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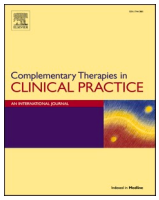

The effect of yoga on dyspnea, sleep, and quality of life in patients with bronchiectasis: A randomized controlled trial

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ABSTRACT

Background and purpose: Bronchiectasis is characterized by chronic cough, acute exacerbations, and excessive sputum production, along with symptoms such as shortness of breath and fatigue, which impair respiratory functions and quality of life. This study aims to investigate the effects of yoga on dyspnea, sleep quality, and overall quality of life in patients with bronchiectasis.

Materials and methods: Forty-eight participants with bronchiectasis were included in the study. The patients were randomly divided into two groups, the yoga group (n = 24) or control group (no placebo or sham intervention) (n = 24). The yoga group participated in a total of 24 sessions over 8 weeks, with three sessions per week. No intervention was performed on the patients in the control group. The Modified Medical Research Council (mMRC) questionnaire was used to assess patients' dyspnea level, and the Pittsburgh Sleep Quality Index (PSQI) and St. George's Respiratory Questionnaire (SGRQ) were used to assess sleep quality and health-related quality of life, respectively.

Results: It was observed that the yoga intervention affected the intergroup change in dyspnea severity score over time ($p < 0.05$) ($\bar{x}_{yoga}$ = 2.64-1.50 = *1.14*; $\bar{x}_{control}$2.24-1.95 = *0.29*). The decrease in the mean PSQI score of the yoga practice group (16.41-13.18 = 3.23) was significantly higher compared with the control group (14.90-14.57 = *0.33*). Post-practice SGRQ activity scores were significantly different from pre-practice SGRQ activity scores. Similar to the change in SGRQ activity and symptom scores, the impact score also changed significantly over time ($\bar{x}_{yoga}$12.55-9.09 = *3.46*; $\bar{x}_{control}$12–11.52 = *0.48*).

Conclusion: The results indicate that yoga may have a positive effect on dyspnea, sleep, and quality of life in patients with bronchiectasis.

1. Introduction

Bronchiectasis is a chronic and progressive lung disease characterized by dyspnea, chronic cough, sputum production, and abnormal and persistent enlargement of the bronchial structure due to bronchial infection [1]. Peripheral muscle weakness is a common feature of the disease, which is associated with decreased endurance, high levels of fatigue, and dyspnea [2–4]. As evidenced by results using the Modified Medical Research Council Dyspnea (mMRC) scale, difficulty in performing daily activities has been reported among people with bronchiectasis [5]. Dyspnea in bronchiectasis is multifactorial, with important factors including altered respiratory mechanics and inadequate gas exchange [4]. In individuals with moderate-to-severe bronchiectasis, dyspnea has been described as a result of expiratory airflow limitation, where the latter leads to a corresponding increase in dynamic hyperinflation and elevated levels of dyspnea, as well as commonly accepted functional abnormalities such as air accumulation [6,7].

Considering the wide range of ways in which bronchiectasis affects the body, numerous treatment methods are used to improve patients' quality of life and manage their symptoms. Recently, yoga has garnered increasing interest in the treatment of respiratory diseases. Several studies have demonstrated that yoga exercises can strengthen respiratory muscles, increase lung capacity, alleviate shortness of breath, and facilitate breath control [8,9].

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Yoga consists of various components, including relaxation, meditation, breathing exercises, and asanas (poses) [10,11]. The therapeutic effects of yoga have been proven through studies that emphasize the importance of controlling the body, emotions, and mind. The breathing exercises involved in yoga can facilitate balanced health through various poses and meditation by establishing a connection between the mind and body [12]. Several studies have demonstrated the positive effects of yoga on respiratory function, quality of life, and symptom control in patients with asthma [13,14]. For instance, Sharma et al. reported that yoga could improve respiratory function and quality of life in patients with asthma [15]. Satyanand et al. [16] found that yoga significantly enhanced body and mind awareness, energy levels, respiratory function, and pectoral muscle strength in patients with asthma, and Hoang et al. [9] demonstrated that yoga could improve lung capacity in these patients.

Yoga is well-known for its effect on stretching the back and waist regions, strengthening muscles, alleviating fatigue, regulating sleep, promoting mindfulness and positive perspective, and reducing stress. These practices have been reported to effectively enhance respiratory muscle strength, increase lung capacity, alleviate shortness of breath, and improve breath control [17]. Yoga is an effective means of rehabilitating respiratory diseases by improving respiratory functions [18]. Evidence-based studies have also proven that yoga is an important preventative practice for various diseases because it can enhance the quality of life for individuals with cardiovascular diseases, multiple sclerosis, diabetes, epilepsy, and low back pain [19–22].

Although there have been studies on yoga in various patient groups in Turkey [23,24], no specific study has been conducted on the effects of yoga on patients with bronchiectasis. There is a need for studies to investigate the effectiveness of yoga in managing symptoms in patients with bronchiectasis, and to contribute to the physiotherapy literature with their findings. Therefore, this study aimed to reveal the effects of yoga practice on shortness of breath, sleep, and quality of life in patients with bronchiectasis.

2. Methods

2.1. Study design

The study was conducted at Istanbul Medipol University, Faculty of Medicine, Department of Chest Diseases. Patients who were admitted to the hospital between September 2020 and September 2021 and diagnosed as having bronchiectasis were included. The study was designed as a randomized controlled clinical trial and approved by the Ethics Committee of Istanbul Medipol University University (protocol code: E−10840098-604.01.01–19408). The clinical trial registration number of the study is NCT04744220. The study was conducted in accordance with the principles of the Declaration of Helsinki. All patients provided written informed consent.

2.2. Participants

Patients aged 30–55 years, who had been diagnosed as having non-cystic fibrosis bronchiectasis for at least 3 months, were not participating in a regular exercise program for the last 3 months, had no other respiratory system disease, were not experiencing exacerbations, had no physical disease or cognitive disability during the study period, had no diagnosis of a cognitive disease that would prevent the understanding of the education given, and volunteered to participate were included in the study.

Patients aged over 55 years were not included in the study because of the high risk of comorbidities, which would adversely affect the reliability and objectivity of the analysis results. Patients who had been treated with antibiotics and those with acute exacerbations up to 4 weeks before the trial were excluded from the study.

2.3. Sample size calculation

The sample size for the study was calculated using the G*Power 3.1.9.6 software (University of Kiel). Based on a medium effect size (Cohen's d = .5), it was determined that 21 participants per group were needed to achieve 90 % statistical power with a 5 % margin of error for comparisons between two independent groups. To account for a potential 15 % dropout rate, the final sample included 48 participants, with 24 in each group [25].

2.4. Randomization

Forty-eight participants who met the inclusion criteria and were willing to participate in the study were randomly assigned to one of two parallel groups: the yoga group or control group (no placebo or sham intervention) (ratio 1:1). To allocate the participants, the Research Randomizer, which is an online randomization web service (https://www.randomizer.org/), was used. Simple randomization procedures (computer-generated random numbers) were applied, and sequentially numbered index cards containing random assignments were prepared. Each participant was asked to select a sealed, folded card. Subsequently, a researcher opened each envelope and assigned the participants to the yoga or control group based on the selected index card. After the study began, two people were excluded from the yoga group, one had difficulty reaching the treatment center and the other had insufficient spare time. Three patients were excluded from the control group because they were unable to allocate sufficient time. The analysis was performed using the data of 43 participants. A flow diagram showing the progress of the phases throughout the study is presented in Fig. 1.

2.5. Interventions

Yoga was performed for a total of 8 weeks, with three sessions per week. The researcher who led the online yoga sessions for the yoga group collected the patients' contact details to ensure the continuity of the practice, and the online group was created. Video and application booklets about the yoga techniques prepared by the researcher in parallel with the literature were given to the yoga group as intervention material [15].

In general, yoga is practised in groups in 60–90-min sessions [26]. The existing literature describes different types of yoga practice that have been found to be effective in the short and long term in patients with lung disease [27,28]. In parallel with these studies, a total of 24 yoga sessions, 3 days per week for 8 weeks were conducted online by the researcher. Groups of 6–8 people were formed. The groups were arranged according to the days and times that were convenient for the patients so that they could attend sessions that were most convenient for them. The researcher was in constant contact with the patients so that they could attend the sessions regularly.

Yoga consists of breathing techniques, asanas (postures) and relaxation phases [29]. Accordingly, the yoga sessions held in this study lasted 65 min in total and included the following exercises.

- 10 min of standing breathing exercise
  (Tadasana Pranayama, Ardha Kati Chakrasana x 3 repetetions)
- 10 min of sitting breathing exercise
  (Shashankasana Pranayama, Vakrasana, Ardha Matsyendrasna x 3 repetetions)
- 10 min of asana breathing exercise *(Asana Pranayama)*
- 15 min of sitting breathing exercise
  (Shashankasana Pranayama, Vakrasana, Ardha Matsyendrasna x 3 repetetions)
- 10 min of alternating breathing exercises
  (Bastrika, Nadishodhana, Suryanuloma Viloma, Chandranuloma Viloma x 5 repetetions)
- 10 min of deep relaxation exercises *(Dharana-Dhyna- Samadhi)*

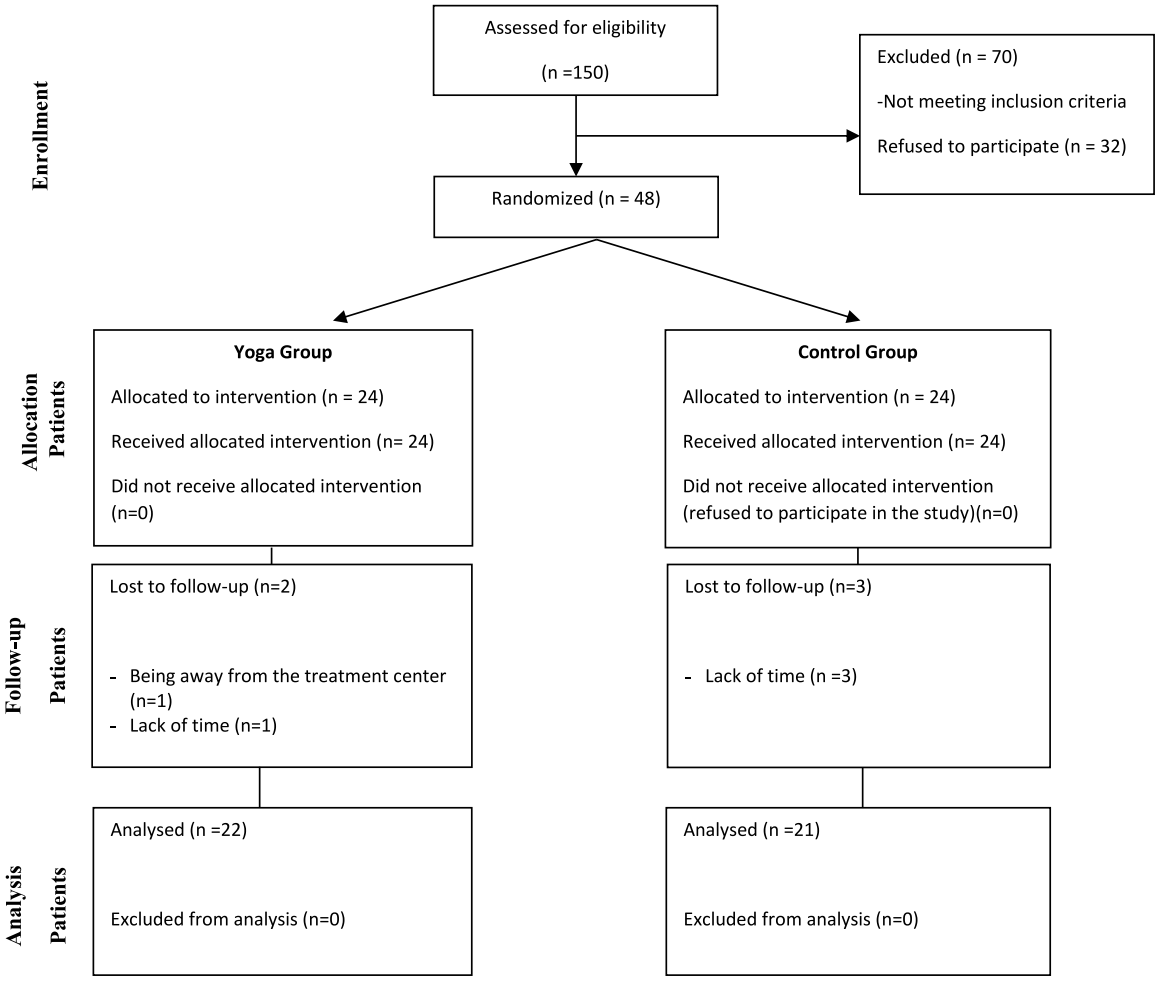


Fig. 1. Flow chart of study.

At the end of the sessions, the patients provided feedback. During the study, all patients in both groups were under the control of a pulmonologist and did not use any mucoactive drugs unless necessary.

The control group received no intervention during the study. However, at the end of the study, the yoga practice performed on the intervention group was introduced to 11 control patients who wanted to try it. In addition, all patients were given an educational booklet and a video on yoga techniques. The importance of respiratory physiotherapy in their treatment was explained to the patients in the control group.

2.6. Outcome measures

The patients included in the study were interviewed face-to-face at the first evaluation, and their demographic and clinical information was recorded. After 8 weeks, the evaluations were repeated face-to-face. A Personal Information Form, the mMRC questionnaire, Pittsburgh Sleep Quality Index (PSQI), and the St. George Respiratory Questionnaire (SGRQ) were used in the data collection process.

Personal Information Form: The personal information form, which was prepared by the researcher, included a total of 15 questions: five questions regarding socio-demographic characteristics such as age, sex, body mass index, educational status, and smoking history, and 10 questions about the patient's medical history such as presence of another chronic disease, family history of bronchiectasis, and time of diagnosis.

Modified Medical Research Council (mMRC) Questionnaire: The mMRC dyspnea scale was used to evaluate the level of dyspnea experienced by the patients. It is a 0–4-point category scale in which patients choose the statement that best describes shortness of breath among five statements. It is used to assess activity limitation due to dyspnea in patients [30].

Pittsburgh Sleep Quality Index (PSQI): The PSQI is commonly used to determine sleep-related disorders and sleep quality in the past month. This scale has a total of 24 questions with scores ranging from 0 to 21 points, consisting of 19 self-report questions and five questions that must be answered by a roommate or spouse. The PSQI evaluates the frequency of sleep-related problems, sleep duration, delays in falling asleep, and the impact of inadequate sleep on an individual's quality of life and a wide variety of domains associated with sleep quality [31]. The validity and reliability of the PSQI was also confirmed in Turkish [32].

St.George's Respiratory Questionnaire (SGRQ): The validity and reliability of the SGRQ has also been confirmed in Turkish [33]. The questionnaire consists of two parts and 50 items (symptom and current status of the patient). It includes the clinical symptoms (e.g., cough, sputum, shortness of breath, wheezing) of the patient in the last month in terms of severity. The patient's current status includes two subscales (activity and impact). The activity subscale assesses the impact of the disease on daily activity. The impact subscale evaluates the impact of the disease on the general health of the individual. Total quality of life and scores for each subscale were calculated by summing the relevant items and then normalized to the 0–100 range using the following formulas: Normal score = (raw score-min)/(maximum − min) × 100. On all subscales and quality-of-life scores, a high score indicates lower quality of life, and 0 represents excellent health [34].

2.7. Statistical analysis

The statistical analyses were performed using the SPSS version 23.0 program. Whether the variables were suitable for normal distribution was examined using histogram graphics and the Kolmogorov-Smirnov/ Shapiro-Wilk test. Mean and standard deviation values were used when presenting descriptive statistics. Frequency and percentage values of the variables were used when presenting categorical variables. Repeated measures analysis of variance (ANOVA) was performed to test the change of group means over time. Results with a p-value below .05 were considered statistically significant.

3. Results

A total of 43 participants were included in the study. The mean age of the yoga group was 43.41 ± 7.81 years, and the mean age of the control group was 38.05 ± 6.35 years. Women accounted for 40.91 % of the participants in the yoga group and 42.86 % of the control group. There was no statistically significant difference between the two groups in terms of sociodemographic and clinical characteristics except age (p>.05). Descriptive statistics of the yoga and control group variables are shown in Table 1.

The change in time had a significant effect on the dyspnea severity score (p = 0.01). It was observed that the dyspnea severity scores after the yoga practice were different from the dyspnea severity scores from beforehand. In addition, it was observed that yoga practice affected the intergroup change in dyspnea severity scores over time (p = 0.01). The decrease in mean dyspnea severity score in the yoga group was significantly greater than the mean decrease in dyspnea severity score in the control group (p = 0.01) (Fig. 2).

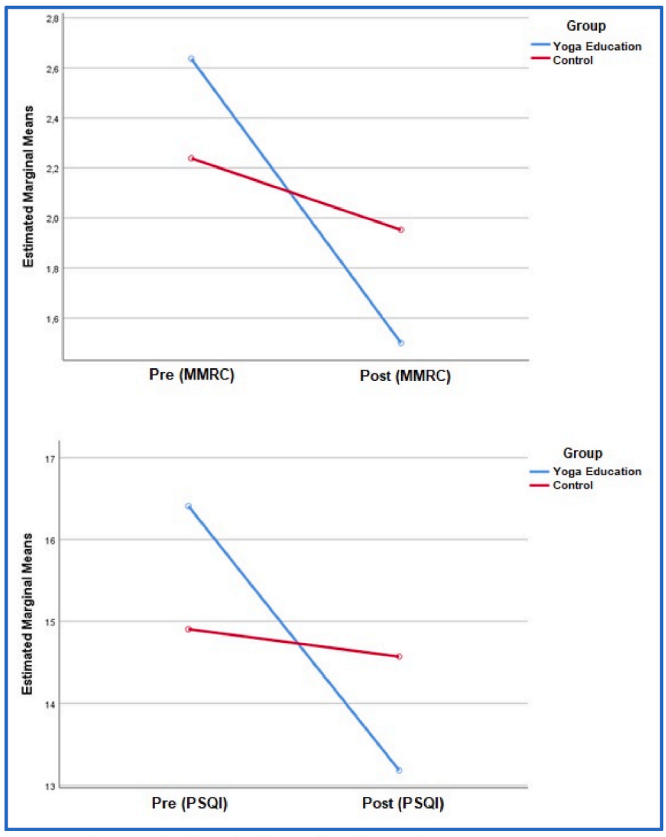
According to the results of the repeated measures ANOVA, the PSQI scores changed significantly after the yoga practice sessions (p = 0.01). The change in PSQI scores over time varied between the groups, indicating the importance of the intervention. The decrease in the mean PSQI score of the yoga group was significantly higher than the decrease in the mean PSQI score in the control group (p = 0.01) (Fig. 2).

Fig. 3-a shows that post-practice SGRQ symptom scores differ from previous SGRQ symptom scores. Interaction was also important in the variation of SGRQ symptom scores over time between the groups (p = 0.01). The decrease in SGRQ symptom scores in the yoga practice group was significantly higher than the decrease in SGRQ symptom scores in the control group (p = 0.01). Accordingly, as shown in Fig. 3-b, post-practice SGRQ activity scores were significantly different from pre-practice SGRQ activity scores. Interaction had a role in the intergroup difference in the change in SGRQ activity score over time (p = 0.01). The decrease in SGRQ activity scores in the yoga practice group was significantly higher than the decrease in the control group. Similar to the change in SGRQ activity and symptom scores, the impact score also changed significantly over time (p = 0.01) (Fig. 3-c). SGRQ impact scores after training were different from SGRQ impact scores before training, but the interaction was not significant (p > 0.05). In other words, the decrease in SGRQ effect score in the yoga practice group was similar to the decrease in the control group. Significant changes in symptom, activity, and effect over time were also valid for SGRQ total scores (p = 0.01) (Fig. 3-d). SGRQ total scores were different from the pre-practice SGRQ total scores, and interaction also affected the difference between groups (p = 0.01). The decrease in SGRQ total score in the yoga practice group was significantly greater than the decrease in SGRQ total score in the control group (Table 2) (Fig. 3-d).

Table 1
Comparison of demographic characteristics of groups.

Demographic and Clinical Features	Yoga Group (n = 22)	Control Group (n = 21)	*p- value*
Age (year) [c]	43.41 ± 7.81	38.05 ± 6.35	0.210[a]
Gender, n(%)			0.897[b]
Female	9 (40.91)	9 (42.86)	
Male	13 (59.09)	12 (57.14)	
BMI (kg/m^2)[c]	25.89 ± 3.44	26.41 ± 2.76	0.776[a]
Education, n(%)			0.704[b]
Elementary	6 (27.27)	4 (19.05)	
High School	6 (27.27)	7 (33.33)	
University	10 (45.45)	10 (47.62)	
Education (year) [c]	13.18 ± 3.87	13.62 ± 3.60	0.742[a]
Smoking, n(%)			0.341[b]
Yes	12 (54.55)	11 (52.38)	
No	10 (45.45)	10 (47.62)	
Cause of Admission, n(%)			0.522[b]
Dyspnea	21 (95.45)	19 (90.48)	
Atresia	13 (59.09)	13 (61.90)	
Wheeze	11 (50.00)	15 (71.43)	
Cough	15 (68.18)	14 (66.67)	
Phlegm	11 (50.00)	16 (76.19)	

Note: BMI = Body mass index (kg/m^2), kg = kilogram, cm = centimeter.
*p < 0.05.
[a] Mann Whitney-U Test.
[b] Kruskal Wallis Test.
[c] mean ± Standart deviation.

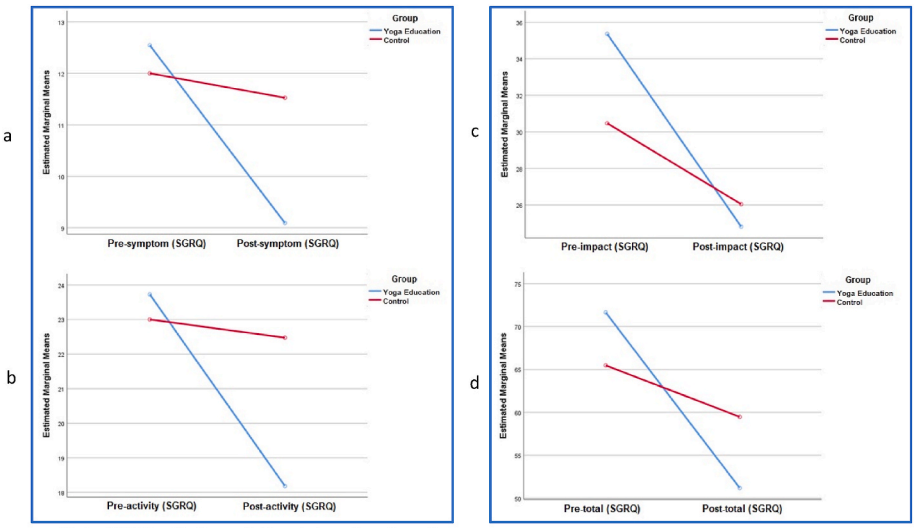


Note: PSQI = Pittsburgh Sleep Quality Index

Fig. 2. Change of dyspnea severity scores and PSQI scores over time in groups. Note: SGRQ = St. George's Respiratory Questionnaire, a = SGRQ-Symptom score, b = SGRQ-Activity score, c = SGRQ-Impact score, d = SGRQ-Total score.

4. Discussion

This study was conducted to investigate the effects of yoga on dyspnea, sleep, and quality of life in patients with bronchiectasis. A bibliographic review found that since 1964 there have been 486 studies showing the effects of yoga on respiratory and cardiac diseases. However, only 40 % of the studies conducted in the last 10 years used experimental methods [35]. Our experimental study showed a significant improvement in dyspnea, sleep, and quality of life after 8 weeks of



Note: SGRQ = St. George's Respiratory Questionnaire,
a = SGRQ-Symptom score, b = SGRQ-Activity score, c = SGRQ-Impact score, d = SGRQ-Total score

Fig. 3. Change of SGRQ sub-scores (a–c) and total score (d) over time in groups.

Table 2
Repeated measurement results before and after training.

Variables	Measurement time	Yoga Group (n = 22) mean ± SD	Control Group (n = 21) mean ± SD	p^1	p^2
mMRC	*BT*	2.64 ± .95	2.24 ± .94	**<0.001**	**0.001**
	AT	1.50 ± .91	1.95 ± .74		
PSQI	*BT*	16.41 ± 1.65	14.90 ± 1.97	**<0.001**	**<0.001**
	AT	13.18 ± 2.38	14.57 ± 1.86		
SGRQ - Symptom	*BT*	12.55 ± 2.84	12.00 ± 2.68	**<0.001**	**<0.001**
	AT	9.09 ± 2.60	11.52 ± 2.52		
SGRQ - Activity	*BT*	23.73 ± 4.51	23.00 ± 5.51	**<0.001**	**<0.001**
	AT	18.18 ± 3.75	22.48 ± 5.40		
SGRQ - Impact	*BT*	35.36 ± 7.50	30.48 ± 8.12	**<0.001**	.057
	AT	24.82 ± 12.31	26.05 ± 8.07		
SGRQ -Total	*BT*	71.64 ± 10.14	65.48 ± 12.09	**<0.001**	**<0.001**
	AT	51.18 ± 11.62	59.48 ± 11.91		

Note: mMRC = modified Medical Research Council Dyspnea Scale; PSQI = Pittsburgh Sleep Quality Index.
SGRQ = St. George's Respiratory Questionnaire, *BT* = Before training, *AT* = After training.
*p < 0.05, p^1 = Mann Whitney-U Test, p^2 = Wilcoxon Signed Rank Test.

yoga practice in patients with bronchiectasis who presented to the clinic with various symptoms.

Patients with bronchiectasis often experience chronic bronchial infections leading to a progressive decline in lung function, which can result in reduced exercise capacity and physical activity [36]. Pulmonary rehabilitation is one of the key components in the management of bronchiectasis. When the pre-test and post-test mean scores of the dyspnea scale were compared between the groups, a decrease was observed in the dyspnea values of the patients in the yoga group, but the decrease in the patients in the control group was not statistically significant. The findings indicate that yoga may have a positive effect on dyspnea levels in patients with bronchiectasis.

In their study, Agnihotri et al. showed that yoga had a positive effect on the treatment processes of patients with asthma. They found that yoga as a supportive additional treatment to pharmacologic treatment increased respiratory capacity in patients [37]. Karmur et al. concluded that yoga could be used as an alternative treatment method to increase the effectiveness of treatment in lung diseases [38]. A yoga practice study conducted on 50 patients with chronic heart failure (CHF) with reduced pulmonary functions and saturation levels showed that controlled breathing exercises caused an increase in oxygen consumption [39]. The results of our study on dyspnea score are consistent with the literature.

Sleep disturbances in adults with bronchiectasis are more common and associated with poorer quality of life than in healthy people due to depression, aging, nocturnal cough. and increased sputum volume [40,41]. Gao et al. compared 144 patients with bronchiectasis and healthy controls and reported that 82 patients with bronchiectasis had sleep disturbances based on PSQI (>5), which was significantly higher than in the healthy control group [42]. In a meta-analysis, sleep quality of women with breast cancer or peri/postmenopause was evaluated using the PSQI and 16 randomized controlled trials reported positive effects of yoga on improving sleep quality [43]. When the mean PSQI post-test scores of the groups were compared, it was found that the yoga group had lower mean post-test scores than the control group and the difference was statistically significant. This is consistent with the findings in our study, which observe a significant decrease in mean PSQI scores for the yoga practice group.

There are several studies showing the importance of yoga in disorders with similar symptoms such as airway irritations, constriction, inflammation, accelerated respiration, congestion, wheezing, coughing, and chest tightness [44]. In a study of the effect of yoga on sleep and respiratory problems in patients with chronic obstructive pulmonary disease (COPD) and asthma using the COPD and Asthma Fatigue Scale (CAFS) and Asthma and COPD Sleep Impact Scale (CASIS), it was reported that the respiratory capacity of the patients increased after 8 weeks of yoga practice [45]. The post-practice change in mMRC scores

obtained from that study is in line with our findings.

Quality of life was evaluated in a 10-week yoga practice study in patients with asthma [46]. The post-implementation changes in SGRQ scores obtained from the study are consistent with our results. When the mean post-test scores of SGRQ sub-parameters symptom, activity, effect, and total values between the groups were compared, it was observed that the mean score of the yoga group was significantly lower than that of the control group ($p < 0.05$). These results support the idea that the use of yoga as a complementary treatment, in addition to pharmacologic treatment, has a positive effect on the healing process of the disease.

4.1. Strengths and limitations

This study has important strengths. Despite the increasing number of studies over the past decade demonstrating the effects of yoga on conditions such as nasal allergy, asthma, chronic bronchitis, and lung cancer, there remains a significant gap in research evaluating its effects on chronic diseases such as bronchiectasis. Therefore, our research is of considerable importance in proposing an alternative therapeutic approach to this common clinical condition that significantly reduces patients' quality of life. A comprehensive analysis of our findings, together with the existing literature, underlines that the practice of yoga provides significant data suggesting a reduction in dyspnea, an improvement in sleep quality, and an improvement in overall quality of life.

Nevertheless, there are also limitations to our study. Our study is limited by the fact that we did not evaluate functional capacity and saturation tests, although our results could be beneficial in future studies that evaluate these factors. The study only measured short-term outcomes (up to 8 weeks); the long-term results of our methods were not evaluated. Our study was conducted within the scope of a thesis, accordingly, it could not be planned blindly and was conducted and interpreted by a single researcher. The patients in the control group received no placebo or sham intervention. A sham control group could also have been included in the study to observe the placebo effect.

In conclusion, our study indicates that yoga practice may have positively affected the sleep quality of patients with bronchiectasis and decreased their dyspnea symptoms. Our findings are important in terms of showing that yoga practice can be applied following pharmacologic treatment for patients with bronchiectasis. These results also offer the opportunity to expand the study in collaboration with different disciplines, such as cardiology and pulmonology, and several patients with chronic lung disease. With further research on this subject, we will be able to offer a treatment option to the chronic respiratory patient group that is not limited to pharmacologic or physiotherapeutic interventions but also includes different disciplines.

Conflict of interest

The authors have no conflicts of interest to declare.

Financial disclosure

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CRediT authorship contribution statement

M. Salih Tan: Writing – original draft, Investigation, Data curation. **Z. Candan Algun:** Writing – review & editing, Supervision. **Mustafa Duger:** Writing – review & editing, Supervision, Formal analysis. **Yasemin Aslan Keles:** Writing – review & editing, Writing – original draft, Resources, Methodology, Investigation.

Declaration of competing interest

The authors have no conflicts of interest to declare.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ctcp.2024.101914.

References

[1] E. Polverino, P.C. Goeminne, M.J. McDonnell, S. Aliberti, S.E. Marshall, M. R. Loebinger, et al., European Respiratory Society guidelines for the management of adult bronchiectasis, Eur. Respir. J. 50 (3) (2017 Sep 9) 1700629, https://doi.org/10.1183/13993003.00629-2017.

[2] A.A. de Camargo, J.C. Boldorini, A.E. Holland, R.A.S. de Castro, F.C. Lanza, R. A. Athanazio, et al., Determinants of peripheral muscle strength and activity in daily life in people with bronchiectasis, Phys. Ther. 98 (3) (2018 Mar 1) 153–161, https://doi.org/10.1093/ptj/pzx123. PMID: 29237078.

[3] O. Ozalp, D. Inal-Ince, A. Cakmak, E. Calik-Kutukcu, M. Saglam, S. Savci, et al., High-intensity inspiratory muscle training in bronchiectasis: a randomized controlled trial, Respirology 24 (3) (2019 Mar) 246–253, https://doi.org/10.1111/resp.13397.

[4] O. Ozalp, D. Inal-Ince, E. Calik, N. Vardar-Yagli, M. Saglam, S. Savci, et al., Extrapulmonary features of bronchiectasis: muscle function, exercise capacity, fatigue, and health status, Multidiscip Respir Med 7 (1) (2012 Jun 11) 3, https://doi.org/10.1186/2049-6958-7-3.

[5] M.A. Martínez-García, M. Perpiñá-Tordera, J.J. Soler-Cataluña, P. Román-Sánchez, A. Lloris-Bayo, A. González-Molina, Dissociation of lung function, dyspnea ratings and pulmonary extension in bronchiectasis, Respir. Med. 101 (11) (2007) 2248–2253, https://doi.org/10.1016/j.rmed.2007.06.028.

[6] D. Radovanovic, P. Santus, F. Blasi, G. Sotgiu, F. D'Arcangelo, E. Simonetta, et al., A comprehensive approach to lung function in bronchiectasis, Respir. Med. 145 (2018 Dec) 120–129, https://doi.org/10.1016/j.rmed.2018.10.031.

[7] M.Y. Liaw, Y.H. Wang, Y.C. Tsai, K.T. Huang, P.W. Chang, Y.C. Chen, et al., Inspiratory muscle training in bronchiectasis patients: a prospective randomized controlled study, Clin. Rehabil. 25 (6) (2011 Jun) 524–536, https://doi.org/10.1177/0269215510391682.

[8] P. Harika, R. Sayyad, P.K. Yadav, S. Sah, S.K. Kar, Evaluation of pulmonary function test before and after yoga practice in asthma patients, Indian J. Basic Med. Res IJBAMR 3 (2014) 8–14.

[9] K. Hoang, H. Nguyen, The effectiveness of practicing pranayama yoga on some respiratory indicators in patients suffering from bronchial disease, Int. J Sport Cult Sci 3 (2) (2015) 6–12.

[10] K. Altuntuğ, E. Ege, Mind based body applications, in: M. Başer, S. Taşçı (Eds.), *Complementary And Supporting Trainings With Evidence-Based Guidelines*, Yenişehir/Ankara: Academician Bookstore, 2015, pp. 25–35.

[11] A. Manaf, Pranayama Art of Breathing, third ed., Singing Offset, Istanbul, 2013.

[12] S.R. Vedala, A.B. Mane, C.N. Paul, Pulmonary functions in yogic and sedentary population, Int. J. Yoga 7 (2) (2014 Jul) 155–159, https://doi.org/10.4103/0973-6131.133904.

[13] S.K. Agarwal, Evidence based medical benefits of yoga, Indian J Sci 2 (2013) 1–4.

[14] K.A. Karmur, H.A. Jani, N.H. Vala, P.C. Bhanderi, Effect of Yoga on pulmonary function tests, Int J Res Med Sci 3 (9) (2017 Jan. 12) 2357–2361 [Internet]. (Accessed 28 October 2023).

[15] M. Sharma, T. Haider, P.P. Bose, Yoga as an alternative and complementary treatment for asthma: a systematic review, Journal of Evidence-Based Complementary and Alternative Medicine 17 (3) (2012) 212–217. Available from: http://chp.sagepub.com/content/17/3/212.

[16] V. Satyanand, G. Kumar, N. Ram, D. Mohanan, A. Shaik, P. Bingi, Study effect of two breathing techniques on pulmonary function in asthma, Int. J. Biomed. Res. 5 (8) (2014) 510–512, https://doi.org/10.7439/ijbrv5i8.707.

[17] L.M. Mullur, S. Bagali, J.P. Khodnapur, M. Aithala, Role of short term yoga on pulmonary functions of young and middle aged healthy individuals, IJBAR 3 (2012) 252–255.

[18] S. Haaz, S.J. Bartlett, Yoga for arthritis: a scoping review, Rheum. Dis. Clin. N. Am. 37 (1) (2011) 33–46, https://doi.org/10.1016/j.rdc.2010.11.001.

[19] S. Singh, V. Malhotra, K.P. Singh, S.V. Madhu, O.P. Tandon, Role of yoga in modifying certain cardiovascular functions in type 2 diabetic patients, J. Assoc. Phys. India 52 (2004) 203–206.

[20] B.S. Oken, S. Kishiyama, D. Zajdel, D. Bourdette, J. Carlsen, M. Haas, Randomized controlled trial of yoga and exercise in multiple sclerosis, Neurology 62 (11) (2004) 2058–2064, https://doi.org/10.1212/01.wnl.0000129534.88602.5c.

[21] T.N. Sathyaprabha, P. Satishchandra, C. Pradhan, S. Sinha, B. Kaveri, K. Thennarasu, B.T. Murthy, T.R. Raju, Modulation of cardiac autonomic balance with adjuvant yoga therapy in patients with refractory epilepsy, Epilepsy Behav. 12 (2) (2008 Feb) 245–252, https://doi.org/10.1016/j.yebeh.2007.09.006.

[22] K.J. Sherman, D.C. Cherkin, R.D. Wellman, A.J. Cook, R.J. Hawkes, K. Delaney, R. A. Deyo, A randomized trial comparing yoga, stretching, and a self-care book for

chronic low back pain, Arch. Intern. Med. 171 (22) (2011 Dec 12) 2019–2026, https://doi.org/10.1001/archinternmed.2011.524.
[23] F. Kavak, M. Ekinci, The effect of yoga on functional recovery level in schizophrenic patients, Arch. Psychiatr. Nurs. 30 (6) (2016) 761–767, https://doi.org/10.1016/j.apnu.2016.07.010.
[24] N.V. Yagli, O. Ulger, The effects of yoga on the quality of life and depression in elderly breast cancer patients, Compl. Ther. Clin. Pract. 21 (1) (2015) 7–10, https://doi.org/10.1016/j.ctcp.2015.01.002.
[25] K.R. Murphy, B. Myors, Statistical Power Analysis, a Simple and General Model for Traditional and Modern Hypothesis Test, Lawrence Erlbaum Associates, London, 2004, pp. 55–68.
[26] R. Nagarathna, H.R. Nagendra, Approach of Yoga Therapy Fo Positive Health: Swami Vivekananda Yoga.Bangalore, 2007.
[27] L.N. Joshi, V.D. Joshi, L.V. Gokhale, Effect of short term 'Pranayam' practice on breathing rate and ventilatory functions of lung, Indian J. Physiol. Pharmacol. 36 (2) (1992) 105–108.
[28] R. Vempati, R.L. Bijlani, K.K. Deepak, The efficacy of a comprehensive lifestyle modification programme based on yoga in the management of bronchial asthma: a randomized controlled trial, BMC Pulm. Med. 9 (2009) 37, https://doi.org/10.1186/1471-2466-9-37.
[29] M.E. Cameron, C.K. Cheung, R. Yoga, M.F. Lindquist, Tracy M. Snyder (Eds.), Complementary and Alternative Therapies in Nursing, eighth ed., Springer Publishing Company, New York, 2018, pp. 151–161.
[30] S.M. Brooks, Surveillance for respiratory hazards, ATS News 8 (1982) 12–16.
[31] D.J. Buysse, C.F. Reynolds, T.H. Monk, S.R. Berman, D.J. Kupfer, The Pittsburgh sleep quality index: a new instrument for psychiatric training and research, Psychiatr. Res. 28 (1989) 193–213, https://doi.org/10.1016/0165-1781(89)90047-4.
[32] İ. Agar, C. Malakcıoglu, H.H. Mutlu, Uykusuzluk şikayetleri ve uyku kalitesi temel ölçeği'nin Türkçe geçerlilik ve güvenirliği, Turkish Journal of Family Medicine and Primary Care 15 (4) (2021) 846–852, https://doi.org/10.21763/tjfmpc.971532.
[33] M. Polatlı, A. Yorgancıoğlu, Ö. Aydemir, N. Yılmaz Demirci, G. Kırkıl, S. Atış Naycı, et al., St. George solunum anketinin Türkçe geçerlilik ve güvenilirliği [Validity and reliability of Turkish version of St. George's respiratory questionnaire], Tuberk Toraks 61 (2) (2013) 81–87, https://doi.org/10.5578/tt.5404. Turkish.
[34] P.W. Jones, F.H. Quirk, C.M. Baveystock, P. Littlejohns, A self-complete measure of health status for chronic airflow limitation. The St. George's Respiratory Questionnaire, Am. Rev. Respir. Dis. 145 (6) (1992 Jun) 1321–1327, https://doi.org/10.1164/ajrccm/145.6.1321. PMID: 1595997.
[35] P.E. Jeter, J. Slutsky, N. Singh, S.B. Khalsa, Yoga as a therapeutic intervention: a bibliometric analysis of published research studies from 1967 to 2013, J. Alternative Compl. Med. 21 (10) (2015) 586–592, https://doi.org/10.1089/acm.2015.0057.
[36] S. Cedeño de Jesús, V. Almadana Pacheco, A. Valido Morales, A.M. Muñíz Rodríguez, R. Ayerbe García, A. Arnedillo-Muñoz, Exercise capacity and physical activity in non-cystic fibrosis bronchiectasis after a pulmonary rehabilitation home-based programme: a randomised controlled trial, Int. J. Environ. Res. Publ. Health 19 (17) (2022 Sep 3) 11039, https://doi.org/10.3390/ijerph191711039.
[37] S. Agnihotri, S. Kant, S. Mishra, R. Singh, Efficacy of yoga in mild to moderate persistent chronic bronchial asthma Indian, J. Tradit. Knowl. 15 (2016) 337–340.
[38] K.A. Karmur, H.A. Jani, N.H. Vala, P.C. Bhanderi, Effect of Yoga on pulmonary function tests, Int J Res Med Sci 3 (9) (2017 Jan. 12) 2357–2361 [Internet]. (Accessed 6 November 2023).
[39] S. Babbar, J. Shyken, Yoga in pregnancy, Clin. Obstet. Gynecol. 59 (3) (2016) 600–612, https://doi.org/10.1097/GRF.0000000000000210.
[40] F.A. Chandra, Respiratory trainings in yoga, in: In Behavioral and Psychological Approaches to Breathing Disorders, Springer, Boston, MA, 1994, pp. 221–232.
[41] Y. Bülbül, Ö. Erçen Diken, E.G. Uğur Chousein, Ulusal yayınlar ışığında Türkiye'de bronşektazi [Bronchiectasis in Turkey: Under the light of national publications], Tuberk Toraks 68 (1) (2020) 48–65, https://doi.org/10.5578/tt.69231.
[42] Y. Gao, W. Guan, G. Xu, Z. Lin, Y. Tang, Z. Lin, et al., Sleep disturbances and health-related quality of life in adults with steady-state bronchiectasis, PLoS One 9 (7) (2014 Jul 18) e102970, https://doi.org/10.1371/journal.pone.0102970.
[43] W.L. Wang, K.H. Chen, Y.C. Pan, S.N. Yang, Y.Y. Chan, The effect of yoga on sleep quality and insomnia in women with sleep problems: a systematic review and meta-analysis, BMC Psychiatr. 20 (1) (2020 May 1) 195, https://doi.org/10.1186/s12888-020-02566-4.
[44] M.A. Bray, K.A. Sassu, V. Kapoor, S. Margiano, H.L. Peck, T.J. Kehle, et al., Yoga as an intervention for asthma, School Psychology Forum 6 (2) (2012).
[45] L. Bernardi, G. Spadacini, J. Bellwon, R. Hajric, H. Roskamm, A.W. Frey, Effect of breathing rate on oxygen saturation and exercise performance in chronic heart failure, Lancet 351 (9112) (1998) 1308–1311, https://doi.org/10.1016/S0140-6736(97)10341-5.
[46] A.J. Bidwell, B. Yazel, D. Davin, T.J. Fairchild, J.A. Kanaley, Yoga practice improves quality of life in women with asthma, J. Alternative Compl. Med. 18 (8) (2012) 749–755, https://doi.org/10.1089/acm.2011.0079.