TCE may offer unique advantages beyond those conferred by physical training alone. Additionally, COPD self-management education is a vital element in the implementation of traditional Chinese exercise. This educational approach incorporates disease knowledge, skill training, and strategies for behavior modification. Increasing patients' understanding of the importance and benefits of traditional Chinese exercises can lead to improvements in quality of life, reductions in acute exacerbations and hospitalizations, changes in sedentary lifestyles, and increased motivation for exercise rehabilitation. Consequently, self-management and education play a significant role in the early identification, prevention, and rehabilitation of COPD (78). In the field of public health, traditional Chinese exercises emphasize practitioners' cultural understanding and cognitive identification. As a practice combining exercise and meditation, they can alleviate stress, enhance emotional regulation, and improve symptoms of anxiety and depression by inhibiting the activation of the sympathetic nervous system. For example, workers often face more serious of emotional stress, and integrating traditional Chinese exercises into daily life can provide a valuable self-care method to support mental health. Similarly, incorporating traditional Chinese exercises into student groups facing academic pressure and uncertainty may help reduce stress and enhance their focus in daily life.

Traditional Chinese exercises exhibit unique compatibility, making them a versatile supplement to comprehensive treatment plans. Their simplicity and ease of learning make them particularly suitable for older adults, providing a moderate yet holistic form of exercise that encompasses breathing, cardiovascular function,

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	Expe	rimen	tal	C	ontrol			Std. Mean Difference	Std. Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% Cl	IV, Random, 95% Cl
1.7.1 Baduanjin									
Cao 2016	35.65			40.88		50	5.5%	-0.87 [-1.28, -0.46]	
Dong 2020	45.35	3.79	40	47.97	3.93	40	5.4%	-0.67 [-1.12, -0.22]	
Jiang 2023	42.56	4.29	40	50.34	5.9	40	5.3%	-1.49 [-1.99, -1.00]	
Xia 2022	32.32	4.42	52	38.63	2.71	52	5.4%	-1.71 [-2.16, -1.26]	
Xu 2021	49.78	2.58	132	57.34	3.11	130	5.6%	-2.64 [-2.97, -2.31]	
Yang 2023	44.26	5.43	40	50.26	5.11	40	5.4%	-1.13 [-1.60, -0.65]	
Yao 2022	21.56	2.22	42	33.16	3.4	38	4.7%	-4.04 [-4.82, -3.26]	
Zhang 2008	31.44	4		34.86	6.41	28	5.2%	-0.63 [-1.17, -0.10]	
Subtotal (95% CI)			427			418	42.4%	-1.62 [-2.31, -0.94]	•
Heterogeneity: Tau² =	0.90; CI	hi² = 12	20.87,	df = 7 (P	< 0.00	0001); I	²= 94%		
Test for overall effect:	Z = 4.67	(P < 0	.00001)					
1. 7.2 Taichi									
Li 2011	51.07	3.86	40	56.34	4.55	40	5.3%	-1.24 [-1.72, -0.76]	
Pan 2018	2.25		20		0.65	21	5.1%	-0.25 [-0.87, 0.36]	-+
Ren 2017	38.92	8.83	30	39.84	8.65	30	5.3%	-0.10 [-0.61, 0.40]	
Subtotal (95% CI)			90			91	15.7%	-0.54 [-1.28, 0.20]	
Heterogeneity: Tau ² =	0.35; CI	hi ² = 11	l.68, dt	f = 2 (P =	= 0.003	3); I ² = 8	33%		
Test for overall effect:	Z=1.43	(P = 0	.15)						
1.7.3 Liuzijue									
Chen 2016	11.82	2 27	33	13.01	2.53	34	5.3%	-0.49 [-0.98, -0.00]	
Jian 2021	8.47		27		2.13	29	5.2%	-0.56 [-1.10, -0.03]	
Liu 2018	10.84			12.95	1.9	37	5.3%	-1.11 [-1.60, -0.62]	
Wang 2014	6.1	1.92	30	8.79	1.93	29	5.2%	-1.38 [-1.95, -0.81]	
Zhao 2018	6	1.7	42	9	2	42	5.3%	-1.60 [-2.10, -1.11]	
Subtotal (95% CI)			169			171	26.3%	-1.03 [-1.46, -0.59]	◆
Heterogeneity: Tau ² =	0.18; CI	hi² = 14	1.33, di	f= 4 (P =	= 0.008	5); l² = 7	2%		
Test for overall effect:	Z = 4.62	(P < 0	.00001)					
1.7.4 Wuqinxi									
Chen 2017	37.03	4.57	59	42.41	5.13	58	5.5%	-1.10 [-1.49, -0.71]	
He 2015	12.42			13.47		45	5.5%	-0.67 [-1.09, -0.25]	
Ni 2019	17.57			23.42		24	4.6%	-2.77 [-3.58, -1.95]	<u> </u>
Subtotal (95% CI)			130	20.12	2.01	127	15.5%	-1.44 [-2.35, -0.52]	◆
Heterogeneity: Tau ² =	0.58; CI	hi² = 20		f = 2 (P -	< 0.000				
Test for overall effect:				- 0		.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			
Total (95% CI)			816			807	100.0%	-1.26 [-1.64, -0.89]	•
Heterogeneity: Tau ² =	0.63.0	hiž – pr		df - 197	P < ∩ ſ				
Test for overall effect:					, -0.0	50001),	1 - 3170		-4 -2 0 2 4
Test for subaroup diff				·	0 - 0 1	7) 12 -	40.0%		Favours [experimental] Favours [control]
reación suburoub uni	ciences	. 0111-	- J.00.	ur – 5 (r	- 0.1	0.1 =	40.370		

		eriment			ontrol			Std. Mean Difference	Std. Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% Cl	IV, Random, 95% Cl
1.7.1 Anxiety<24we	eks								
Chen 2016	11.82	2.27	33	13.01	2.53	34	5.3%	-0.49 [-0.98, -0.00]	
Jian 2021	8.47	2.14	27	9.69	2.13	29	5.2%	-0.56 [-1.10, -0.03]	
Jiang 2023	42.56	4.29	40	50.34	5.9	40	5.3%	-1.49 [-1.99, -1.00]	
Li 2011	51.07	3.86	40	56.34	4.55	40	5.3%	-1.24 [-1.72, -0.76]	
Liu 2018	10.84	1.86	37	12.95	1.9	37	5.3%	-1.11 [-1.60, -0.62]	
Ni 2019	17.57	2.12	23	23.42	2.04	24	4.6%	-2.77 [-3.58, -1.95]	
Pan 2018	2.25	0.76	20	2.43	0.65	21	5.1%	-0.25 [-0.87, 0.36]	
Ren 2017	38.92	8.83	30	39.84	8.65	30	5.3%	-0.10 [-0.61, 0.40]	
Xia 2022	32.32	4.42	52	38.63	2.71	52	5.4%	-1.71 [-2.16, -1.26]	
Xu 2021	49.78	2.58	132	57.34	3.11	130	5.6%	-2.64 [-2.97, -2.31]	-
Yang 2023	44.26	5.43	40	50.26	5.11	40	5.4%	-1.13 [-1.60, -0.65]	
Yao 2022	21.56	2.22	42	33.16	3.4	38	4.7%	-4.04 [-4.82, -3.26]	
Zhang 2008	31.44	4	29	34.86	6.41	28	5.2%	-0.63 [-1.17, -0.10]	
Subtotal (95% CI)			545			543	67.7%	-1.38 [-1.93, -0.83]	◆
Heterogeneity: Tau ² =	= 0.94; C	hi ² = 18	32.76, 0	df = 12 (P < 0.0	00001);	² = 93%		
Test for overall effect	Z = 4.91	(P < 0	.00001)					
1.7.2 Anxiety≥24we	eks								
Cao 2016	35.65	5.34	52	40.88	6.56	50	5.5%	-0.87 [-1.28, -0.46]	
Chen 2017	37.03	4.57	59	42.41	5.13	58	5.5%	-1.10 [-1.49, -0.71]	
Dong 2020	45.35	3.79	40	47.97	3.93	40	5.4%	-0.67 [-1.12, -0.22]	
He 2015	12.42	1.78	48	13.47	1.27	45	5.5%	-0.67 [-1.09, -0.25]	
Wang 2014	6.1	1.92	30	8.79	1.93	29	5.2%	-1.38 [-1.95, -0.81]	
Zhao 2018	6	1.7	42	9	2	42	5.3%	-1.60 [-2.10, -1.11]	
Subtotal (95% CI)			271			264	32.3%	-1.03 [-1.31, -0.74]	◆
Heterogeneity: Tau ² =	= 0.08; C	hi² = 12	2.45, df	f = 5 (P =	= 0.03)	; I ² = 60	1%		
Test for overall effect	Z = 6.95	5 (P < 0	.00001)					
Total (95% CI)			816			807	100.0%	-1.26 [-1.64, -0.89]	•
Heterogeneity: Tau ² =	= 0.63; C	hi² = 20	05.71, 0	df = 18 (P < 0.0	00001);	I ² = 91%		-4 -2 0 2
Test for overall effect	Z = 6.58) (P < 0	.00001	0					-4 -2 U 2 Favours (experimental) Favours (control)
Test for subaroup dif		0.04.2	4 22	df = 1 /		7) 12 -	10.000		Favours (experimental) Favours (control)

		eriment		-	ontrol			Std. Mean Difference	Std. Mean Difference
Study or Subgroup			Total	Mean	SD	Total	Weight	IV, Random, 95% Cl	IV, Random, 95% Cl
1.7.1 Frequency 45									
Cao 2016	35.65			40.88		50	5.5%	-0.87 [-1.28, -0.46]	
Chen 2017	37.03			42.41			5.5%	-1.10 [-1.49, -0.71]	
Li 2011	51.07			56.34			5.3%	-1.24 [-1.72, -0.76]	
Ni 2019	17.57			23.42		24	4.6%	-2.77 [-3.58, -1.95]	
Pan 2018		0.76	20			21	5.1%	-0.25 [-0.87, 0.36]	
Ren 2017	38.92			39.84		30	5.3%	-0.10 [-0.61, 0.40]	
Xu 2021	49.78			57.34		130	5.6%	-2.64 [-2.97, -2.31]	
Yang 2023	44.26	5.43	40	50.26	5.11	40	5.4%	-1.13 [-1.60, -0.65]	
Yao 2022	21.56	2.22	42	33.16	3.4	38	4.7%	-4.04 [-4.82, -3.26]	
Zhang 2008	31.44	4		34.86	6.41	28	5.2%	-0.63 [-1.17, -0.10]	
Subtotal (95% CI)			467			459	52.1%	-1.45 [-2.12, -0.79]	◆
Heterogeneity: Tau ^a	²= 1.07; C	hi² = 18)5.53, d	df = 9 (F	× 0.0	0001);1	²= 95%		
Test for overall effect	ct: Z = 4.29)(P < 0	.0001)						
1.7.2 Frequency>5	otimes/we	eks							
Chen 2016	11.82	2.27	33	13.01	2.53	34	5.3%	-0.49 [-0.98, -0.00]	
Dong 2020	45.35	3.79	40	47.97	3.93	40	5.4%	-0.67 [-1.12, -0.22]	
He 2015	12.42	1.78	48	13.47	1.27	45	5.5%	-0.67 [-1.09, -0.25]	
Jian 2021	8.47	2.14	27	9.69	2.13	29	5.2%	-0.56 [-1.10, -0.03]	
Jiang 2023	42.56	4.29	40	50.34	5.9	40	5.3%	-1.49 [-1.99, -1.00]	
Liu 2018	10.84	1.86	37	12.95	1.9	37	5.3%	-1.11 [-1.60, -0.62]	
Wang 2014	6.1	1.92	30	8.79	1.93	29	5.2%	-1.38 [-1.95, -0.81]	
Xia 2022	32.32	4.42	52	38.63	2.71	52	5.4%	-1.71 [-2.16, -1.26]	
Zhao 2018	6	1.7	42	9	2	42	5.3%	-1.60 [-2.10, -1.11]	_ —
Subtotal (95% CI)			349			348	47.9%	-1.07 [-1.39, -0.75]	◆
Heterogeneity: Tau ^a	² = 0.18; C	hi ² = 31	.46, df	= 8 (P =	= 0.00	01); I ² =			
Test for overall effect									
				·					
Total (95% CI)			816			807	100.0%	-1.26 [-1.64, -0.89]	•
Heterogeneity: Tau ^a	² = 0.63; C	hi ² = 20)5.71. d	df = 18 (P < 0.	00001)	; I² = 91%		<u> t t t t t t t </u>
Test for overall effect						.,			-4 -2 0 2 4
Test for subaroup d					P = 0.3	1), I ² =	1.7%		Favours [experimental] Favours [control]
							10.00		

endurance training, psychological regulation, and limb coordination. This enhances older adults' ability to meet various health needs and complements medical interventions. For younger age groups, traditional Chinese exercises may offer greater benefits in regulating the autonomic nervous system. However, since the intensity of these exercises may not meet the recommended levels of aerobic activity, their effectiveness in preventing cardiovascular disease might be limited. Therefore, in the rehabilitation of COPD patients, combining traditional Chinese exercises with modern exercise regimens may be more effective than relying solely on one form of exercise. Meanwhile, the practical application of TCE in COPD management requires attention to healthcare context and cultural adaptability. In Eastern healthcare systems, where TCE is widely accepted and even reimbursed in some cases, clinicians can incorporate these interventions seamlessly into routine pulmonary rehabilitation programs. In contrast, in Western healthcare systems, successful integration may depend on exercises category, patient education, and availability of qualified instructors. Introducing culturally tailored exercise types, pilot community-based TCE programs, or integrating TCE into existing physiotherapy services could enhance feasibility and uptake. Furthermore, some researchers have evaluated improvements in patients' physical function by analyzing results such as exercise performance, scale evaluation, neural imaging activation, and physiological indicators, which can provide more comprehensive evidence for the role of TCE in promoting COPD rehabilitation.

This review has several limitations. First, in some of the included RCTs, traditional Chinese exercises were combined with other therapies, which may have diluted the specific effects of traditional Chinese exercise. The observed effects may have been impacted by these additional therapies, and making it difficult to attribute the improvement in the disease solely to traditional Chinese exercises. Second, variations in study quality, sample size, exercise duration, frequency, intensity, outcome measures, and patient factors (e.g., participants' proficiency, age, and compliance in performing the exercises) may have contributed to heterogeneity in the results. Most included studies did not report concealment or blinding of the allocation of participants and researchers, limiting the ability to draw clear conclusions about the effectiveness of the intervention measures. Finally, since most research has been conducted in China, the findings may not be easily generalizable to other countries. As more research in this area continues to emerge, future studies should aim to include larger, high-quality, multicenter trials. These limitations emphasize the need for future research to combine rigorously designed controlled trials, standard implementation of blinding methods, and precise statistical approaches to provide stronger evidence

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		erimenta			ontrol			Std. Mean Difference	Std. Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% Cl	IV, Random, 95% Cl
1.8.1 Baduanjin									
Cao 2016	36.01	5.71		40.25	6.66	50	5.5%	-0.68 [-1.08, -0.28]	
Dong 2020	47.26	5.01	40	50.11	5.03	40	5.4%	-0.56 [-1.01, -0.11]	
Jiang 2023	43.87	3.14		49.12	4.29	40	5.3%	-1.38 [-1.87, -0.89]	
Xia 2022	31.45	2.21		39.13	2.44	52	5.0%	-3.27 [-3.87, -2.68]	
Xu 2021	50.34	2.12		54.38	2.17	130	5.8%	-1.88 [-2.17, -1.59]	
Yang 2023	46.21	5.38	40	53.62	4.54	40	5.3%	-1.47 [-1.97, -0.98]	
Yao 2022	28.56	2.76	42	35.73	3.26	38	5.1%	-2.36 [-2.94, -1.78]	
Zhang 2008 Subtotal (95% Cl)	27.48	6.91	29 427	31.29	5.7	28 418	5.2% 42.7 %	-0.59 [-1.12, -0.06] - 1.51 [-2.10, -0.92]	•
Heterogeneity: Tau² = Test for overall effect:					0.0000	l); I² = 9	33%		
1.8.2 Taichi									
Li 2011	51.86	4.83		59.75	4.56	40	5.3%	-1.66 [-2.18, -1.15]	
Pan 2018	2.25	0.63	20	3.43	0.92	21	4.7%	-1.46 [-2.16, -0.76]	
Ren 2017	36.91	10.43	30	39.5	11.33	30	5.3%	-0.23 [-0.74, 0.27]	
Subtotal (95% CI)			90			91	15.3%	-1.11 [-2.06, -0.17]	
Heterogeneity: Tau ² = Test for overall effect:				= 2 (P =	0.0002)	; I ² = 88	3%		
	. 2 - 2.30	(1 - 0.0	,2)						
1.8.3 Liuzijue	C	4.74	~~		4.05	~ .		0.77//07 0.55	
Chen 2016	9.67	1.74		11.12	1.95	34	5.3%	-0.77 [-1.27, -0.28]	
Jian 2021	8.13	2.14	27	9.39	2.09	29	5.2%	-0.59 [-1.12, -0.05]	
Liu 2018	9.11	1.24	37	11.14	1.18	37	5.2%	-1.66 [-2.19, -1.13]	
Wang 2014	6.3	1.93	30	8.52	1.74	29	5.1%	-1.19 [-1.75, -0.63]	
Zhao 2018	6.1	2	42	8.7	1.7	42	5.4%	-1.39 [-1.87, -0.91]	
Subtotal (95% CI)			169			171	26.2%	-1.12 [-1.50, -0.74]	◆
Heterogeneity: Tau ² = Test for overall effect:					,,.				
1.8.4 Wuqinxi	00.75	C 07	60		6 07	60	5.000		
Chen 2017	36.75 11.65	5.37	59	41.1	5.27	58	5.6%	-0.81 [-1.19, -0.43]	
He 2015		1.52	48	12.31	1.5	45	5.5%	-0.43 [-0.85, -0.02]	
Ni 2019	18.09	2.94	23	23.96	3.18	24	4.7%	-1.88 [-2.58, -1.19]	
Subtotal (95% CI)	18.09	2.94	130			127	15.8%	-1.88 [-2.58, -1.19] - 0.98 [-1.66, -0.30]	
Subtotal (95% Cl) Heterogeneity: Tau² =	18.09 = 0.30; Ch	2.94 ni² = 12.3	130 33, df =			127	15.8%		
	18.09 = 0.30; Ch	2.94 ni² = 12.3	130 33, df =			127 ² = 849	15.8%		•
Subtotal (95% Cl) Heterogeneity: Tau² = Test for overall effect:	18.09 = 0.30; Ch : Z = 2.83	2.94 hi² = 12.1 (P = 0.0	130 33, df = 105) 816	= 2 (P =	0.002);	127 ² = 849 807	15.8% % 100.0%	-0.98 [-1.66, -0.30]	
Subtotal (95% Cl) Heterogeneity: Tau² = Test for overall effect: Total (95% Cl)	18.09 = 0.30; Ch : Z = 2.83 = 0.45; Ch	2.94 hi² = 12.3 (P = 0.0 hi² = 153	130 33, df= 105) 816 3.90, df	= 2 (P = ⁷ = 18 (P	0.002);	127 ² = 849 807	15.8% % 100.0%	-0.98 [-1.66, -0.30]	
Subtotal (95% Cl) Heterogeneity: Tau ² = Test for overall effect: Total (95% Cl) Heterogeneity: Tau ² = Test for overall effect:	18.09 = 0.30; Ch : Z = 2.83 = 0.45; Ch : Z = 7.66	2.94 ni² = 12.3 (P = 0.0 ni² = 153 (P < 0.0	130 33, df = 105) 816 3.90, df	= 2 (P = 7= 18 (P	0.002); < 0.00(127 ² = 849 807 001); ²	15.8% % 100.0% = 88%	-0.98 [-1.66, -0.30]	-4 -2 0 2 4 Favours [experimental] Favours [control]
Subtotal (95% Cl) Heterogeneity: Tau ² = Test for overall effect: Total (95% Cl) Heterogeneity: Tau ² = Test for overall effect:	18.09 = 0.30; Ch : Z = 2.83 = 0.45; Ch : Z = 7.66 fferences:	2.94 $hi^2 = 12.1$ (P = 0.0) $hi^2 = 153$ (P < 0.0) $(Chi^2 = 1)$	130 33, df= 105) 816 8.90, df 1.66. d	= 2 (P = 7 = 18 (P f = 3 (P	0.002); < 0.00(= 0.65).	127 ² = 849 807 001); ²	15.8% % 100.0% = 88%	-0.98 [-1.66, -0.30] -1.26 [-1.59, -0.94]	Favours [experimental] Favours [control]
Subtotal (95% CI) Heterogeneity: Tau ² = Test for overall effect: Total (95% CI) Heterogeneity: Tau ² = Test for overall effect; Test for subaroup diff	18.09 = 0.30; Ch : Z = 2.83 = 0.45; Ch : Z = 7.66 fferences: Expe	2.94 $hi^2 = 12.3$ (P = 0.0) $hi^2 = 153$ (P < 0.0) $: Chi^2 = 100$ eriment:	130 33, df= 105) 816 3.90, df 1.0001) 1.66. d	= 2 (P = 7 = 18 (P f = 3 (P C	0.002); < 0.00(= 0.65). ontrol	127 ² = 849 807 001); ² ² = 0%	15.8% % 100.0% = 88%	-0.98 [-1.66, -0.30] -1.26 [-1.59, -0.94] Std. Mean Difference	Favours [experimental] Favours [control] Std. Mean Difference
Subtotal (95% CI) Heterogeneity: Tau ² = Test for overall effect: Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Test for subaroup diff Study or Subgroup	18.09 = 0.30; Ch :: Z = 2.83 = 0.45; Ch :: Z = 7.66 fferences: Expe Mean	2.94 $hi^2 = 12.3$ (P = 0.0) $hi^2 = 153$ (P < 0.0) $: Chi^2 = 100$ eriment:	130 33, df= 105) 816 3.90, df 1.0001) 1.66. d	= 2 (P = 7 = 18 (P f = 3 (P	0.002); < 0.00(= 0.65). ontrol	127 ² = 849 807 001); ² ² = 0%	15.8% % 100.0% = 88%	-0.98 [-1.66, -0.30] -1.26 [-1.59, -0.94]	Favours [experimental] Favours [control]
Subtotal (95% CI) Heterogeneity: Tau ² = Test for overall effect: Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Test for subaroup diff Study or Subaroup 1.8.1 Depression <2	18.09 = 0.30; Ch : Z = 2.83 = 0.45; Ch : Z = 7.66 fferences: Expe <u>Mean</u> 24weeks	2.94 $hi^2 = 12.3$ (P = 0.0) $hi^2 = 153$ (P < 0.0) $Chi^2 = 3$ eriment: SD	130 33, df = 105) 816 3.90, df 00001) 1.66. d 1.66. d al Total	= 2 (P = 7 = 18 (P f = 3 (P C <u>Mean</u>	0.002); < 0.000 = 0.65). Control SD	127 ² = 849 807 001); ² ² = 0% <u>Total</u>	15.8% % 100.0% = 88% Weight	-0.98 [-1.66, -0.30] -1.26 [-1.59, -0.94] Std. Mean Difference IV. Random, 95% Cl	Favours [experimental] Favours [control] Std. Mean Difference
Subtotal (95% CI) Heterogeneity: Tau ² = Test for overall effect: Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Test for subdroup diff Study or Subgroup 1.8.1 Depression <2 Chen 2016	18.09 = 0.30; Ch : Z = 2.83 = 0.45; Ch : Z = 7.66 fferences: Expe <u>Mean</u> 24weeks 9.67	2.94 $hi^2 = 12.3$ (P = 0.0) $hi^2 = 153$ (P < 0.0) $Chi^2 = 100$ eriment: <u>SD</u> 1.74	130 33, df = 105) 816 3.90, df 1.66, df 1.66, df al <u>Total</u> 33	= 2 (P = ⁷ = 18 (P f = 3 (P <u>Mean</u> 11.12	0.002); < 0.000 = 0.65). Control SD 1.95	127 ² = 849 807 001); ² ² = 0% <u>Total</u> 34	15.8% % 100.0% = 88% % Weight 5.3%	-0.98 [-1.66, -0.30] -1.26 [-1.59, -0.94] Std. Mean Difference IV. Random, 95% CI -0.77 [-1.27, -0.28]	Favours [experimental] Favours [control] Std. Mean Difference
Subtotal (95% CI) Heterogeneity: Tau ² = Test for overall effect: Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Test for subaroup diff Study or Subgroup I.8.1 Depression <2 Chen 2016 Jian 2021	18.09 = 0.30; Ch : Z = 2.83 = 0.45; Ch : Z = 7.66 fferences: Expe Mean 24weeks 9.67 8.13	2.94 $hi^{2} = 12.3$ (P = 0.0) $hi^{2} = 153$ (P < 0.0) $Chi^{2} = 100$ erimenta SD 1.74 2.14	130 33, df = 105) 816 3.90, df 00001) 1.66, d al <u>Total</u> 33 27	= 2 (P = 7 = 18 (P f = 3 (P <u>Mean</u> 11.12 9.39	0.002); < 0.00(= 0.65). control SD 1.95 2.09	127 ² = 849 807 001); ² ² = 0% <u>Total</u> 34 29	15.8% 5 100.0% = 88% Weight 5.3% 5.2%	-0.98 [-1.66, -0.30] -1.26 [-1.59, -0.94] Std. Mean Difference <u>IV, Random, 95% CI</u> -0.77 [-1.27, -0.28] -0.59 [-1.12, -0.05]	Favours [experimental] Favours [control] Std. Mean Difference
Subtotal (95% CI) Heterogeneity: Tau ² = Test for overall effect: Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Test for subaroup diff Study or Subgroup 1.8.1 Depression <2 Chen 2016 Jian 2021 Jiang 2023	18.09 = 0.30; Ch : Z = 2.83 = 0.45; Ch : Z = 7.66 fferences: Expe Mean 24weeks 9.67 8.13 43.87	2.94 $hi^{2} = 12.3$ (P = 0.0) $hi^{2} = 153$ (P < 0.0) $Chi^{2} = 100$ $Chi^{2} = 100$ erimenta SD 1.74 2.14 3.14	130 33, df = 005) 816 3.90, df 00001) 1.66. df al Total 33 27 40	= 2 (P = = 18 (P f = 3 (P <u>Mean</u> 11.12 9.39 49.12	0.002); < 0.000 = 0.65). control SD 1.95 2.09 4.29	127 ² = 849 001); ² ² = 0% <u>Total</u> 34 29 40	15.8% % 100.0% = 88% % <u>Weight</u> 5.3% 5.2% 5.3%	-0.98 [-1.66, -0.30] -1.26 [-1.59, -0.94] Std. Mean Difference IV, Random, 95% CI -0.77 [-1.27, -0.28] -0.59 [-1.12, -0.05] -1.38 [-1.87, -0.89]	Favours [experimental] Favours [control] Std. Mean Difference
Subtotal (95% CI) Heterogeneity: Tau ² = Test for overall effect: Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Test for subaroup diff Study or Subgroup 1.8.1 Depression <2 Chen 2016 Jiang 2023 Li 2011	18.09 = 0.30; Ch : Z = 2.83 = 0.45; Ch : Z = 7.66 fferences: Expe Mean 24weeks 9.67 8.13 43.87 51.86	2.94 $hi^2 = 12.3$ (P = 0.0) $hi^2 = 1533$ (P < 0.0) $: Chi^2 = 100$ erimenta SD 1.74 2.14 3.14 4.83	130 33, df = 005) 816 3.90, df 00001) 1.66. d al Total 33 27 40 40	= 2 (P = = 18 (P f = 3 (P <u>Mean</u> 11.12 9.39 49.12 59.75	0.002); < 0.000 = 0.65). ontrol SD 1.95 2.09 4.29 4.56	127 ² = 849 001); ²: ² = 0% <u>Total</u> 34 29 40 40	15.8% 5 100.0% = 88% 5 Weight 5.3% 5.2% 5.3% 5.3%	-0.98 [-1.66, -0.30] -1.26 [-1.59, -0.94] Std. Mean Difference IV. Random, 95% CI -0.77 [-1.27, -0.28] -0.59 [-1.12, -0.05] -1.38 [-1.87, -0.89] -1.66 [-2.18, -1.15]	Favours [experimental] Favours [control] Std. Mean Difference
Subtotal (95% CI) Heterogeneity: Tau ² = Test for overall effect: Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Test for suboroup diff Study or Subgroup 1.8.1 Depression <2 Chen 2016 Jian 2021 Jiang 2023 Li 2011 Liu 2018	18.09 = 0.30; Ch : Z = 2.83 = 0.45; Ch : Z = 7.66 fferences: Expe 9.67 8.13 43.87 51.86 9.11	2.94 $hi^2 = 12.3$ (P = 0.0) $hi^2 = 1533$ (P < 0.0) $C hi^2 = 1000$ erimenta SD 1.74 2.14 3.14 4.83 1.24	130 33, df = 005) 816 3.90, df 00001) 1.66. d al 1.66. d al 33 27 40 40 37	= 2 (P = = 18 (P f = 3 (P <u>Mean</u> 11.12 9.39 49.12 59.75 11.14	 0.002); < 0.000 = 0.65). ontrol SD 1.95 2.09 4.29 4.56 1.18 	127 ² = 849 001); ²: ² = 0% <u>Total</u> 34 29 40 40 37	15.8% 5 100.0% = 88% 5 Weight 5.3% 5.2% 5.3% 5.2%	-0.98 [-1.66, -0.30] -1.26 [-1.59, -0.94] Std. Mean Difference IV. Random, 95% CI -0.77 [-1.27, -0.28] -0.59 [-1.12, -0.05] -1.38 [-1.87, -0.89] -1.86 [-2.19, -1.13]	Favours [experimental] Favours [control] Std. Mean Difference
Subtotal (95% CI) Heterogeneity: Tau ² = Test for overall effect: Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Test for subaroup diff Study or Subgroup 1.8.1 Depression <2 Chen 2016 Jian 2021 Jiang 2023 Li 2011 Liu 2018 Ni 2019	18.09 = 0.30; Ch : Z = 2.83 = 0.45; Ch : Z = 7.66 fferences: Expe <u>Mean</u> 24weeks 9.67 8.13 43.87 51.86 9.11 18.09	2.94 $hi^2 = 12.3$ (P = 0.0) $hi^2 = 153$ (P < 0.0) $Chi^2 = 100$ erimenta SD 1.74 2.14 3.14 4.83 1.24 2.94	130 33, df = 105) 816 8.90, df 10001) 1.66, d al Total 33 27 40 40 37 23	= 2 (P = = 18 (P f = 3 (P 0 Mean 11.12 9.39 49.12 59.75 11.14 23.96	 0.002); < 0.000 = 0.65). ontrol SD 1.95 2.09 4.29 4.56 1.18 3.18 	127 807 001); I ² I ² = 0% <u>Total</u> 34 29 40 40 37 24	15.8% 100.0% = 88% Weight 5.3% 5.2% 5.3% 5.3% 5.2% 5.3% 5.2% 4.7%	-0.98 [-1.66, -0.30] -1.26 [-1.59, -0.94] Std. Mean Difference IV. Random, 95% CI -0.77 [-1.27, -0.28] -0.59 [-1.12, -0.05] -1.38 [-1.87, -0.89] -1.66 [-2.18, -1.15] -1.66 [-2.19, -1.13] -1.88 [-2.58, -1.19]	Favours [experimental] Favours [control] Std. Mean Difference
Subtotal (95% CI) Heterogeneity: Tau ² = Test for overall effect: Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Test for subaroup diff Study or Subgroup 1.8.1 Depression <2 Chen 2016 Jian 2021 Jian 2021 Jiang 2023 Li 2011 Liu 2018 Ni 2018 Ni 2019 Pan 2018	18.09 = 0.30; Ch : Z = 2.83 = 0.45; Ch : Z = 7.66 fferences: 24weeks 9.67 8.13 43.87 51.86 9.11 18.09 2.25	2.94 $hi^2 = 12.3$ (P = 0.0) $hi^2 = 153$ (P < 0.0) $Chi^2 = 100$ chi = 100 chi = 1000 chi = 10000 chi = 1000 chi = 10000 chi = 10000 chi = 10000 chi = 10000 chi = 100	130 33, df = 105) 816 3.90, df 10001) 1.66. d al Total 33 27 40 40 37 23 20	= 2 (P = = 18 (P f = 3 (P <u>Mean</u> 11.12 9.39 49.12 59.75 11.14 23.96 3.43	 0.002); < 0.000 = 0.65). ontrol SD 1.95 2.09 4.29 4.29 4.18 3.18 0.92 	127 807 001); ² ² = 0% <u>Total</u> 34 29 40 37 24 21	15.8% 5 100.0% = 88% 5 5 5 5 5 5 5 5 3% 5 5 5 3% 5 5 5 5 5 5 5 5 5 5 5 5 5	-0.98 [-1.66, -0.30] -1.26 [-1.59, -0.94] Std. Mean Difference IV, Random, 95% CI -0.77 [-1.27, -0.28] -0.59 [-1.12, -0.05] -1.38 [-1.87, -0.89] -1.66 [-2.19, -1.15] -1.66 [-2.19, -1.13] -1.88 [-2.58, -1.19] -1.46 [-2.16, -0.76]	Favours [experimental] Favours [control] Std. Mean Difference
Subtotal (95% CI) Heterogeneity: Tau ² = Test for overall effect: Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Test for subaroup diff Study or Subaroup diff Study or Subaroup diff Study or Subaroup diff Study or Subaroup List for subaroup List	18.09 = 0.30; Ch : Z = 2.83 = 0.45; Ch : Z = 7.66 fferences: Expe Mean 24weeks 9.67 8.13 43.87 51.86 9.11 18.09 2.25 36.91	2.94 $hi^2 = 12.3$ (P = 0.0) $hi^2 = 153$ (P < 0.0) $Chi^2 = 100$ chi = 100 chi = 1000 erimenta SD 1.74 2.14 3.14 4.83 1.24 2.94 0.63 10.43	130 33, df = 333, df =	= 2 (P = = 18 (P f = 3 (P 0 11.12 9.39 49.12 59.75 11.14 23.96 3.43 39.5	 0.002); < 0.000 = 0.65). control SD 1.95 2.09 4.29 4.29 4.56 1.18 3.18 0.92 11.33 	127 807 001); I ² : I ² = 0% Total 34 29 40 40 37 24 21 30	15.8% 100.0% = 88% Weight 5.3% 5.3% 5.3% 5.3% 5.2% 4.7% 4.7% 5.3%	-0.98 [-1.66, -0.30] -1.26 [-1.59, -0.94] Std. Mean Difference IV. Random, 95% CI -0.77 [-1.27, -0.28] -0.59 [-1.12, -0.05] -1.38 [-1.87, -0.89] -1.66 [-2.19, -1.15] -1.66 [-2.19, -1.13] -1.88 [-2.58, -1.19] -1.46 [-2.16, -0.76] -0.23 [-0.74, 0.27]	Favours [experimental] Favours [control] Std. Mean Difference
Subtotal (95% CI) Heterogeneity: Tau ² = Test for overall effect: Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Test for subaroup diff Study or Subaroup diff Study or Subaroup diff Study or Subaroup diff Study or Subaroup List for subaroup diff Study or Subaroup diff Study of Subaroup di Subaroup diff Study of Subar	18.09 = 0.30; Ch : Z = 2.83 = 0.45; Ch : Z = 7.66 fferences: 24weeks 9.67 8.13 43.87 51.86 9.11 18.09 2.25	2.94 $hi^2 = 12.3$ (P = 0.0) $hi^2 = 153$ (P < 0.0) $Chi^2 = 100$ chi = 100 chi = 1000 chi = 10000 chi = 1000 chi = 10000 chi = 10000 chi = 10000 chi = 10000 chi = 100	130 33, df = 333, df =	= 2 (P = = 18 (P f = 3 (P <u>Mean</u> 11.12 9.39 49.12 59.75 11.14 23.96 3.43	 0.002); < 0.000 = 0.65). control SD 1.95 2.09 4.29 4.56 1.18 3.18 0.92 11.33 2.44 	127 807 001); ² ² = 0% <u>Total</u> 34 29 40 37 24 21	15.8% 5 100.0% = 88% 5 5 5 5 5 5 5 5 3% 5 5 5 3% 5 5 5 5 5 5 5 5 5 5 5 5 5	-0.98 [-1.66, -0.30] -1.26 [-1.59, -0.94] Std. Mean Difference IV, Random, 95% CI -0.77 [-1.27, -0.28] -0.59 [-1.12, -0.05] -1.38 [-1.87, -0.89] -1.66 [-2.19, -1.15] -1.66 [-2.19, -1.13] -1.88 [-2.58, -1.19] -1.46 [-2.16, -0.76]	Favours [experimental] Favours [control] Std. Mean Difference
Subtotal (95% CI) Heterogeneity: Tau ² = Test for overall effect: Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Test for subaroup diff Study or Subaroup diff Study or Subaroup diff Study or Subaroup Chen 2016 Jian 2021 Jiang 2023 Li 2011 Liu 2018 Ni 2019 Pan 2018 Ren 2017 Xia 2022	18.09 = 0.30; Ch : Z = 2.83 = 0.45; Ch : Z = 7.66 fferences: Expe Mean 24weeks 9.67 8.13 43.87 51.86 9.11 18.09 2.25 36.91	2.94 $hi^2 = 12.3$ (P = 0.0) $hi^2 = 153$ (P < 0.0) $Chi^2 = 100$ chi = 100 chi = 1000 erimenta SD 1.74 2.14 3.14 4.83 1.24 2.94 0.63 10.43	130 33, df = 333, df =	= 2 (P = = 18 (P f = 3 (P 0 11.12 9.39 49.12 59.75 11.14 23.96 3.43 39.5	 0.002); < 0.000 = 0.65). control SD 1.95 2.09 4.29 4.29 4.56 1.18 3.18 0.92 11.33 	127 807 001); I ² : I ² = 0% Total 34 29 40 40 37 24 21 30	15.8% 100.0% = 88% Weight 5.3% 5.3% 5.3% 5.3% 5.2% 4.7% 4.7% 5.3%	-0.98 [-1.66, -0.30] -1.26 [-1.59, -0.94] Std. Mean Difference IV. Random, 95% CI -0.77 [-1.27, -0.28] -0.59 [-1.12, -0.05] -1.38 [-1.87, -0.89] -1.66 [-2.19, -1.15] -1.66 [-2.19, -1.13] -1.88 [-2.58, -1.19] -1.46 [-2.16, -0.76] -0.23 [-0.74, 0.27]	Favours [experimental] Favours [control] Std. Mean Difference
Subtotal (95% CI) Heterogeneity: Tau ² = Test for overall effect: Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Test for subaroup diff Study or Subgroup 1.8.1 Depression <2 Chen 2016 Chen 2016 Jian 2021 Jiang 2023 Li 2011 Liu 2018 Ni 2019 Pan 2018 Ren 2017 Xia 2022 Xu 2021	18.09 = 0.30; Ch : Z = 2.83 = 0.45; Ch : Z = 7.66 fferences: Expe Mean 24weeks 9.67 8.13 43.87 51.86 9.11 18.09 2.25 36.91 31.45	2.94 $hi^{2} = 12.3$ (P = 0.0) $hi^{2} = 153$ (P < 0.0) $Chi^{2} = 100$ eriments SD 1.74 2.14 3.14 4.83 1.24 2.94 1.24 2.94 10.43 10.43 2.21	130 33, df = 333, df =	= 2 (P = T = 18 (P f = 3 (P 0 11.12 9.39 49.12 59.75 11.14 23.96 3.43 39.5 39.13	 0.002); < 0.000 = 0.65). control SD 1.95 2.09 4.29 4.56 1.18 3.18 0.92 11.33 2.44 	127 807 ()01); [² ; ²] () ² = 0% Total () ² = 0% () ² = 0%	15.8% 100.0% = 88% 5.3% 5.2% 5.3% 5.2% 4.7% 4.7% 5.3% 5.0%	-0.98 [-1.66, -0.30] -1.26 [-1.59, -0.94] Std. Mean Difference IV. Random, 95% CI -0.77 [-1.27, -0.28] -0.59 [-1.12, -0.05] -1.38 [-1.87, -0.89] -1.66 [-2.19, -1.13] -1.66 [-2.16, -0.76] -0.23 [-0.74, 0.27] -3.27 [-3.87, -2.68]	Favours [experimental] Favours [control] Std. Mean Difference
Subtotal (95% CI) Heterogeneity: Tau ² = Test for overall effect: Total (95% CI) Heterogeneity: Tau ² =	18.09 = 0.30; Ch : Z = 2.83 = 0.45; Ch : Z = 7.66 fferences: Expe <u>Mean</u> 24weeks 9.67 8.13 43.87 51.86 9.11 18.09 2.25 36.91 31.45 50.34	2.94 $h^{ P} = 12.2.$ $(P = 0.0$ $h^{ P} = 1533$ $(P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} = 1$ $rimentic transmission (P < 0.0 - Ch^{ P} $	130 33, df = 005) 8166 3.90, dt 00001) 1.66. d al Total 33 27 40 40 37 23 20 30 30 52 21 32 40	= 2 (P = = 18 (P f = 3 (P C Mean 11.12 9.39 49.12 59.75 51.14 23.96 3.43 39.13 39.13 54.38	 0.002); < 0.001 = 0.65). ontrol SD 1.95 2.09 4.29 4.29 4.29 4.29 4.29 1.18 3.18 0.92 11.33 3.18 0.92 2.44 2.17 	127 807 001); ² = 84% 001); ² = 0% Total 1 ² = 0% Total 34 29 40 37 24 21 30 052 130	15.8% 100.0% = 88% Weight 5.3%	-0.98 [-1.66, -0.30] -1.26 [-1.59, -0.94] Std. Mean Difference IV, Random, 95% CI -0.77 [-1.27, -0.28] -0.59 [-1.12, -0.05] -1.38 [-1.87, -0.89] -1.66 [-2.18, -1.15] -1.66 [-2.18, -1.15] -1.66 [-2.16, -0.76] -0.23 [-0.77, -0.27] -3.27 [-3.87, -2.68] -1.88 [-2.17, -1.59]	Favours [experimental] Favours [control] Std. Mean Difference
Subtotal (95% CI) Heterogeneity: Tau ² = Test for overall effect: Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: Test for subaroup diff Study or Subgroup 1.8.1 Depression <2 Chen 2016 Jian 2021 Jian 2021 Jiang 2023 Li 2011 Liu 2018 Ni 2019 Pan 2018 Ren 2017 Xia 2022 Xiu 2021 Yang 2023	18.09 = 0.30; Ch : Z = 2.83 = 0.45; Ch :: Z = 7.66 fferences: 24weeks 9.67 8.13 43.87 51.86 9.11 18.09 2.25 36.91 31.45 50.34 46.21	2.94 $ii^{2} = 12.$ (P = 0.0 $ii^{2} = 1533$ (P < 0.0 Chi ² = trimentu sb 1.74 4.83 1.24 4.83 1.24 4.83 1.24 4.83 1.24 4.83 1.24 5.294	130 33, df = 005) 8166 3.90, dt 00001) 1.66. d al Total 33 27 40 40 37 23 20 30 30 52 21 32 40	= 2 (P = = 18 (P f = 3 (P C Mean 11.12 9.39 49.12 59.75 59.75 39.13 39.13 39.5 39.13 54.38 53.62	 0.002); < 0.000 = 0.65). ontrol SD 1.95 2.09 4.29 4.56 0.92 1.33 2.47 4.54 	127 807 001); [² = 849 001); [² = 0% Total 1 ² = 0% 40 40 40 40 40 40 40 52 130 40 40 52 130 40 40	15.8% 100.0% = 88% 5.3% 5.	-0.98 [-1.66, -0.30] -1.26 [-1.59, -0.94] Std. Mean Difference IV, Random, 95% CI -0.77 [-1.27, -0.28] -0.59 [-1.12, -0.05] -1.38 [-1.87, -0.89] -1.66 [-2.19, -1.15] -1.66 [-2.19, -1.13] -1.88 [-2.58, -1.19] -1.46 [-2.68, -1.19] -1.46 [-2.16, -0.76] -0.23 [-0.74, 0.27] -3.27 [-3.87, -1.59] -1.47 [-1.97, -0.98]	Favours [experimental] Favours [control] Std. Mean Difference

1.8.2 Depression≥24weeks 52 40.25 59 41.1 40 50.11 48 12.31 Cao 2016 36.01 5.71 6.66 50 58 40 45 29 36.75 5.37 47.26 5.01 11.65 1.52 5.27 5.03 1.5 Chen 2017 Dong 2020 He 2015 30 42 271 Wang 2014 6.3 1.93 8.52 1.74 Zhao 2018 Subtotal (95% Cl) 42 264 6.1 2 8.7 1.7

Heterogeneity: Tau² = 0.07; Chi² = 12.17, df = 5 (P = 0.03); l² = 59% Test for overall effect: Z = 5.75 (P < 0.00001) Total (95% CI) 816 807 100.0%

Heterogeneity: Tau² = 0.45; Chi² = 153.90, df = 18 (P < 0.00001); l² = 88% Test for overall effect: Z = 7.66 (P < 0.00001) Test for subaroup differences: Chi² = 6.41. df = 1 (P = 0.01). l² = 84.4%

FIGURE 11 (Continued)

B

5.5%

5.6% 5.4% 5.5%

5.1%

5.4% **32.6**%

-0.68 [-1.08, -0.28] -0.81 [-1.19, -0.43] -0.56 [-1.01, -0.11] -0.43 [-0.85, -0.02]

-1.19 [-1.75, -0.63] -1.39 [-1.87, -0.91] -**0.82 [-1.10, -0.54]**

-1.26 [-1.59, -0.94]

-4

-2

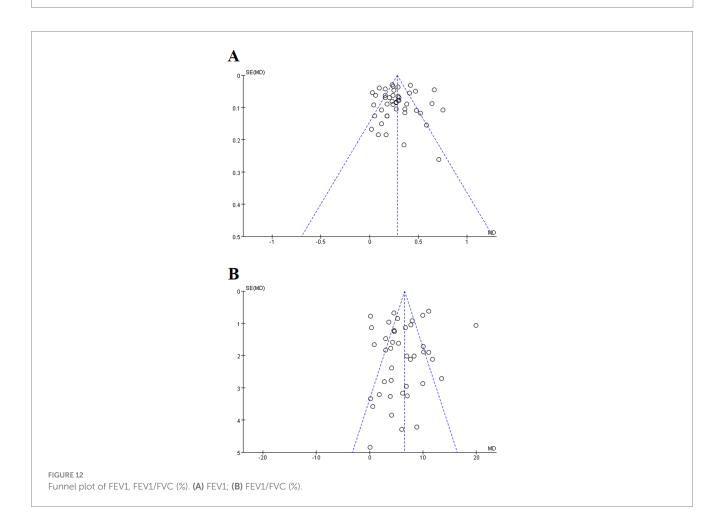
4

2

ό Favours [experimental] Favours [control]

	Expe	eriment	al	C	ontrol		5	Std. Mean Difference	Std. Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% Cl	IV, Random, 95% Cl
1.8.1 Frequency <5	times/we	ek							
Cao 2016	36.01	5.71	52	40.25	6.66	50	5.5%	-0.68 [-1.08, -0.28]	
Chen 2017	36.75	5.37	59	41.1	5.27	58	5.6%	-0.81 [-1.19, -0.43]	
Li 2011	51.86	4.83	40	59.75	4.56	40	5.3%	-1.66 [-2.18, -1.15]	
Ni 2019	18.09	2.94	23	23.96	3.18	24	4.7%	-1.88 [-2.58, -1.19]	
Pan 2018	2.25	0.63	20	3.43	0.92	21	4.7%	-1.46 [-2.16, -0.76]	
Ren 2017	36.91	10.43	30	39.5	11.33	30	5.3%	-0.23 [-0.74, 0.27]	
Xu 2021	50.34	2.12	132	54.38	2.17	130	5.8%	-1.88 [-2.17, -1.59]	
Yang 2023	46.21	5.38	40	53.62	4.54	40	5.3%	-1.47 [-1.97, -0.98]	
Yao 2022	28.56	2.76	42	35.73	3.26	38	5.1%	-2.36 [-2.94, -1.78]	
Zhang 2008	27.48	6.91	29	31.29	5.7	28	5.2%	-0.59 [-1.12, -0.06]	
Subtotal (95% CI)			467			459	52.5%	-1.29 [-1.72, -0.87]	◆
Heterogeneity: Tau ²	= 0.40; Cł	ni² = 72.	77, df=	= 9 (P <	0.00001); ² = 8	38%		
Test for overall effec	t: Z = 5.94	(P < 0.0	00001)						
1.8.2 Frequency>5	times/we	ek							
1.8.2 Frequency>5 Chen 2016		ek 1.74	33	11.12	1.95	34	5.3%	-0.77 [-1.27, -0.28]	
				11.12 50.11	1.95 5.03	34 40	5.3% 5.4%	-0.77 [-1.27, -0.28] -0.56 [-1.01, -0.11]	<u> </u>
Chen 2016	9.67	1.74	40						
Chen 2016 Dong 2020	9.67 47.26	1.74 5.01	40	50.11 12.31	5.03	40	5.4%	-0.56 [-1.01, -0.11]	
Chen 2016 Dong 2020 He 2015	9.67 47.26 11.65	1.74 5.01 1.52	40 48 27	50.11 12.31	5.03 1.5	40 45	5.4% 5.5%	-0.56 [-1.01, -0.11] -0.43 [-0.85, -0.02]	
Chen 2016 Dong 2020 He 2015 Jian 2021	9.67 47.26 11.65 8.13	1.74 5.01 1.52 2.14	40 48 27 40	50.11 12.31 9.39	5.03 1.5 2.09	40 45 29	5.4% 5.5% 5.2%	-0.56 [-1.01, -0.11] -0.43 [-0.85, -0.02] -0.59 [-1.12, -0.05]	
Chen 2016 Dong 2020 He 2015 Jian 2021 Jiang 2023	9.67 47.26 11.65 8.13 43.87	1.74 5.01 1.52 2.14 3.14	40 48 27 40	50.11 12.31 9.39 49.12	5.03 1.5 2.09 4.29	40 45 29 40	5.4% 5.5% 5.2% 5.3%	-0.56 [-1.01, -0.11] -0.43 [-0.85, -0.02] -0.59 [-1.12, -0.05] -1.38 [-1.87, -0.89]	
Chen 2016 Dong 2020 He 2015 Jian 2021 Jiang 2023 Liu 2018	9.67 47.26 11.65 8.13 43.87 9.11	1.74 5.01 1.52 2.14 3.14 1.24	40 48 27 40 37 30	50.11 12.31 9.39 49.12 11.14	5.03 1.5 2.09 4.29 1.18	40 45 29 40 37	5.4% 5.5% 5.2% 5.3% 5.2%	-0.56 [-1.01, -0.11] -0.43 [-0.85, -0.02] -0.59 [-1.12, -0.05] -1.38 [-1.87, -0.89] -1.66 [-2.19, -1.13]	
Chen 2016 Dong 2020 He 2015 Jian 2021 Jiang 2023 Liu 2018 Wang 2014	9.67 47.26 11.65 8.13 43.87 9.11 6.3	1.74 5.01 1.52 2.14 3.14 1.24 1.93	40 48 27 40 37 30	50.11 12.31 9.39 49.12 11.14 8.52	5.03 1.5 2.09 4.29 1.18 1.74	40 45 29 40 37 29	5.4% 5.5% 5.2% 5.3% 5.2% 5.1%	-0.56 [-1.01, -0.11] -0.43 [-0.85, -0.02] -0.59 [-1.12, -0.05] -1.38 [-1.87, -0.89] -1.66 [-2.19, -1.13] -1.19 [-1.75, -0.63]	
Chen 2016 Dong 2020 He 2015 Jian 2021 Jiang 2023 Liu 2018 Wang 2014 Xia 2022	9.67 47.26 11.65 8.13 43.87 9.11 6.3 31.45	1.74 5.01 1.52 2.14 3.14 1.24 1.93 2.21	40 48 27 40 37 30 52	50.11 12.31 9.39 49.12 11.14 8.52 39.13	5.03 1.5 2.09 4.29 1.18 1.74 2.44	40 45 29 40 37 29 52	5.4% 5.5% 5.2% 5.3% 5.2% 5.1% 5.0%	-0.56 [1.01, -0.11] -0.43 [-0.85, -0.02] -0.59 [-1.12, -0.05] -1.38 [-1.87, -0.89] -1.66 [-2.19, -1.13] -1.19 [-1.75, -0.63] -3.27 [-3.87, -2.68]	
Chen 2016 Dong 2020 He 2015 Jian 2021 Jiang 2023 Liu 2018 Wang 2014 Xia 2022 Zhao 2018	9.67 47.26 11.65 8.13 43.87 9.11 6.3 31.45 6.1	1.74 5.01 1.52 2.14 3.14 1.24 1.93 2.21 2	40 48 27 40 37 30 52 42 349	50.11 12.31 9.39 49.12 11.14 8.52 39.13 8.7	5.03 1.5 2.09 4.29 1.18 1.74 2.44 1.7	40 45 29 40 37 29 52 42 348	5.4% 5.5% 5.2% 5.2% 5.1% 5.0% 5.4% 4 7.5 %	-0.56 [-1.01, -0.11] -0.43 [-0.85, -0.02] -0.59 [-1.12, -0.05] -1.38 [-1.87, -0.89] -1.66 [-2.19, -1.13] -1.19 [-1.75, -0.63] -3.27 [-3.87, -2.86] -1.39 [-1.87, -0.91]	
Chen 2016 Dong 2020 He 2015 Jian 2021 Jiang 2023 Liu 2018 Wang 2014 Xia 2022 Zhao 2018 Subtotal (95% CI)	9.67 47.26 11.65 8.13 43.87 9.11 6.3 31.45 6.1 = 0.57; Cł	1.74 5.01 1.52 2.14 3.14 1.24 1.93 2.21 2 ni ^z = 79.	40 48 27 40 37 30 52 42 349 05, df=	50.11 12.31 9.39 49.12 11.14 8.52 39.13 8.7	5.03 1.5 2.09 4.29 1.18 1.74 2.44 1.7	40 45 29 40 37 29 52 42 348	5.4% 5.5% 5.2% 5.2% 5.1% 5.0% 5.4% 4 7.5 %	-0.56 [-1.01, -0.11] -0.43 [-0.85, -0.02] -0.59 [-1.12, -0.05] -1.38 [-1.87, -0.89] -1.66 [-2.19, -1.13] -1.19 [-1.75, -0.63] -3.27 [-3.87, -2.86] -1.39 [-1.87, -0.91]	
Chen 2016 Dong 2020 He 2015 Jian 2021 Jiang 2023 Liu 2018 Wang 2014 Xia 2022 Zhao 2018 Subtotal (95% CI) Heterogeneity: Tau ²	9.67 47.26 11.65 8.13 43.87 9.11 6.3 31.45 6.1 = 0.57; Cł	1.74 5.01 1.52 2.14 3.14 1.24 1.93 2.21 2 ni ^z = 79.	40 48 27 40 37 30 52 42 349 05, df=	50.11 12.31 9.39 49.12 11.14 8.52 39.13 8.7	5.03 1.5 2.09 4.29 1.18 1.74 2.44 1.7	40 45 29 40 37 29 52 42 348	5.4% 5.5% 5.2% 5.2% 5.1% 5.0% 5.4% 4 7.5 %	-0.56 [-1.01, -0.11] -0.43 [-0.85, -0.02] -0.59 [-1.12, -0.05] -1.38 [-1.87, -0.89] -1.66 [-2.19, -1.13] -1.19 [-1.75, -0.63] -3.27 [-3.87, -2.86] -1.39 [-1.87, -0.91]	
Chen 2016 Dong 2020 He 2015 Jian 2021 Jiang 2023 Liu 2018 Wang 2014 Xia 2022 Zhao 2018 Subtotal (95% CI) Heterogeneity: Tau ²	9.67 47.26 11.65 8.13 43.87 9.11 6.3 31.45 6.1 = 0.57; Cł	1.74 5.01 1.52 2.14 3.14 1.24 1.93 2.21 2 ni ^z = 79.	40 48 27 40 37 30 52 42 349 05, df=	50.11 12.31 9.39 49.12 11.14 8.52 39.13 8.7	5.03 1.5 2.09 4.29 1.18 1.74 2.44 1.7	40 45 29 40 37 29 52 42 348); ² = 9	5.4% 5.5% 5.2% 5.2% 5.1% 5.0% 5.4% 4 7.5 %	-0.56 [-1.01, -0.11] -0.43 [-0.85, -0.02] -0.59 [-1.12, -0.05] -1.38 [-1.87, -0.89] -1.66 [-2.19, -1.13] -1.19 [-1.75, -0.63] -3.27 [-3.87, -2.86] -1.39 [-1.87, -0.91]	
Chen 2016 Dong 2020 He 2015 Jian 2021 Jiang 2023 Liu 2018 Wang 2014 Xia 2022 Zhao 2018 Subtotal (95% Cl) Heterogeneity: Tau ² Test for overall effec	9.67 47.26 11.65 8.13 43.87 9.11 6.3 31.45 6.1 = 0.57; CI t Z = 4.64	1.74 5.01 1.52 2.14 1.24 1.93 2.21 2 hi ² = 79. (P < 0.0	40 48 27 40 37 30 52 42 349 05, df= 00001) 816	50.11 12.31 9.39 49.12 11.14 8.52 39.13 8.7 8 (P <	5.03 1.5 2.09 4.29 1.18 1.74 2.44 1.7	40 45 29 40 37 29 52 42 348); ² = 9 807	5.4% 5.5% 5.2% 5.2% 5.2% 5.1% 5.0% 5.4% 47.5% 90%	-0.56 [-1.01, -0.11] -0.43 [-0.85, -0.02] -0.59 [-1.12, -0.05] -1.38 [-1.87, -0.89] -1.66 [-2.19, -1.13] -1.19 [-1.75, -0.63] -3.27 [-3.87, -2.68] -1.39 [-1.87, -0.91] -1.24 [-1.76, -0.71]	
Chen 2016 Dong 2020 He 2015 Jian 2021 Jiang 2023 Liu 2018 Wang 2014 Xia 2022 Zhao 2018 Subtotal (95% CI) Heterogeneity: Tau ² Test for overall effec Total (95% CI)	9.67 47.26 11.65 8.13 43.87 9.11 6.3 31.45 6.1 = 0.57; Cl t Z = 4.64	1.74 5.01 1.52 2.14 3.14 1.24 1.93 2.21 2 1.24 1.93 (P < 0.0) (P < 0.0)	40 48 27 40 37 30 52 42 349 05, df= 00001) 816 3.90, dt	50.11 12.31 9.39 49.12 11.14 8.52 39.13 8.7 = 8 (P <	5.03 1.5 2.09 4.29 1.18 1.74 2.44 1.7	40 45 29 40 37 29 52 42 348); ² = 9 807	5.4% 5.5% 5.2% 5.2% 5.2% 5.1% 5.0% 5.4% 47.5% 90%	-0.56 [-1.01, -0.11] -0.43 [-0.85, -0.02] -0.59 [-1.12, -0.05] -1.38 [-1.87, -0.89] -1.66 [-2.19, -1.13] -1.19 [-1.75, -0.63] -3.27 [-3.87, -2.68] -1.39 [-1.87, -0.91] -1.24 [-1.76, -0.71]	+ + + + + + + + + + + + + + + + + + +

Effect of TCE on depression in patients with COPD. (A) Types of intervention; (B) Duration of intervention; (C) Frequency of intervention.



regarding the independent efficacy of TCE in the rehabilitation of COPD patients.

5 Conclusion

To summarize, this study shows that TCE have a significant influence on improving lung function, alleviating anxiety and depression in COPD patients. Compared with drug intervention, TCEs are simple, inexpensive, easy to learn and practice, and not limited by the venue. They are one of the important means to alleviate the social and economic burden caused by COPD, providing more choices for clinical treatment. This study not only highlights the nonpharmacological intervention value of TCE but also provides new directions for psychological intervention, which deserves wider promotion.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

SL: Data curation, Validation, Conceptualization, Formal analysis, Supervision, Methodology, Writing – original draft, Investigation, Software, Visualization. DX: Conceptualization, Writing – review & editing, Funding acquisition, Project administration, Resources.

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Funding

The author(s) declare that no financial support was received for the research and/or publication of this article.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2025.1612741/ full#supplementary-material

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