Medical Journal of Europe

ISSN: 2995-7907 doi: 10.5281/zenodo.11112996

The Effect of Pranayama Yoga Exercises on the Symptoms and Spirometric Respiration Parameters of Individuals with Group B COPD: Experimental Pilot Study

Selman Çelik [1], Sıdıka Oğuz [2], Huriye Berk Takir [3]

[1] Department of Nursing, Yeditepe University, Faculty of Health Sciences, Istanbul, Turkey
[2] Department of Nursing, Marmara University, Faculty of Health Sciences, Istanbul, Turkey
[3] Department of Internal Medicine Nursing, Süreyyapasa Chest Diseases and Chest Surgery Training and Research Hospital, Istanbul, Turkey

Article Info

Received: 4 April 2024

Revised: 27 April 2024

Accepted: 27 April 2024

Published: 27 April 2024

Keywords:

Pranayama yoga, COPD, symptom, spirometric respiratory parameters.

Corresponding author:

Selman Çelik.

Nursing Department, Yeditepe University, Faculty of Health Sciences, Istanbul, Turkey.

selman.celik@yeditepe.edu.tr

ABSTRACT

Chronic Obstructive Pulmonary Disease (COPD). is a disease characterized by progressive obstruction of the airways and respiratory distress, coughing and sputum production. Deep and controlled breathing exercises called pranayama yoga can be applied to prevent the progression of the disease, relieve breathing, increase some lung parameters and oxygenation of the body. This study was planned as a pilot study to examine the effects of pranayama yoga breathing exercises on symptom levels and spirometric respiratory parameters in individuals with group B COPD. The study sample consisted of 32 patients aged 40-65 years who were diagnosed with COPD for at least six months, who voluntarily agreed to participate in the study, Group B COPD patients according to GOLD Classification, and Stage I (mild). and Stage II (moderate). patients according to FEV1 value. Among the individuals with COPD, 14 individuals with COPD met the study criteria. The patients included in the study were filled with CAT and CAFS scales, PFTs were made, pranayama yoga was explained to the patients included in the study, 20 minutes of pranayama yoga was taught and practiced, the patients were allowed to practice pranayama yoga for 21 days. At the end of 21 days, the patients were evaluated. After Pranayam yoga exercises (21 days), the mean CAT score of the patients decreased from 14.50±3.52 to 5.21±2.78, the mean CAFS score ranged from 41.2±15.5 to 13.14±10.2, FVC(L) scores ranged from 3.48±0.56 to 3.60±.74, FEV1(L) scores from 2.40 ± 0.58 to 2.57±.67, FEV1/FVC (%) mean score from 68.2±8.2 to 71.7±7.7, PEF (L/s) score from 5.88±1.4 to 6.91±1.5, and the mean VC(L) score increased from 3.75±0.51 to 3.81±0.66. It was determined that Pranayama yoga exercises decreased the symptom and fatigue levels of individuals with group B COPD, and increased the spirometric values.

Cite as: Çelik S, Oğuz S, Berk Takir H. The Effect of Pranayama Yoga Exercises on the Symptoms and Spirometric Respiration Parameters of Individuals with Group B COPD: Experimental Pilot Study. Med J Eur. 2024;2(3):6-11. doi: 10.5281/zenodo.11075962

INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD). is a public health problem that is the fourth cause of death worldwide and has significant morbidity and mortality rates. COPD is a progressive disease characterized by symptoms of respiratory distress, chronic cough and sputum production associated with bronchial obstruction (1,2). According to World Health Organization (WHO). data, it is estimated that there are approximately 64 million individuals with COPD worldwide, 3.23 million people died due to COPD in 2019, and there is a 163% increase in COPD mortality (3,4)).

Situations such as environmental harmful gases and smoking, which increase with globalization, are important risk factors that play a role in the emergence of the disease. After long-term exposure to risk factors, obstruction occurs in the respiratory tract and the parenchymal structure of the lungs is disrupted.

For this reason, it prevents the body from oxygenating and causes hypoxia (1-3). To prevent the emergence of COPD and prevent the progression of existing COPD or hypoxia, individuals must avoid risk factors and ensure adequate oxygenation of the body. In today's world where air pollution is intense, it is important to do deep breathing exercises to ensure that the body receives sufficient oxygen and to prevent obstruction (4,5). Deep breathing exercises are important in relieving breathing difficulties in the airways of patients with airway obstruction such as COPD, ensuring that their tissues receive adequate oxygen, and improving the quality of life of patients (4,6,7). Deep breathing exercises called pranayama yoga increase the oxygen intake capacity of the alveoli in the lungs and the diffusion capacity in the membrane, facilitating gas exchange (7,8). Thus, tissue perfusion increases and more oxygen is bound to hemoglobin and transported (6,9). Therefore, the severity of symptoms such as dyspnea, fatigue, weakness and physical weakness is alleviated, the progression of the disease is prevented and the patient's quality of life increases. In addition, pranayama yoga may lead to an increase in spirometric values such as FVC (L) (Forced Vital Capacity), FEV1 (L) (Forced Vital Capacity in First Second), FEV1/FVC (%), PEF (L/min) (Peak Expiratory Flow) and VC (L) (Vital Capacity), which are important diagnostic findings in COPD. As a result, pranayama yoga practices increase the oxygen transfer in the lungs, expand the diffusion capacity, reduce the individual's symptom level and severity, and can provide significant change and improvement in some spirometric respiratory parameters (1,2,10,11).

The effects of many different exercises on individuals with COPD have been examined in the literature. However, the scarcity of studies examining the effects of pranayama yoga practices on individuals with COPD, and the fact that there is no study where it is applied and followed every day for 21 days, are thought to contribute to the literature by revealing the unique value of the research. This study was planned as an experimental study to examine the effects of pranayama yoga practices on symptom levels and spirometric respiratory parameters in individuals with Group B COPD. The results of the study are important in terms of giving COPD patients and healthcare professionals an idea about the effect of pranayama yoga on patients.

METHODS

COPD patients receiving inpatient or outpatient treatment at a chest diseases hospital between February and May 2022 were included in the study.

The sample of the study consists of 14 individuals with COPD who were randomly selected among 32 individuals with COPD, who were diagnosed with COPD for at least six months, who agreed to participate in the study voluntarily, and who were between the ages of 40-65. Patients with Group B COPD according to the Global Initiative for Chronic Obstructive Lung Disease (GOLD). Classification, that is, Stage I (mild) and Stage II (moderate) COPD according to FEV1 value, were included in the study. This study continues and is planned as a preliminary study of the doctoral thesis titled "The Effect of Pranayama Yoga on Symptoms, Fatigue and Respiratory Parameters in People with COPD".

This study is limited to patients with Group B Stage I and Stage II COPD according to the GOLD classification, who have been diagnosed with COPD for at least six months.

Hypotheses of the study

H1: Pranayama yoga reduces symptom severity in individuals with COPD.

H2: Pranayama yoga increases spirometric parameters in individuals with COPD.

Data Collection Tools

A data collection form consisting of 24 questions, including the demographic characteristics of the patients and their smoking-related behaviors (smoking, quitting, daily cigarette amount, quitting time (years), smoking duration (years)), prepared by the researcher, was used. To evaluate the severity of COPD and the level of disease impact, the COPD Assesment Test-CAT, which includes basic symptoms such as difficulty breathing, cough, sputum production, and general symptoms such as sleep and physical strength, and consists of eight questions, was used. The COPD and Asthma Fatigue Scale (CAFS), consisting of 12 five-point Likert questions, was used to evaluate the fatigue level of the patients, and the mir-spirobank spirometry device was used for the Pulmonary Function Test (PFT). to evaluate the respiratory parameters of the patients.

Implementation of the Research

The researcher met with the patients face to face and explained the study and their written consent was obtained. The data collection form, COPD Assessment Test (CAT), COPD and Asthma Fatigue Scale (CAFS) were filled out, and the patients' Pulmonary Function Test (PFT) was performed. The patients were taught and performed 20 minutes of pranayama yoga by the researcher (Yoga instructor), and they were advised to do the taught yoga every day for 21 days. In addition, patients were given a training booklet detailing pranayama yoga exercises, a training video, and a 21-day checklist of practicing pranayama yoga. The researcher called the patients every morning for 21 days or contacted them online, and the patient was encouraged to do yoga. After Pranayama yoga (21 days), the researcher interviewed the patients face to face for the second time, the data collection form, CAT, and CAFS were filled out, and PFTs of the patients were performed and evaluated for the second time.

Evaluation of Data

SPSS package program was used in the statistical analysis of the data obtained as a result of the study. Descriptive statistics were shown as numbers and %, and for measured variables, mean ± standard deviation. In statistical decisions; A level of $p<0.05$ was considered an indicator of significant difference. To

evaluate comparative statistics, it was examined whether the sample showed normal distribution.

Ethical Dimension of Research

In order to conduct the study, approval number 09.2020.416 was received from Marmara University Faculty of Medicine Clinical Research Ethics Committee. Data collection tools, COPD Assessment Test (CAT) (12); Yorgancıoglu et al. (12), who conducted a Turkish validity and reliability study of these scales for the use of the COPD and Asthma Fatigue Scale (CAFS)(13); written permission was obtained from the authors of Arslan and Oztunç (13). The purpose of the study was explained to all patients included in the sample and their written consent was obtained. During the research, human rights were adhered to the Declaration of Helsinki, as individual rights must be protected.

RESULTS

In this section, the participants' answers to the CAT and CAFS scales before and after pranayama yoga and the findings regarding spirometric measurements before and after pranayama yoga were evaluated. All participants included in the study (N=14) performed the taught pranayama yoga practices completely for 21 days and gave important feedback. The average age of the participants is 51.6±3.42 (years), the average Body Mass Index (BMI) is 29.9±2.70 (kg/m²) and they are in the overweight group according to BMI. It was found that all participants smoked an average of 29.83±20.8 pack/year (Table 1)

Table 1. Average age and BMI of the patients (n=14).

Descriptive Characteristics of Patients	$\bar{x} \pm Sd$	Min-Max
Age (year)	51.6±3.42	55-64
BMI (kg/m²)	29.9±2.70	26.2-35.5
Smoking (Pack-Year)	29.83±20.8	3.2-35.8

$\bar{x}$: Mean, Sd: Standard deviation, Min: Minimum, Max: Maximum, BMI: Body mass index.

Of the participants, 78.6% were male, all were married, 8.1% were primary school graduates, 28.5% were auto mechanics, 64.3% were not working, all had social security, 64.3% were It was determined that the income level was sufficient. Additionally, it was found that 41.47% of the participants smoked and 58.3% quit smoking (Table 2).

Table. 2. Distribution of Descriptive Characteristics of Patients (n=14).

Characteristics of Patients		n	%
Gender	Female	3	21.4
	Male	**11**	**78.6**
Marital status	Single	0	0
	Married	**14**	**100**
Educational Status	Primary school	**8**	**58.1**
	Middle school	2	14.3
	High School and Above	4	28.6
Occupation	Car mechanic	**4**	**28.5**
	Housewife	3	21.4
	Tobacco Worker	3	21.4
	Small business	2	14.3
	Security	2	14.3
Working Status	Workers	2	14.3
	Nonworkers	12	**85.7**
Health Assurance	Present	14	100
	None	0	0
Income	Sufficient	9	**64.3**
	Insufficient	5	35.7
Smoking	Smoker	6	42.9
	Ex-smoker	8	57.1

Comparison of Patients' Descriptive Characteristics and Score Averages

According to our findings, there was no difference between the patients' demographic characteristics, smoking behavior and before and after pranayama yoga ($p>0.05$).

There was no difference between the descriptive characteristics of the patients and the CAT score averages before and after pranayama yoga ($p>0.05$), and there was no difference between the patients' disease stage, medication use status and duration, frequency of hospital admission, and CAT score averages before and after pranayama yoga ($p>0.05$), however, while there was no significant difference between the diagnosis period and the CAT score averages pre pranayama yoga, there was a difference between the diagnosis period and the CAT score averages post pranayama yoga ($p<0.05$).

There was no significant difference between the patients' demographic characteristics, smoking behavior and fatigue score averages pre and post pranayama yoga ($p>0.05$). However, a significant difference was found between smoking status and fatigue level post pranayama yoga ($p<0.05$).

There was no significant difference between the descriptive characteristics of the participants and their spirometric values before and after pranayama yoga (p>0.05). No significant difference was detected between the spirometric values of FVC, FEV1, FEV1/FVC and PEF and smoking behavior of the patients before and after yoga. However, a strong positive relationship was found between the VC rate after pranayama yoga and the duration of smoking cessation (r<0.01).

After 21 days of pranayama yoga, a significant decrease was detected in the patients' symptom and fatigue levels (p<0.01). Additionally, it was found that there was a significant increase in the patients' FEV1, FEV1/FVC and PEF values (p<0.05). (Table 3).

Table 3. Difference in CAT, CAFS and Some Respiratory Parameters before and after Pranayama Yoga.

	Pranayama Yoga (Before)	**Pranayama Yoga (After)**		
	x̄±Sd (n=14)	**x̄±Sd (n=14)**	**t**	**p**
CAT	14.50±3.52	**5.21±2.78**	7.011	**.000***
CAFS	41.2±15.5	**13.14±10.2**	5.273	**.000***
FVC (L)	3.48±.56	3.60±.74	-1.084	.051
FEV1 (L)	2.40±.58	**2.57±.67**	-2.795	**.017****
FEV1/FVC (%)	68.2±8.2	**71.7±7.7**	-3.214	**.008***
PEF ((L/min)	5.88±1.4	**6.91±1.5**	-4.366	**.001***
VC (L)	3.75±.51	3.81±.66	-.382	.709

*(p<0.01). ** (p<0.05). CAT: KOAH Assesment Test, CAFS: COPD and Ashma Ftigue Scale, FVC: Forced Vital Capacity; FEV1 (L): First Second of Forced Expiration; PEF(L/min): Peak Expiratory Flow; VC (L): Vital capacity.

DISCUSSION

Pranayama yoga; Since it can partially meet the increased oxygen and energy needs of the individual with COPD, it can positively affect the individual's symptoms, fatigue level and spirometric values. COPD is a disease that causes the patient to experience severe symptoms, decrease in quality of life, and physical fatigue due to gas exchange disorders in the lungs. Thanks to deep breathing exercises such as pranayama yoga, the air intake rate of the alveoli increases and the severity of symptoms and the level of disease exposure can decrease. In addition, thanks to pranayama yoga, spirometric values can be improved, physical fatigue caused by the disease can be reduced, and progression of the disease can be prevented (14-16).

There was no difference between the demographic characteristics of the patients and the CAT score averages before and after yoga. However, there was a difference between the participants' diagnosis time and their average CAT score after pranayama yoga. It was determined that the change in CAT levels after yoga was greater in COPD patients with a diagnosis period of five years or less than in patients with a diagnosis period of five years or more. In this case, pranayama yoga was found to better reduce the severity of symptoms and the rate of being affected by the disease in people whose disease duration is less than five years. A significant decrease was determined between the patients' pre-yoga CAT score averages and post-yoga CAT score averages. This shows that pranayama yoga reduces the severity of symptoms and the level of disease-affected individuals with group B COPD. Gupta et al. in their study to determine the effects of pranayama yoga on moderate and severe COPD, determined that the mean CAT score before pranayama yoga (21.2±2.6) decreased significantly after pranayama yoga (17.4±2.5) (17). In his study, Raj found that yoga significantly reduced CAT scores (18). This study is similar to previous studies in terms of pranayama yoga exercises reducing disease severity and disease-affected level (CAT) in patients.

There was no difference between the patients' demographic characteristics, smoking behavior and fatigue averages before and after pranayama yoga. However, there was a difference between smoking status and fatigue level after pranayama yoga. It was found that smokers had higher levels of fatigue than individuals who quit smoking. Supporting this study, Taşpınar et al. found that smoking COPD patients had higher fatigue levels than non-smoking COPD patients (19). Another study supporting this study found that the functional capacity of COPD individuals who smoked for a long time decreased. Additionally, it has been found that as the amount of cigarette smoking increases, patients' fatigue perception and fatigue levels increase (20).

According to the findings, a significant decrease was determined between the CAFS score average before pranayama yoga (41.2±15.5) and the CAFS score average after pranayama yoga (13.14±10.2) (Table 3). This shows that pranayama yoga reduces fatigue in individuals with group B COPD. Ozer et al. in their randomized study on the ZOOM program, they found that the average CAFS score of the COPD group doing yoga was 69.1 ± 8.48 before yoga, but it decreased to 23.61 ± 6.36 after yoga (15). Ranjita et al. found that yoga increased the functional capacity, diffusion capacity and oxygen saturation of COPD patients, and also significantly reduced the level of fatigue (7). In another study, pranayama yoga was found to increase the exercise capacity of individuals with COPD (21). In another study, it was stated that pranayama yoga provided significant improvements in the six-minute walk test and functional capacity of individuals with Stage III and Stage IV COPD (17). The results of this study are similar to the results of the above studies.

While there was no difference between the patients' FVC, FEV1, FEV1/FVC and PEF spirometric values and their smoking behavior, a strong positive relationship was found between the VC rate and smoking cessation time after pranayama yoga (r<0.01). It was determined that the post-exercise VC value increased faster as the duration of smoking cessation increased. This shows that pranayama yoga exercises increase the VC capacity of people who quit smoking more than smokers. Demirbaş and Kutlu found in their study that the lung age of smokers is much higher than that of non-smokers (22). As smoking duration increases, the lung ages and VC decreases. It is thought that the lungs of COPD patients who quit smoking remain younger than COPD patients who do not

quit smoking, and VC levels increase faster with pranayama yoga.

According to the findings of the study, it was determined that there were significant changes in the FVC, FEV1, FEV1/FVC, PEF and VC spirometric values of the patients before and after pranayama yoga. There was a certain increase in the patients' mean FVC before yoga (3.48±.56), after yoga (3.60±.74). Although the difference is not significant, it seems that pranayama yoga increases forced vital capacity. When FEV1 values, which are an important diagnostic and obstruction level determination criterion for COPD, were examined, it was determined that while the FEV1 average of the patients was 2.40±.58 before pranayama yoga, it increased to 2.57±.67 after pranayama yoga and the increase was statistically significant ($p<0.05$; p=.017**). Similar to these results, some studies that implemented a 12-week pranayama yoga program also found significant increases in spirometric values. Singh et al. found an increase in FVC, FEV1, PEF and VC values after yoga in their study (23). Gupta et al. found that the average FEV1 of individuals doing pranayama yoga increased from 51.2±8.7 to 53.3±8.8 (17). In another study, it was found that the average FEV1 increased from 43±16 before pranayama yoga to 45±14 after pranayama yoga (21).

When FEV1/FVC values, which is another important diagnostic criterion for COPD, were examined in the study, it was determined that while the mean FEV1/FVC score of the patients was 68.2±8.2 before pranayama yoga, it increased to 71.7±7.7 after pranayama yoga and the increase in between was significant. When the PEF peak flow rate averages, which is one of the spirometric respiratory values, were examined, it was determined that the PEF average increased from 5.88±1.4 before pranayama yoga to 6.91±1.5 after pranyama yoga and the difference was significant. Additionally, in this study, an increase in the average VC score was found before and after pranayama yoga. While the mean CV score was 3.75±.51 before pranayama yoga, it was found that the mean CV score increased to 3.81±.66 after pranayama yoga. Supporting the increase in the spirometric values of the study, Thokchom et al. determined in their study that after yoga, there was an increase in the respiratory parameters of the participants such as FEV1/FVC, FEV1, FVC, PEF and that the health status of the patients improved (11). In another study, it was found that yoga increased diffusion capacity and vital capacity (VC) (8). Ranjita et al. determined in his study that yoga increased diffusion capacity and oxygen saturation (7)

According to the findings of this study, pranayama yoga reduces the severity of symptoms and disease-affected levels in individuals with COPD, reduces the amount of fatigue, and provides significant improvements in FVC, FEV1, FEV1/FVC, PEF and VC values. Cramer et al. in their meta-analysis study to determine the risks and benefits of yoga on COPD, found that yoga reduced symptom severity and fatigue level, and increased and improved respiratory parameters FVC, FEV1, FEV1/FVC, PEF and VC (10). Li et al. in their meta-analysis study to examine the effects of yoga on COPD, they determined that yoga reduces symptom severity, improves spirometric values, increases functional capacity and reduces the level of fatigue in patients with COPD (6). The results of this study are based on Cramer et al. (10) and Li et al. (6) is similar to meta-analysis results.

CONCLUSION

After 21 days of pranayama yoga, it was found that the symptom severity and disease-affectedness of group B COPD individuals decreased, their fatigue levels decreased, and their FVC, FEV1, FEV1/FVC, PEF and VC spirometric values increased and improved. Since pranayama yoga relaxes the respiratory muscles of individuals with COPD and increases lung capacity, it is recommended to be applied as an additional treatment method to the medical treatment of individuals with COPD.

ORCIDs

SÇ: 0000-0003-0114-1684

SO: 0000-0002-1101-1923

HBT: 0000-0001-9262-7078

Conflict of Interest Declaration

No conflict of interest was declared by the authors in this study.

Declaration of Institutional and Financial Support

This study received no financial support.

Author Contributions

Selman ÇELİK is responsible for the entire phase of this study. The final checks and consultancy support of the study were made by Sıdıka Oğuz and Huriye BERK TAKIR.

Ethical Approval

Ethical approval of the study was received.

REFERENCES / REFERÊNCIAS

1. Global Initiative for Chronic Obstructive Lung Disease (GOLD). Global Strategy for the Diagnosis, Management, and Prevention of Chronic Obstructive Pulmonary Disease 2021 Report. https://goldcopd.org Date of Access: 15. 06. 2023
2. Global Initiative for Chronic Obstructive Lung Disease (GOLD). Pocket guide to COPD diagnosis, management and prevention, a guide for health care professionals (2019 report). https://goldcopd.org 13 Temmuz 2019, Date of access: 20.05.2023
3. World Health Organization: Chronic obstructive pulmonary disease (COPD), Key Facts, 16 March 2023, https://www.who.int/news-room/fact-sheets/detail/chronic-obstructive-pulmonary-disease-(copd) Date of Access : 17. 05. 2023
4. Kocabas A. Chronic obstructive pulmonary disease epidemiology and risk factors. TTD Thoracic Surgery Bulletin. 2010;1(2):105-113.

5. Overview of the Turkish Thoracic Society's GOLD 2021 Chronic Obstructive Pulmonary Disease (COPD). Report, 2021. Available at: https://toraks.org.tr/site/sf/books/2021/04/f9e6f8f7ed4cf0235b450f52a5fed8906c5389f98d31d2e0c231db64cae1b4a2.pdf

6. Li C, Liu Y, Ji Y, Xie L, Hou Z. Efficacy of yoga training in chronic obstructive pulmonary disease patients: a systematic review and meta-analysis. Complementary therapies in clinical practice. 2018;30:33-37. doi: 10.1016/j.ctcp.2017.11.006

7. Ranjita R, Hankey A, Nagendra HR, Mohanty S. Yoga-based pulmonary rehabilitation for the management of dyspnea in coal miners with chronic obstructive pulmonary disease: a randomized controlled trial. Journal of Ayurveda and integrative medicine. 2016;7(3):158-166.

8. Soni R, Munish K, Singh KP, Singh S. Study of the effect of yoga training on diffusion capacity in chronic obstructive pulmonary disease patients: A controlled trial. International journal of yoga. 2012;5(2):123.

9. Pomidori L, Campigotto F, Amatya TM, Bernardi L, Cogo A. Efficacy and tolerability of yoga breathing in patients with chronic obstructive pulmonary disease: a pilot study. Journal of cardiopulmonary rehabilitation and prevention. 2009;29(2):133-137.

10. Cramer H, Haller H, Klose P, Ward L, Chung VC, Lauche R. The risks and benefits of yoga for patients with chronic obstructive pulmonary disease: a systematic review and meta-analysis. Clinical rehabilitation. 2019;33(12):1847-1862.

11. Thokchom SK, Gulati K, Ray A, Menon BK. Effects of yogic intervention on pulmonary functions and health status in patients of COPD and the possible mechanisms. Complementary Therapies in Clinical Practice. 2018;33:20-26. doi: 10.1016/j.ctcp.2018.07.008

12. Yorgancioglu A, Polatli M, Aydemir O, Demirci NY, Kirkil G, Atıs SN. Validity and reliability of the COPD assessment test in Turkish. Tuberk Thorax. 2012;60(4):314-320.

13. Arslan S, Oztunc G. Validity and reliability of the chronic obstructive pulmonary disease and asthma fatigue scale. Journal of Research and Development in Nursing. 2013;15(1):48-60.

14. Zhuang SM, An SH, Zhao Y. Yoga effects on mood and quality of life in Chinese women undergoing heroin detoxification: A randomized controlled trial. Nursing Research. 2013;62(4):260-268.

15. Ozer Z, Turan GB, Aksoy M. The effects of yoga on dyspnea, sleep and fatigue in chronic respiratory diseases. Complementary therapies in clinical practice. 2021;43:101306. Available at: doi: 10.1016/j.ctcp.2021.101306

16. Cınar S, Olgun N. Determining of fatigue and sleep disturbance in patients with chronic obstructive pulmonary disease. Turkiye Clinics J Nurs Sci. 2010;2(1):24-31.

17. Gupta A, Gupta R, Sood S, Arkham M. Pranayam for treatment of chronic obstructive pulmonary disease: Results from a randomized, controlled trial. Integrative Medicine: A Clinician's Journal. 2014 Feb;13(1):26.

18. Raj N. Yoga Training in Chronic Obstructive Pulmonary Disease. Indian Journal Of Applied Research, 7 (11). 2017:225-8.

19. Taspinar B, Gul C, Taspinar F, Aksoy CC, Afsar E. Dyspnea and fatigue perception in young adult smokers. SDU Journal of Health Science Institute/SDU Journal of Health Science Institute. 2015;6(1):15-19.

20. Ince DI, Sozcu S, Saglam M, Guçlu MB, Arıkan H, Coplu L. Relationship between smoking history and functional capacity in patients with chronic obstructive pulmonary disease. Physiotherapy Rehabil. 2011;22(1):39-43. Available at: https://dergipark.org.tr/tr/download/article-file/138102

21. Kaminsky DA, Guntupalli KK, Lippmann J, et al. Effect of yoga breathing (pranayama). on exercise tolerance in patients with chronic obstructive pulmonary disease: a randomized, controlled trial. The Journal of Alternative and Complementary Medicine. 2017;23(9):696-704.

22. Demirbas N, Kutlu R. The effect of smoking on lung age and pulmonary function tests. Cukurova Medical Journal. 2018;43(1):155-163.

23. Singh S, Soni R, Singh KP, Tandon OP. Effect of yoga practices on pulmonary function tests including transfer factor of lung for carbon monoxide (TLCO). in asthma patients. Indian J Physiol Pharmacol. 2012;56(1):63-68.