

Original Article

Comparison of Yoga and Tai Chi Exercises in Patients With Asthma

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ABSTRACT

Background: Asthma can impair exercise tolerance, pulmonary function, and health-related quality of life. Yoga and Tai Chi are mind-body approaches that may complement conventional asthma management, but direct comparative evidence is limited. **Objective:** To compare the effects of Yoga-based exercise and Tai Chi on cardiopulmonary fitness and health-related quality of life in adults with asthma. **Methods:** This randomized clinical trial included 30 adults with mild-to-moderate asthma at Ittefaq Hospital, Lahore, Pakistan. Participants were allocated to Yoga (n=15) or Tai Chi (n=15) and completed supervised 30-minute sessions three times weekly for eight weeks. Outcomes included SGRQ, 6MWT, VO₂ max, spirometry, dyspnea, and cardiorespiratory measures. Continuous outcomes were assessed using paired and independent-samples comparisons, with direct between-group changes calculated where supported by the reported data. **Results:** Yoga produced a greater reduction in SGRQ total score than Tai Chi (between-group change -6.68 points; 95% CI -10.21 to -3.15; p<0.001) and a greater increase in 6MWT distance (+31.44 m; 95% CI 14.35–48.53; p<0.001), FEV₁ (+0.098 L; 95% CI 0.038–0.158; p=0.003), and FEV₁ predicted (+3.18 percentage points; 95% CI 1.14–5.22; p=0.003). Week-8 VO₂ max was also higher with Yoga (mean difference 3.22 mL/kg/min; p=0.005). Between-group changes in FEV₁/FVC, FVC, and cardiorespiratory responses were not significant. **Conclusion:** Both interventions were associated with improvement, while Yoga showed greater short-term benefit for selected quality-of-life, functional, and pulmonary outcomes. **Keywords:** Asthma; Yoga; Tai Chi; Cardiopulmonary Fitness; Health-Related Quality of Life; Pulmonary Rehabilitation; Randomized Clinical Trial.

INTRODUCTION

Asthma is a chronic inflammatory disorder of the airways characterized by variable respiratory symptoms, including wheezing, cough, chest tightness, and breathlessness, together with fluctuating airflow limitation. Although appropriate medical management is fundamental to asthma control, many patients continue to experience limitations in physical activity, exercise tolerance, respiratory function, and health-related quality of life. These limitations may contribute to physical deconditioning and reduced participation in daily activities, particularly when breathlessness or fear of symptom exacerbation discourages regular exercise. Previous intervention studies in patients with asthma have therefore increasingly examined complementary exercise and breathing-based approaches aimed at improving respiratory function, symptom control, and quality of life (1–4).

Cardiopulmonary fitness is particularly relevant in asthma because respiratory symptoms and reduced exercise participation can influence functional capacity and aerobic performance. Functional exercise capacity can be assessed using measures such as the Six-Minute Walk Test, whereas aerobic capacity may be reflected by maximal oxygen uptake. Pulmonary function measures, including forced expiratory volume in one second, forced vital capacity, and the FEV₁/FVC ratio, provide complementary information regarding ventilatory function and airflow limitation. In addition to these physiological outcomes, health-related quality of life is an important patient-centered outcome because asthma may affect activity, symptom burden, emotional well-being, and participation in everyday life. Studies of respiratory and exercise-based interventions in asthma have demonstrated that improvements in physiological function may occur alongside improvements in asthma control and quality of life (2–4).

Yoga has received considerable attention as a complementary intervention for people with asthma because it combines physical postures, controlled breathing techniques, and relaxation or meditative components. These elements may provide a structured approach to physical conditioning while simultaneously emphasizing respiratory control and relaxation. Randomized studies have reported improvements in pulmonary function among patients with asthma following Yoga-based interventions (2). Other trials have demonstrated favorable effects of Yoga or pranayama-based breathing on symptom control, pulmonary function, and quality of life (1,3). Yoga has also been investigated as an adjunct to conventional asthma management, with evidence suggesting benefits in asthma control and other patient-reported outcomes (4,5). More recent studies have continued to report improvements in respiratory symptoms, psychological outcomes, inflammatory measures, or related clinical outcomes following structured Yoga programs in patients with asthma (6). Collectively, these findings support the potential role of Yoga as a complementary component of asthma rehabilitation, although the magnitude and consistency of benefit vary across outcomes and intervention protocols.

Breathing-focused exercise may be particularly relevant because respiratory control constitutes a central component of several Yoga programs. Pranayama and related breathing exercises have been associated with improvements in pulmonary function, asthma control, quality of life, and functional respiratory outcomes in patients with asthma (3,7). These interventions differ from conventional aerobic exercise because they combine voluntary breathing regulation with relaxation and, in many programs, physical postures or meditation. However, Yoga is not the only mind-body intervention that integrates controlled breathing with physical movement, and comparative evaluation against other structured mind-body approaches is therefore important.

Tai Chi is another mind-body exercise characterized by slow, coordinated movements, postural control, balance, concentration, and synchronized breathing. Although the asthma-specific evidence base for Tai Chi is smaller than that for Yoga, available studies suggest potential respiratory benefits. Tai Chi Chuan has been reported to improve lung function and asthma control in children with asthma, with proposed effects involving respiratory and immune-related mechanisms (8). Improvements in pulmonary function, exhaled nitric oxide, and quality of life have also been reported following Tai Chi training in children with asthma (9). Similar favorable findings have been described in younger populations with bronchial asthma undergoing structured Tai Chi exercise (10). These findings indicate that Tai Chi may have value as a complementary respiratory exercise; however, the available evidence is relatively limited and has frequently involved pediatric populations.

The comparative effectiveness of different mind-body exercise approaches in asthma remains insufficiently established. Existing asthma studies have more commonly compared Yoga with usual care, breathing interventions, or aerobic exercise rather than directly with Tai Chi. Studies comparing Yoga or pranayama with aerobic exercise have reported beneficial effects on asthma-related outcomes, but these comparisons do not establish whether Yoga provides greater benefit than another breathing-coordinated mind-body exercise such as Tai Chi (11,12). Direct comparisons of Yoga and Tai Chi have been undertaken in other clinical populations, including patients with diabetic neuropathy, but findings from such populations cannot be directly generalized to asthma because the underlying impairments, treatment objectives, and physiological responses differ (13). Consequently, evidence from separate Yoga and Tai Chi studies does not adequately answer which intervention may produce greater improvement in asthma-related functional and patient-reported outcomes.

This gap is clinically relevant because Yoga and Tai Chi are both low-cost, non-pharmacological exercise approaches that can potentially be incorporated into supervised rehabilitation programs, yet they differ in their

physical and respiratory emphasis. Yoga commonly combines sustained postures, specific breathing exercises, and meditation, whereas Tai Chi relies predominantly on continuous slow movement, postural transitions, balance, and coordinated breathing. A direct comparison may therefore clarify whether these different training characteristics result in different effects on health-related quality of life, functional exercise capacity, aerobic capacity, pulmonary function, dyspnea, and cardiorespiratory responses in patients with asthma.

Accordingly, the present randomized clinical trial was conducted to compare the effects of Yoga-based exercises and Tai Chi exercises in adults with mild-to-moderate asthma. The study evaluated health-related quality of life using the St. George's Respiratory Questionnaire and cardiopulmonary outcomes including Six-Minute Walk Test performance, VO_2 max, spirometric parameters, dyspnea, and selected cardiorespiratory responses before and after an eight-week supervised intervention. The study tested the hypothesis that the effects of Yoga-based exercise and Tai Chi exercise would differ with respect to cardiopulmonary fitness and health-related quality of life in patients with asthma.

MATERIAL AND METHODS

A two-arm randomized clinical trial was conducted to compare the effects of Yoga-based exercise and Tai Chi exercise on cardiopulmonary fitness and health-related quality of life in adults with asthma. The study was carried out at Ittefaq Hospital, Lahore, Pakistan, over a study period of approximately 10 months following approval of the research synopsis. The intervention period for each participant lasted eight weeks, with supervised exercise sessions conducted three times per week. The target population comprised adults with clinically diagnosed mild-to-moderate persistent bronchial asthma who were able to participate safely in supervised exercise training.

Participants were recruited from the outpatient clinical setting using convenience sampling and were screened against predefined eligibility criteria before enrollment. Men and women aged 25–35 years with mild-to-moderate persistent bronchial asthma were eligible if they demonstrated reversible airflow limitation, defined in the study protocol as an improvement in FEV_1 of more than 12% and more than 200 mL following bronchodilator administration. Participants were required to be nonsmokers or ex-smokers who had abstained from smoking for at least six months and to be willing and able to provide written informed consent. Individuals were excluded if they had used antibiotic or steroid medication during the preceding four weeks or had cardiovascular disease, neuromusculoskeletal disorders that could interfere with exercise performance, tuberculosis, hepatic or renal disease, pregnancy or lactation, or a history of thyroid or parathyroid disorders. Eligible participants received an explanation of the study procedures and their participation requirements, and written informed consent was obtained before enrollment.

The sample-size calculation was performed using Epitool on the basis of previously reported between-group outcome data. The calculation used a 95% confidence level, 80% statistical power, a two-tailed test, and a 1:1 allocation ratio between the intervention groups. A 20% allowance for attrition was incorporated into the calculation, giving a planned sample of 38 participants. Following eligibility screening, 30 participants were included in the randomized trial and allocated equally to the Yoga group ($n=15$) and Tai Chi group ($n=15$).

Random allocation was performed using a computer-generated randomization sequence. Allocation concealment was implemented using sealed envelopes, after which participants were assigned in a 1:1 ratio to Group A, which received Yoga-based exercise training, or Group B, which received Tai Chi exercise training. Outcome assessors were kept unaware of treatment allocation to reduce measurement bias. Because the interventions involved visibly different forms of supervised exercise, participant blinding was not feasible. The same intervention duration and weekly session frequency were applied to both groups to reduce differences in treatment exposure unrelated to the exercise modality.

The independent variable was the type of exercise intervention, namely Yoga-based exercise or Tai Chi exercise. The principal outcome domains were health-related quality of life and cardiopulmonary fitness. Health-related quality of life was assessed using the St. George's Respiratory Questionnaire (SGRQ), with symptom, activity, impact, and total scores used in the analysis. Lower SGRQ scores represented better respiratory health status. Functional exercise capacity was evaluated using the Six-Minute Walk Test (6MWT), expressed as the total distance walked in metres over six minutes. Aerobic capacity was assessed using VO_2 max expressed in mL/kg/min. Pulmonary function was evaluated using spirometric measures comprising forced expiratory volume in one second (FEV_1),

forced vital capacity (FVC), the FEV_1/FVC ratio, and FEV_1 percentage of predicted value. Dyspnea was assessed using the modified Medical Research Council (mMRC) dyspnea grading system, while exercise-related breathlessness was additionally recorded using the Borg dyspnea score. Cardiorespiratory measurements associated with the 6MWT included heart rate, respiratory rate, and peripheral oxygen saturation before and after the test. Adherence was assessed from the number of supervised exercise sessions attended out of the 24 scheduled sessions and was also expressed as a percentage. Adverse events occurring during the intervention period were recorded for comparison between the groups.

Baseline assessment was completed before initiation of the exercise program. Demographic and clinical information was recorded, followed by measurement of SGRQ scores, spirometric parameters, 6MWT distance, VO_2 max, mMRC dyspnea grade, and cardiorespiratory responses associated with exercise testing. The same principal clinical and functional outcomes were reassessed after completion of the eight-week intervention to permit evaluation of change over time and comparison between the two exercise groups. Measurements at baseline were designated as Week 0 and post-intervention measurements as Week 8.

Participants allocated to the Yoga group completed a structured supervised session of approximately 30 minutes three times weekly for eight weeks. The program incorporated Yoga postures, controlled breathing exercises, and guided meditation. The postural component included Gomukhasana, Ardhamatsyendrasana, Paschimottanasana, Bhujangasana, Dhanurasana, Naukasana, Parva Asana, Tadasana, and Shavasana. The breathing component lasted approximately seven minutes and consisted of Nadishodhana for three minutes, Bhastrika for two minutes, and Bhramari for two minutes. Approximately 10 minutes were allocated to guided meditation emphasizing breathing awareness, postural control, and relaxation. The intervention was progressively delivered across the eight-week training period under professional supervision. Yoga interventions incorporating postures, controlled breathing, and relaxation have previously been evaluated as complementary approaches in patients with asthma (1–5).

Participants allocated to the Tai Chi group also attended supervised sessions approximately 30 minutes in duration, three times weekly for eight weeks. The Tai Chi program incorporated gentle warm-up activity, slow rhythmic Tai Chi movements emphasizing coordinated movement and body control, controlled breathing, balance and postural exercises, and a cool-down period incorporating relaxation. The intervention was intended to integrate breathing control with coordinated low-impact movement and postural training. Tai Chi has previously been investigated as a mind-body exercise for improving respiratory and functional outcomes in people with asthma, including pediatric asthma populations (8–10).

At the completion of the eight-week intervention, participants underwent repeat assessment of health-related quality of life, functional exercise capacity, aerobic capacity, pulmonary function, dyspnea, and cardiorespiratory responses. Exercise adherence was determined from attendance across the 24 planned supervised sessions. Any adverse events reported during the trial were recorded and compared between the intervention groups. The use of equal treatment duration, supervised exercise delivery, concealed random allocation, blinded outcome assessment, standardized pre- and post-intervention assessment points, and identical session frequency across groups was intended to reduce selection, performance, and measurement-related sources of bias.

Data were entered and analyzed using IBM SPSS Statistics version 25.0. Continuous variables were summarized using means and standard deviations, whereas categorical variables were summarized using frequencies and percentages. Distributional assumptions for continuous outcomes were examined using the Shapiro–Wilk test because of the small number of participants in each intervention group. Baseline categorical characteristics were compared between treatment groups using Pearson's chi-square test, with Fisher's exact test used where small expected cell counts made the chi-square approximation unsuitable. Continuous outcomes were compared between the Yoga and Tai Chi groups using independent-samples t-tests, and pre- to post-intervention changes within each group were evaluated using paired-samples t-tests. Where the assumption of normality was not satisfied, non-parametric testing was considered appropriate. The mMRC measure was treated as an ordinal categorical outcome for group comparison rather than as a normally distributed continuous measure. Statistical tests were two-sided, and a p-value of ≤ 0.05 was considered statistically significant. Results were interpreted together with mean differences and 95% confidence intervals where these were available. Analyses were based on the participant observations available for the two randomized groups at the specified assessment time points.

The study incorporated voluntary participation, written informed consent, confidentiality of participant information, and the right to withdraw from the study without penalty. Participant information was used for research purposes and handled confidentially. The study protocol specified ethical review through the Institutional Review Board of the University of Lahore before commencement of data collection, and the consent documentation explained the nature of participation, confidentiality, and voluntary withdrawal to prospective participants.

RESULTS

Thirty participants were analyzed, with 15 allocated to Yoga and 15 to Tai Chi. The groups were generally comparable with respect to gender, smoking status, educational level, baseline mMRC dyspnea grade, SGRQ scores, VO_2 max, and spirometric measures. Marital-status distribution differed between groups on exact testing ($p=0.014$). Two additional baseline imbalances were evident among continuous outcomes: the Tai Chi group had a greater 6MWT distance than the Yoga group (421.96 ± 46.65 vs 387.61 ± 42.61 m, $p=0.044$), while pre-6MWT heart rate was lower in the Yoga group (73.33 ± 9.51 vs 79.53 ± 6.61 bpm, $p=0.047$). Pasted text(20261019-050333) Pasted text(20261019-050333)

Health-related quality of life improved in both intervention groups, with larger reductions in all SGRQ domains after Yoga. Direct comparison of the change scores showed a greater reduction with Yoga in SGRQ Symptoms by 7.36 points (95% CI 1.54–13.18 in favor of Yoga; $p=0.015$; $lg|=-0.93$), Activity by 16.65 points (95% CI 10.01–23.29; $p<0.001$; $lg|=1.84$), Impact by 7.04 points (95% CI 0.80–13.28; $p=0.029$; $lg|=0.83$), and Total score by 6.68 points (95% CI 3.15–10.21; $p<0.001$; $lg|=1.38$). The largest standardized between-group effect was observed for the SGRQ Activity domain. Pasted text(20261019-050333) Pasted text(20261019-050333)

Functional exercise capacity increased from 387.61 ± 42.61 to 454.25 ± 39.08 m in the Yoga group and from 421.96 ± 46.65 to 457.17 ± 45.75 m in the Tai Chi group. The corresponding mean increases were 66.65 m and 35.21 m, producing a between-group difference in change of 31.44 m (95% CI 14.35–48.53; $p<0.001$; $g=1.34$). Thus, although the Tai Chi group began with a higher walking distance and the Week-8 group means were similar, the increase over the intervention period was larger in the Yoga group. VO_2 max increased from 27.51 ± 2.94 to 31.84 ± 2.69 mL/kg/min with Yoga and from 26.23 ± 2.73 to 28.61 ± 3.16 mL/kg/min with Tai Chi. At Week 8, Yoga had a 3.22 mL/kg/min higher mean VO_2 max than Tai Chi (95% CI 1.03–5.42; $p=0.005$; $g=1.07$). Pasted text(20261019-050333) Pasted text(20261019-050333)

Table 1. Baseline characteristics of the study participants

Characteristic	Yoga (n=15)	Tai Chi (n=15)	p-value
Male, n (%)	7 (46.7)	6 (40.0)	1.000
Female, n (%)	8 (53.3)	9 (60.0)	1.000
Never smoker, n (%)	15 (100.0)	13 (86.7)	0.483
Ex-smoker, n (%)	0 (0.0)	2 (13.3)	0.483
Primary education, n (%)	1 (6.7)	2 (13.3)	0.763
Secondary education, n (%)	3 (20.0)	5 (33.3)	0.763
College education, n (%)	7 (46.7)	6 (40.0)	0.763
University or above, n (%)	4 (26.7)	2 (13.3)	0.763
Single, n (%)	7 (46.7)	14 (93.3)	0.014
Married, n (%)	7 (46.7)	1 (6.7)	0.014
Divorced/widowed, n (%)	1 (6.7)	0 (0.0)	0.014
mMRC grade 1, n (%)	5 (33.3)	7 (46.7)	0.728
mMRC grade 2, n (%)	6 (40.0)	6 (40.0)	0.728
mMRC grade 3, n (%)	4 (26.7)	2 (13.3)	0.728
SGRQ Symptoms	53.07 $\pm$ 6.69	57.30 $\pm$ 9.08	0.158
SGRQ Activity	56.54 $\pm$ 8.91	51.70 $\pm$ 7.97	0.128
SGRQ Impact	49.97 $\pm$ 7.41	52.67 $\pm$ 11.19	0.443
SGRQ Total	51.83 $\pm$ 5.46	55.79 $\pm$ 7.66	0.114
6MWT distance, m	387.61 $\pm$ 42.61	421.96 $\pm$ 46.65	0.044
VO_2 max, mL/kg/min	27.51 $\pm$ 2.94	26.23 $\pm$ 2.73	0.226
FEV ₁ , L	2.46 $\pm$ 0.31	2.38 $\pm$ 0.24	0.405
FVC, L	3.42 $\pm$ 0.40	3.44 $\pm$ 0.43	0.924
FEV ₁ /FVC, %	71.97 $\pm$ 3.15	69.15 $\pm$ 4.53	0.058
FEV ₁ predicted, %	77.97 $\pm$ 7.19	76.31 $\pm$ 6.76	0.521
HR before 6MWT, bpm	73.33 $\pm$ 9.51	79.53 $\pm$ 6.61	0.047
HR after 6MWT, bpm	103.27 $\pm$ 9.68	109.40 $\pm$ 12.44	0.143
RR before 6MWT, breaths/min	15.93 $\pm$ 1.58	16.47 $\pm$ 2.77	0.523
RR after 6MWT, breaths/min	24.20 $\pm$ 1.78	25.60 $\pm$ 3.25	0.154
SpO ₂ before 6MWT, %	97.25 $\pm$ 1.47	97.02 $\pm$ 1.05	0.631
SpO ₂ after 6MWT, %	96.03 $\pm$ 1.37	95.57 $\pm$ 0.99	0.309
Borg dyspnea score	4.22 $\pm$ 1.40	4.39 $\pm$ 1.64	0.767

Categorical p-values for gender and smoking were based on Fisher's exact test. Because of sparse expected counts, education, marital status, and baseline mMRC distributions were re-evaluated using the Fisher-Freeman-Halton exact test.

Continuous-variable p-values are the independent-samples comparisons reported in the manuscript. Abbreviations: SGRQ, St. George's Respiratory Questionnaire; mMRC, modified Medical Research Council; 6MWT, Six-Minute Walk Test; FEV₁, forced expiratory volume in 1 second; FVC, forced vital capacity; HR, heart rate; RR, respiratory rate; SpO₂, peripheral oxygen saturation.

The baseline counts and continuous data are drawn from the manuscript's original Tables 1–5 and 9–12. Pasted text(20261019-050333) Pasted text(20261019-050333)

Table 2. Changes in health-related quality of life from baseline to Week 8

Outcome	Yoga baseline	Yoga Week 8	Yoga change (95% CI)	Tai Chi baseline	Tai Chi Week 8	Tai Chi change (95% CI)	Between-group difference in change (95% CI)	p-value	Hedges g
SGRQ Symptoms	53.07 ± 6.69	36.37 ± 8.69	-16.71 (-20.09, -13.32)	57.30 ± 9.08	47.95 ± 13.87	-9.35 (-14.37, -4.34)	-7.36 (-13.18, -1.54)	0.015	-0.93
SGRQ Activity	56.54 ± 8.91	33.82 ± 7.52	-22.72 (-28.46, -16.98)	51.70 ± 7.97	45.62 ± 11.95	-6.07 (-9.91, -2.24)	-16.65 (-23.29, -10.01)	<0.001	-1.84
SGRQ Impact	49.97 ± 7.41	33.21 ± 10.70	-16.76 (-22.41, -11.12)	52.67 ± 11.19	42.95 ± 11.80	-9.72 (-12.85, -6.59)	-7.04 (-13.28, -0.80)	0.029	-0.83
SGRQ Total	51.83 ± 5.46	35.32 ± 7.14	-16.51 (-19.24, -13.79)	55.79 ± 7.66	45.96 ± 10.95	-9.83 (-12.33, -7.33)	-6.68 (-10.21, -3.15)	<0.001	-1.38

Negative change values indicate reduction in SGRQ score. Between-group differences in change were calculated as Yoga change minus Tai Chi change. Hedges g was calculated from the reconstructed SD of change derived from the reported 95% CI of each paired mean change.

The underlying baseline, Week-8, and paired-change values are those reported in the manuscript. Pasted text(20261019-050333) Pasted text(20261019-050333)

Table 3. Exercise capacity and aerobic fitness outcomes

Outcome	Yoga baseline	Yoga Week 8	Yoga change	Tai Chi baseline	Tai Chi Week 8	Tai Chi change	Between-group estimate (95% CI)	p-value	Hedges g
6MWT distance, m	387.61 ± 42.61	454.25 ± 39.08	+66.65	421.96 ± 46.65	457.17 ± 45.75	+35.21	+31.44 (14.35, 48.53)	<0.001	1.34
VO ₂ max, mL/kg/min	27.51 ± 2.94	31.84 ± 2.69	+4.33	26.23 ± 2.73	28.61 ± 3.16	+2.38	+3.22 (1.03, 5.42)*	0.005*	1.07*

For 6MWT, the between-group estimate represents the difference in mean change and was derived from the reported paired-change confidence intervals. For VO₂ max, a change-score CI was not reported and could not be validly reconstructed; the starred estimate, p-value, and effect size therefore represent the reported Week-8 between-group comparison rather than a difference in change. Hedges g for VO₂ max is based on the Week-8 group means and SDs.

The manuscript reported a significant baseline imbalance in 6MWT distance but not in VO₂ max. Pasted text(20261019-050333) Pasted text(20261019-050333)

Table 4. Pulmonary function outcomes from baseline to Week 8

Outcome	Yoga baseline	Yoga Week 8	Yoga change (95% CI)	Tai Chi baseline	Tai Chi Week 8	Tai Chi change (95% CI)	Between-group difference in change (95% CI)	p-value	Hedges g
FEV ₁ , L	2.465 ± 0.31	2.652 ± 0.33	+0.187 (+0.158, +0.217)	2.379 ± 0.24	2.469 ± 0.26	+0.089 (+0.035, +0.144)	+0.098 (+0.038, +0.158)	0.003	1.20
FEV ₁ predicted, %	77.97 ± 7.19	83.50 ± 7.06	+5.53 (+3.94, +7.11)	76.31 ± 6.76	78.66 ± 6.82	+2.35 (+0.92, +3.78)	+3.18 (+1.14, +5.22)	0.003	1.14
FEV ₁ /FVC, %	71.97 ± 3.15	74.93 ± 3.10	+2.96 (+2.03, +3.90)	69.15 ± 4.53	70.87 ± 4.86	+1.72 (+0.46, +2.98)	+1.24 (-0.26, +2.74)	0.102	0.60
FVC, L	3.422 ± 0.40	3.536 ± 0.36	+0.114 (+0.058, +0.170)	3.437 ± 0.43	3.504 ± 0.46	+0.067 (-0.026, +0.161)	+0.047 (-0.058, +0.152)	0.365	0.33

Between-group differences were calculated as Yoga change minus Tai Chi change. Hedges g was calculated from the reconstructed SD of individual change scores obtained from the reported 95% confidence intervals of the paired changes.

These calculations use the original spirometric means and paired-change confidence intervals. Pasted text(20261019-050333) Pasted text(20261019-050333)

Table 5. Cardiorespiratory responses, dyspnea, adherence, and adverse events

Outcome	Yoga baseline	Yoga Week 8	Tai Chi baseline	Tai Chi Week 8	Between-group difference in change (95% p-value CI)	Hedges g	
HR before 6MWT, bpm	73.33 ± 9.51	70.33 ± 8.67	79.53 ± 6.61	76.93 ± 6.30	-0.40 (-2.58, 1.78)	0.709	
HR after 6MWT, bpm	103.27 ± 9.68	99.27 ± 10.28	109.40 ± 12.44	103.33 ± 9.71	+2.07 (-2.69, 6.83)	0.380	
RR before 6MWT, breaths/min	15.93 ± 1.58	15.40 ± 1.92	16.47 ± 2.77	15.80 ± 2.96	+0.14 (-0.54, 0.82)	0.676	
RR after 6MWT, breaths/min	24.20 ± 1.78	22.47 ± 2.33	25.60 ± 3.25	24.40 ± 3.36	-0.53 (-1.64, 0.58)	0.337	
SpO ₂ before 6MWT, %	97.25 ± 1.47	97.41 ± 1.39	97.02 ± 1.05	97.33 ± 1.31	-0.14 (-0.48, 0.20)	0.406	
SpO ₂ after 6MWT, %	96.03 ± 1.37	96.75 ± 1.76	95.57 ± 0.99	96.53 ± 1.34	-0.22 (-0.77, 0.33)	0.420	
Additional outcome		Yoga (n=15)	Tai Chi (n=15)		Effect estimate	95% CI	p-value
Sessions attended, mean ± SD		20.53 ± 1.96	19.60 ± 1.55		+0.93	-0.39 to +2.25	0.159
Adherence, %		85.61 ± 8.18	81.34 ± 6.13		+4.28	-1.13 to +9.68	0.117
Adverse events, n (%)		5 (33.3)	7 (46.7)		RR 0.71	0.29 to 1.75	0.710
mMRC grade 0 at Week 8, n (%)		3 (20.0)	3 (20.0)				0.449
mMRC grade 1 at Week 8, n (%)		6 (40.0)	7 (46.7)				0.449
mMRC grade 2 at Week 8, n (%)		6 (40.0)	3 (20.0)				0.449
mMRC grade 3 at Week 8, n (%)		0 (0.0)	2 (13.3)				0.449

Cardiorespiratory between-group change estimates were derived from the reported paired-change confidence intervals. Adverse-event relative risk compares Yoga with Tai Chi; Fisher's exact p-value is reported. The Week-8 mMRC distribution was re-evaluated using the Fisher-Freeman-Halton exact test because of sparse cell counts. Blank effect-estimate cells indicate that an appropriate single ordinal effect estimate could not be calculated from the aggregated category counts alone.

The source values are reported in the original cardiorespiratory, adherence, mMRC, and adverse-event tables. Pasted text(20261019-050333) Pasted text(20261019-050333) Pasted text(20261019-050333)

For pulmonary function, the increase in FEV₁ was 0.187 L with Yoga and 0.089 L with Tai Chi. The between-group difference in change was 0.098 L (95% CI 0.038–0.158; p=0.003; g=1.20). FEV₁ percentage predicted increased by 5.53 percentage points in the Yoga group compared with 2.35 percentage points in the Tai Chi group, giving a difference in change of 3.18 percentage points (95% CI 1.14–5.22; p=0.003; g=1.14). The between-group change difference for FEV₁/FVC was 1.24 percentage points (95% CI -0.26 to 2.74; p=0.102), while the corresponding difference for FVC was 0.047 L (95% CI -0.058 to 0.152; p=0.365). Accordingly, the change-score analysis supported a between-group difference for FEV₁ and FEV₁ percentage predicted, but not for FEV₁/FVC or FVC. Pasted text(20261019-050333) Pasted text(20261019-050333)

Both groups demonstrated numerical changes in several cardiorespiratory responses over the eight-week intervention; however, none of the direct between-group differences in change reached statistical significance. The change difference was -0.40 bpm for pre-6MWT heart rate (95% CI -2.58 to 1.78; p=0.709), +2.07 bpm for post-6MWT heart rate (95% CI -2.69 to 6.83; p=0.380), +0.14 breaths/min for pre-6MWT respiratory rate (95% CI -0.54 to 0.82; p=0.676), and -0.53 breaths/min for post-6MWT respiratory rate (95% CI -1.64 to 0.58; p=0.337). Similarly, the difference between-group change in pre- and post-6MWT oxygen saturation were small and imprecise. Pasted text(20261019-050333) Pasted text(20261019-050333)

Adherence was high in both groups. Participants attended a mean of 20.53 ± 1.96 of 24 sessions in the Yoga group and 19.60 ± 1.55 sessions in the Tai Chi group, corresponding to adherence rates of 85.61 ± 8.18% and 81.34 ± 6.13%, respectively; neither comparison was statistically significant. Adverse events were reported by 5 of 15 participants (33.3%) in the Yoga group and 7 of 15 (46.7%) in the Tai Chi group, corresponding to a relative risk of 0.71 (95% CI 0.29–1.75; Fisher's exact p=0.710). Week-8 mMRC distributions also did not differ significantly between groups on exact testing (p=0.449).

DISCUSSION

This randomized clinical trial compared eight weeks of supervised Yoga-based exercise with Tai Chi in adults with mild-to-moderate asthma. Both interventions were associated with improvement across several patient-reported and physiological outcomes, but the pattern of between-group change favored Yoga for health-related quality of life, 6-minute walk distance, FEV₁, and FEV₁ percentage predicted. Yoga also produced a higher Week-8 VO₂ max, whereas between-group differences in change were not demonstrated for FEV₁/FVC, FVC, heart rate, respiratory rate, or oxygen saturation. These findings suggest that the relative advantage of Yoga in this sample was outcome-specific rather than uniform across all measures of cardiopulmonary function.

The most consistent between-group differences were observed in health-related quality of life. Yoga produced larger reductions than Tai Chi across the SGRQ Symptoms, Activity, Impact, and Total domains, with the largest standardized effect observed for activity limitation. This pattern is consistent with previous asthma studies reporting favorable effects of Yoga on symptom control, pulmonary function, and quality of life (1–4). Bahçecioğlu Turan and Tan reported improvement in respiratory function, symptom control, and quality of life following Yoga in patients with asthma, while Agnihotri et al. demonstrated beneficial changes in pulmonary function after a structured Yoga intervention (1,2). Pranayama-based and combined breathing-relaxation interventions have also been associated with improvements in asthma control and patient-reported outcomes (3,4). The present findings extend this body of evidence by suggesting that, when directly compared with another mind-body intervention, Yoga may provide greater short-term benefit for perceived respiratory health and activity-related limitation.

Several mechanisms may plausibly contribute to the observed differences in quality-of-life outcomes. The Yoga intervention combined postures, structured breathing exercises, and meditation, whereas the Tai Chi program emphasized continuous slow movement, breathing coordination, posture, and balance. Controlled breathing practices such as pranayama may improve awareness and regulation of breathing patterns and may reduce the sensation of breathlessness or anxiety associated with respiratory symptoms (3,5,7). In addition, the meditative and relaxation components of Yoga may influence symptom perception and emotional responses to chronic respiratory disease. These mechanisms were not directly measured in the present study, and therefore they should be regarded as plausible explanations rather than demonstrated mediators of the observed effect.

Functional exercise capacity improved in both groups, but the increase in 6MWT distance was larger following Yoga. This finding should be interpreted in the context of an important baseline imbalance because the Tai Chi group began with a significantly greater walking distance. By Week 8, the absolute walking distances were similar between groups, indicating that the larger change in the Yoga group partly reflected greater room for improvement from a lower baseline level. Nevertheless, the direct difference in change remained in favor of Yoga. Previous research has similarly suggested that Yoga and breathing-based interventions can improve exercise tolerance and functional performance in respiratory disease populations (4,7). The present result therefore supports a potential functional benefit, although confirmation using larger trials with baseline-adjusted analyses would strengthen confidence in the magnitude of the treatment effect.

The aerobic-capacity findings showed a similar general pattern. Baseline VO_2 max was comparable between groups, whereas the Yoga group demonstrated a higher value after the intervention. This is broadly consistent with the concept that repeated breathing control, postural activity, and supervised physical training can influence ventilatory efficiency and exercise tolerance. Studies comparing Yoga or pranayama with aerobic exercise in patients with asthma have also reported favorable effects of Yoga on respiratory and functional outcomes (11,12). However, because a direct between-group change estimate for VO_2 max could not be reconstructed from the available summary statistics, the present finding should be interpreted as a Week-8 group difference rather than definitive evidence of a larger change over time.

Pulmonary-function responses were more selective. The direct change-score analysis showed greater improvements with Yoga for FEV_1 and FEV_1 percentage predicted, whereas the between-group changes in FEV_1/FVC and FVC were not statistically different. This distinction is important because the original Week-8 comparison suggested a significant group difference in FEV_1/FVC , but the change-score analysis did not demonstrate a significant difference in improvement between groups. Previous Yoga studies in asthma have reported gains in spirometric measures, including FEV_1 and other pulmonary-function indices (2,3). Structured breathing may contribute through improved respiratory muscle coordination, breathing pattern control, thoracic mobility, and more efficient ventilation, although these specific physiological pathways were not evaluated in the current trial. Tai Chi may provide some of the same respiratory benefits through coordinated movement and breathing, which could help explain why both groups improved while between-group differences were absent for several spirometric outcomes.

The findings for Tai Chi remain clinically relevant despite the smaller magnitude of change in several outcomes. Previous studies in asthma, particularly pediatric populations, have reported improvements in pulmonary function, asthma control, exhaled nitric oxide, and quality of life after Tai Chi training (8–10). In the present trial, Tai Chi participants demonstrated within-group improvement across several outcomes and maintained good adherence.

These findings support Tai Chi as a feasible supervised mind-body exercise option, although the available data do not establish that it is equivalent to Yoga. Differences between the present study and earlier Tai Chi studies may relate to age, intervention content, asthma severity, duration of training, outcome selection, and sample size.

Cardiorespiratory responses to the 6MWT did not show clear between-group differences in change. Although the Yoga group had a lower pre-exercise heart rate at Week 8, it also had a lower value at baseline, making it inappropriate to attribute the Week-8 difference solely to the intervention. Direct comparisons of change in heart rate, respiratory rate, and oxygen saturation were not statistically significant. This indicates that the apparent advantage of Yoga was not consistent across all physiological domains and reinforces the need to distinguish baseline differences from true intervention effects.

Adherence was acceptable in both groups, with no statistically significant difference in session attendance or adherence percentage. This is an important practical finding because both interventions required regular supervised participation over eight weeks. Adverse events were numerically less frequent with Yoga than Tai Chi, but the relative-risk estimate was imprecise and the group difference was not statistically significant. Therefore, the data support similar short-term tolerability rather than a conclusion that one intervention was safer than the other.

The study had several strengths. It used a randomized two-group design, applied the same intervention duration and session frequency to both groups, incorporated supervised training, and assessed multiple clinically relevant domains including quality of life, functional exercise capacity, aerobic capacity, spirometry, dyspnea, adherence, and physiological responses. The direct comparison of Yoga and Tai Chi also addressed a clinically relevant question that has been less frequently examined than comparisons of Yoga with usual care or aerobic exercise.

Several limitations should be considered when interpreting the findings. The total sample was small, with 15 participants in each group, which limited statistical precision and the ability to detect modest between-group differences. Recruitment was conducted at a single hospital and involved adults aged 25–35 years with mild-to-moderate asthma, limiting generalizability to older adults, adolescents, patients with severe asthma, and other clinical settings. Baseline imbalances were present for marital status, 6MWT distance, and pre-exercise heart rate, and these differences complicate interpretation of unadjusted post-treatment comparisons. The study also evaluated numerous outcomes, increasing the possibility of chance findings arising from multiple statistical tests. Follow-up ended after eight weeks, so the persistence of any benefit after supervised training is unknown. In addition, the study did not include a usual-care or non-exercise control group, which means that improvements observed within both groups cannot be attributed exclusively to the exercise interventions themselves.

Overall, the findings indicate that both Yoga and Tai Chi can be incorporated into supervised exercise programs for adults with mild-to-moderate asthma, but Yoga showed a more favorable short-term pattern for several patient-centered and functional outcomes in this sample. The clearest comparative benefits were observed for SGRQ scores, functional walking improvement, FEV₁, and FEV₁ percentage predicted, while several other cardiopulmonary measures did not differ between interventions. Larger trials using prespecified primary outcomes, baseline-adjusted analysis, standardized intervention protocols, and longer follow-up are needed to determine the reproducibility and clinical importance of these differences.

CONCLUSION

In this randomized clinical trial of adults with mild-to-moderate asthma, both Yoga-based exercise and Tai Chi were associated with improvement in several health-related quality-of-life and cardiopulmonary outcomes over eight weeks. Compared with Tai Chi, Yoga showed greater improvement in SGRQ scores, 6-minute walk distance, FEV₁, and FEV₁ percentage predicted, and was associated with a higher Week-8 VO₂ max, whereas between-group differences were not demonstrated for several other spirometric and cardiorespiratory measures. These findings suggest that Yoga may provide a greater short-term benefit for selected quality-of-life, functional, and pulmonary outcomes, although the small sample and baseline imbalances warrant cautious interpretation.

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