

## Effect of Postural Drainage and Deep Breathing-Cough Exercises on Oxygen Saturation, Triflo Volume and Pulmonary Function Test in Patients with COPD

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### ABSTRACT

**Objective:** The aim of this study was to examine the effect of postural drainage and deep breathing-coughing exercises on oxygen saturation, triflo volume and pulmonary function test applied to patients with chronic obstructive pulmonary disease.

**Methods:** Postural drainage and deep breathing-coughing exercises were performed twice a day, morning and evening for 7 days. Hemodynamic parameters were recorded four times a day, pre-exercise and post-exercise. The forced vital capacity (FVC), forced expiratory volume (FEV<sub>1</sub>) and FEV<sub>1</sub>/FVC values obtained during the Pulmonary Function Test (PFT) were assessed at the end of the first day of the study before the exercise and at the end of the 7th day.

**Results:** As a result of the analyzes performed, there was a statistically significant difference in the oxygen saturation, triflo volume and pulmonary function test of the patients on all days before and after exercise.

**Conclusions:** Postural drainage and deep breathing-coughing exercises are effective in increasing oxygen saturation, triflo volume, pulmonary function tests.

**Keywords:** postural drainage, deep breathing exercises, cough exercises, COPD

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### INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a common, preventable and treatable disease. It is characterized by persistent usually progressive airflow restriction caused by an enhanced chronic inflammatory response to harmful particles or gases in the airways and the lung [1]. COPD, an increasingly serious public health problem all over the world, is one of the leading causes of mortality and morbidity and a highly prevalent and costly disease especially in industrial and developing countries [2-6]. Due to acute exacerbations of COPD, such factors as increases in medical expenditures and hospitalizations, loss of workforce, etc. cause serious economic and social losses in all countries [7]. Optimal treatment of patients with COPD usually requires pharmacological and nonpharmacological treatment [6,8,9]. Although medical and surgical treatments have led to significant improvements in

recent years, these interventions are often non-therapeutic. Therefore, pulmonary rehabilitation applications aiming to improve the quality of life in all patients with respiratory problems, especially with COPD, have come to the fore [10].

Pulmonary rehabilitation includes physical education programs consisting of patient education, psychosocial support, aerobic and empowering exercises and breathing exercises [8,11]. Depending on the needs of the patient, collaborative self-management strategies such as implementing smoking cessation intervention, adopting a healthy lifestyle and performing regular exercises can be effective in the early and appropriate treatment of COPD exacerbations. Comprehensive pulmonary rehabilitation programs are an appropriate and effective way providing these important components [6,9] and the importance of these programs is increasing day by day [12,13]. With the rehabilitation attempts to be performed in the early stage

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of the disease, it is aimed to prevent the formation of permanent damage, to reduce symptoms and to increase exercise tolerance. The review of the pertinent literature has revealed that pulmonary rehabilitation has a positive effect on the physical and psychological parameters of patients, that postural drainage and deep breathing and coughing exercises improve the patients' oxygen saturation and pulmonary function tests, and that the length of hospital stays and the need for medications decrease [14-18].

The aim of this study was to investigate the effect of postural drainage and deep breathing-coughing exercises applied to patients with chronic obstructive pulmonary disease on oxygen saturation, triflow volume and pulmonary function test.

## METHODS

### Study Design, Setting, and Participants

The study was a quasi-experimental study with 100 patients with COPD who were diagnosed with COPD, have inclusion criteria for the study and agreeing to participate in the study between November 2016 and April 2017 in the state hospital in Turkey. To perform reliable measurements were performed on the close/ similar group of participants, under the same conditions and supervision of a teaching staff. The criteria for inclusion in the study were; (a) according to GOLD (2017) criteria, patients with COPD (Stage I, II, III) are categorized, (b) being older than 18 years of age, (c) patients with stable COPD, (d) patients who can do the exercises properly, (e) patients who can speak and understand Turkish, (f) agreeing to participate in the study after having provided a written consent. The criteria for exclusion from the study were; (a) patients who cannot properly do the exercises prepared for the study, (b) patients who have had exacerbations in the past month, (c) patients with a pulmonary disease comorbid to COPD, (d) patients with congestive heart failure / coronary artery disease, (e) patients with orthopedic problems (especially on the back) / muscle-joint disease, (f) patients with an uncontrollable comorbid disease (diabetes, thyrotoxicosis), (g) patients with active infection, (h) not agreeing to participate in the study.

### Data Collection

Patient Identification form, Deep breathing-cough exercises and Spirometer application steps form, Data Registration Form were used in the collection of data. Questionnaires were prepared by the researchers in accordance with the literature [16,19-21]. Patient Identification Form consisted of 18 questions on sociodemographic (age, sex, marital status, education level, body mass index, etc.), disease and treatment (presence of chronic illness, smoking and alcohol consumption, etc.). The Data Registration Form contained the results of oxygen saturation, respiratory function tests and the times (day) of the measurements.

### Data Collection Method

The study data were collected by the researcher using the "Patient Information Form" through the face-to-face interview method. In order to accurately obtain data oxygen saturation, triflow volume and Pulmonary Function Test were measured with the same devices at all participants. The patients performed the deep breathing and coughing exercises, postural drainage and triflow respiratory exercises for an average of 30-45 minutes twice a day in the morning and evening for 7 days. Pre-exercise and post-exercise oxygen saturation, triflow volume values were recorded four times a day in the morning and evening (twice in the morning and twice in the evening) for seven days. FVC, FEV<sub>1</sub>, FEV<sub>1</sub> / FVC were measured on the 1<sup>st</sup> day of the program before the exercises started and on the 7<sup>th</sup> day of the program after the exercises finished. During the deep breathing exercises, the incentive spirometer volume was measured using the same brand spirometer in all the measurements. In terms of the reliability of the measurements, the PFT results were checked by the Institution's Chest Disease Specialist and if consensus was not reached, measurements were repeated. The incentive spirometer (triflow volume) measurements were repeated at least five times in case the patient could not perform well, and of the data, the best one was taken into account. Oxygen saturation values of the patients were measured using the same brand pulse oximeter device in all the measurements.

### Sample Size and Statistical Power Considerations

A total of 217 patients were evaluated between the dates indicated. 117 individuals who did not meet the eligibility criteria were not accepted to participate in the study. The study consisted of 100 patients who were admitted to the state hospital between November 2016 and April 2017 with COPD and their sample was admitted to the specified dates and accepted to participate in the research. The control group was not created because routine treatment of all the patients in the clinic was performed routinely (because of the ethical problem of not exercising). The participants in the study were chosen by a random sampling method. Power analysis was performed to determine the size of the research sample [16]. Taking  $\alpha = 5\%$ , effect size (d) = 0.53, and  $1 - \beta$  (power) = 0.99 (99,89%), minimum sample size was calculated as 100.

### Ethical Considerations

Before commencing the research, written permission was obtained from faculty's ethics committee (Approval No. 20.478.486-337) and conformed to the principles outlined in the Helsinki Declaration. Written permission was obtained from the institutions where the study was to be carried out; verbal and written informed consent was obtained from each of the patients for the present study. Patients were informed about the purpose and procedures of the study, the voluntary nature of their participation, and the option to withdraw at any time.

## Effect of Exercises on Oxygen Saturation, Triflow Volume and Pulmonary Function Test

**Table 1.** Pre-exercise and post-exercise oxygen saturation values of patients

Day	Morning		Test*		Evening		Test*	
	Oxygen saturation before exercise	Oxygen saturation after exercise	P	Z	Oxygen saturation before exercise	Oxygen saturation after exercise	P	Z
	Mean±SD	Mean±SD			Mean±SD	Mean±SD		
1.Day	87.86±4.10	92.97±3.52	0.000***	-8.670	87.793±.77	93.106±.76	0.000***	-7.900
2.Day	88.14±3.72	93.75±2.82	0.000***	-8.700	88.35±3.58	94.302±.36	0.000***	-8.640
3.Day	88.59±3.53	93.78±2.76	0.000***	-8.320	87.86±9.50	95.032±.27	0.000***	-8.680
4.Day	88.80±0.15	94.26±2.56	0.000***	-8.600	88.69±3.33	94.962±.16	0.000***	-8.680
5.Day	89.24±3.24	94.65±2.30	0.000***	-8.660	89.533±.26	95.48±1.95	0.000***	-8.550
6.Day	89.56±2.79	93.838±.87	0.000***	-8.280	89.99±3.09	95.55±2.09	0.000***	-8.510
7.Day	89.95±1.54	94.68±2.14	0.000***	-8.510	90.46±2.63	95.45±1.72	0.000***	-8.540

\*Wilcoxon Signed Ranks Test p\*\*<0.05 p\*\*\*<0.001

**Table 2.** PFT and Triflow volume values measured on the 1<sup>st</sup> day of the program before the exercises started and on the 7<sup>th</sup> day of the program after the exercises finished

PFT values	1.st day (before exercise)	7.st day (after exercise)	Test*/p
	Mean±SD	Mean±SD	
FVC	68.75±2.97	70.61±10.26	0.008**
FEV <sub>1</sub>	61.90±12.49	64.43±12.38	0.000***
FEV <sub>1</sub> /FVC	89.04±9.39	93.07±12.10	0.000***
Triflow volume values	677.5±110.13	1148.5±96.87	0.000***

\*Paired Samples Test p\*\*<0.05 p\*\*\*<0.001

### Data Analysis

Data were analyzed using the SPSS program evaluated in the computer environment. Descriptive statistics were used to define the sociodemographic and disease characteristics of the sample (number, percentage, mean, standard deviation). The data obtained from the study were analysed on a computer using the Wilcoxon Signed Ranks Test, Paired Samples Test, MannWhitney U Test, Kruskal Wallis Test.

## RESULTS

The mean age of the participants was 66.58±0,78 years, 74% were male, 82% were married, and 65% were educated to primary school level. The participants' mean body mass index of 39% was regarded as above normal. The patients' COPD stage routinely evaluated and recorded in the patient file by the Institution's Chest Disease Specialist. It was determined that 66% of patients were in COPD II. stage, 2.55% had a chronic illness and 41% of the patients did not smoke, 86% did not drink alcohol and 79% did not exercise deep breathing-coughing.

**Table 1** shows the patients' oxygen saturation values measured before and after postural drainage, and deep breathing and coughing exercises performed in the morning and evening. On all days, the patients' oxygen saturation values increased after exercises and the difference was statistically significant (p<0.05).

According to **Table 2**, the values obtained on the 1<sup>st</sup> day morning before the exercises were as follows: FVC: 68.75 ± 2.97, FEV<sub>1</sub>: 61.90 ± 12.49, FEV<sub>1</sub> / FVC: 89.04 ± 9.39. The values obtained on the 7<sup>th</sup> day evening after the exercises were as follows; FVC: 70.61 ± 10.26, FEV<sub>1</sub>: 64.43 ± 12.38, FEV<sub>1</sub> / FVC: 93.07 ± 12.10. The triflow volume value was 677.5 ± 110.13 on the 1st day morning before the exercises and 1148.5 ± 96.87 on the 7th day evening after the exercises. There was a statistically significant difference between PFT values measured on the first and seventh days and between the triflow volume values on the first and seventh days (p<0.05).

In **Table 3**, the participating patients' oxygen saturation, triflow volume and pulmonary function test (FVC, FEV<sub>1</sub>, FEV<sub>1</sub> / FVC) values were compared in terms of some variables (age, gender, COPD stages, smoking status and conducting the breathing and coughing exercises).

The comparison of the participants' mean scores for the oxygen saturation, triflow volume and PFT values obtained on the 1st day morning before the exercises and on the 7th day evening after the exercises by gender revealed that there were significant differences between the two genders in terms of the mean scores for the oxygen saturation and FEV<sub>1</sub>/FVC on the 7th day evening after the exercises, and for the triflow volume and FEV<sub>1</sub>/FVC on the 1st day morning before the exercises (p<0.05). The differences between the

### Effect of Exercises on Oxygen Saturation, Triflow Volume and Pulmonary Function Test

**Table 3.** Comparison of the patients' oxygen saturation, Triflow volume and pulmonary function test [FVC, FEV<sub>1</sub>, FEV<sub>1</sub> / FVC] values in terms of some variables

Measuring Time	Sociodemographic Features and Diseases	n	O <sub>2</sub> saturation Mean±SD	Test** p/Z	Triflow Volume Mean±SD	Test** p/Z	FVC Mean±SD	Test** p/Z	FEV <sub>1</sub> Mean±SD	Test** p/Z	FEV <sub>1</sub> /FVC Mean±SD	Test** p/Z
<b>Age Groups</b>												
Before	41-54	6	91.68±1.72	0.327	800.00±282.84	0.183	79.50±30.40	0.489	81.00±29.69	0.241	101.00±4.24	0.618
Exercise [1.day]	55-68	56	87.88±3.85		695.54±98.87		71.59±17.68		63.13±14.47		91.44±18.72	
	69-83	38	88.08±4.06		664.17±113.82		75.25±12.27		66.58±11.22		95.25±15.31	
<b>Age Groups</b>												
After	41-54	6	95.50±3.53	0.753	1150.00±70.71	0.652	79.50±27.57	0.811	82.00±26.87	0.355	102.00±8.48	0.948
Exercise [7.day]	55-68	56	95.54±1.63		1147.44±75.17		74.45±14.50		65.67±17.60		97.45±12.98	
	69-83	38	94.92±2.23		1116.50±106.78		77.16±11.25		70.42±14.49		102.25±8.48	
<b>COPD Stages</b>												
Before	I. Stage	14	90.00±15.00	0.626	700.00±123.09	0.217	88.50±16.32	0.001***	88.09±13.87	0.001***	100.50±6.76	0.001** *
Exercise [1.day]	II. Stage	66	89.00±16.02		600.00±56.87		68.42±11.02		60.65±12.34		91.00±14.22	
	III. Stage	20	90.07±13.08		650.47±112.34		56.52±13.45		44.50±15.08		76.50±13.57	
<b>COPD Stages</b>												
After	I. Stage	14	95.87±6.00	0.038***	1200.00±0.00	0.666	89.64±13.87	0.001***	93.50±14.56	0.001***	105.03±8.92	0.001** *
Exercise [7.day]	II. Stage	66	96.67±7.08		1200.00±0.00		69.50±14.67		63.35±13.58		94.46±15.03	
	III. Stage	20	96.09±4.21		1200.00±0.00		58.87±12.43		48.50±13.89		80.50±14.51	
<b>Gender</b>												
Before	Female	74	87.93±3.96	0.971	689.86±110.09	0.023** *	69.00±15.28	0.790	60.81±16.69	0.164	84.62±18.39	0.000** **
Exercise [1.day]	Male	26	87.65±4.56	-0.336	642.31±93.48	-2.275	68.04±17.08	-0.637	65.00±14.47	-1.392	101.62±11.34	-4.493
<b>Gender</b>												
After	Female	74	95.74±1.59	0.005***	1155.41±77.00	0.088	70.28±14.63	0.884	63.58±16.36	0.328	90.34±15.52	0.000** **
Exercise [7.days]	Male	26	94.62±1.83	-2.793	1128.85±83.87	-1.709	71.54±18.10	-0.145	66.85±15.28	0.979	103.92±12.47	-4.037
<b>Smoking</b>												
Before	Yes	20	88.00±4.32	0.794	690.00±115.39	0.556	70.90±15.73	0.512	59.75±17.11	0.959	86.85±18.20	0.518
Exercise [1.day]	No	80	87.83±4.07	-0.261	674.38±106.13	-0.589	68.21±15.72	-0.655	62.44±16.00	-0.052	89.59±18.50	-0.647
<b>Smoking</b>												
After	Yes	20	95.90±1.77	0.154	1165.00±69.01	0.300	70.50±11.51	0.663	61.15±16.39	0.540	88.25±17.52	0.146
Exercise [7.days]	No	80	95.34±1.70	-1.424	1144.38±81.51	-1.088	70.64±16.43	-0.435	65.25±16.00	-0.612	95.28±15.26	-1.453
<b>Exercise Situation</b>												
Before	Yes	21	88.76±3.17	0.397	680.95±111.21	0.989	65.90±15.88	0.400	60.33±19.44	0.657	84.43±26.11	0.706
Exercise [1.day]	No	79	87.62±4.30	-0.847	676.58±107.36	-0.014	69.51±15.64	-0.842	62.32±15.31	0.445	90.27±15.71	-0.377
<b>Exercise Situation</b>												
After	Yes	21	95.29±1.76	0.750	1121.43±90.23	0.064	68.52±15.47	0.456	64.62±19.53	0.589	91.57±20.84	0.694
Exercise [7.days]	No	79	95.49±1.72	-0.319	1155.70±75.10	-1.850	71.16±15.58	-0.588	64.38±15.17	-0.178	94.48±14.41	0.394

\*Mann Whitney U Test \*\* Kruskal Wallis Test p\*\*\*<0.05 p\*\*\*\*<0.001

other mean scores for the other factors were not significant (p>0.05).

The comparison of the mean scores for the oxygen saturation, triflow volume, and PFT on the 1<sup>st</sup> day evening before the exercises and on the 7<sup>th</sup> day evening after the exercises according to the patients' COPD stages indicated

that all their mean scores increased on the 7<sup>th</sup> day evening after the exercises and that there were significant differences between the mean scores for the oxygen saturation on the 7<sup>th</sup> day evening after the exercises, and between the mean scores for the FVC, FEV<sub>1</sub>, FEV<sub>1</sub>/FVC on the 1<sup>st</sup> day morning before the exercises and on the 7<sup>th</sup> day evening after the exercises

( $p < 0.05$ ). However, there were no differences between the mean scores for the oxygen saturation on the 1<sup>st</sup> day morning before the exercises, and between the mean scores for the triflow volume on the 1<sup>st</sup> and 7<sup>th</sup> days ( $p > 0.05$ ).

The comparison of the patients' mean scores for the oxygen saturation, triflow volume and PFT values obtained on the 1st day morning before the exercises and on the 7th day evening after the exercises in terms of factors such as age, smoking status and conducting the breathing and coughing exercises demonstrated no significant differences ( $p > 0.05$ ).

## DISCUSSION

The comparison of the effects of postural drainage and deep breathing and coughing exercises on oxygen saturation summarized in **Table 1** revealed that the mean post-exercise oxygen saturation values were higher than pre-exercise values and the difference between them was statistically significant. In their study, Gürgün et al. determined that the oxygen saturation level increased from 71 before the rehabilitation to 77 after the rehabilitation in the experimental group, but that there was no difference in the control group [22]. In their study conducted to investigate the effect of pursed lips and diaphragmatic respiratory exercises on pulmonary function tests, Kara et al. reported that oxygen saturation which was 92.4 before the exercises increased to 96.5 after the exercises [18]. In their study, Faager, Stahle and Larsen found that pursed lip exercises increased oxygen saturation rates in patients with moderate or severe COPD [17]. Gosselink reported that pursed lips respiratory exercises improved oxygenation in patients [14].

Çiçek and Akbayrak reported that in the experimental group, oxygen saturation values measured after the respiratory exercises were higher than those measured before the respiratory exercises, but the difference was not statistically significant [15]. Although the duration and method of respiratory exercises varied from one study to another, the results of the present study were similar to the results of other studies in the literature [14,15,17,18,22].

When the effect of postural drainage and deep breathing and coughing exercises on respiratory function test values and triflow volume values was analyzed in line with the results given in **Table 2**, the analysis demonstrated that the mean values obtained at the end of the seventh day were higher than were those obtained on the first day, and the difference between them was statistically significant. The review of the literature showed that the results of the studies which investigated the effect of exercise programs on respiratory functions varied. In a study conducted by Çiçek and Akbayrak, all the PFT values of the patients in the experimental group increased statistically significantly after the respiratory exercises [15]. Ecevit reported that there was a significant improvement in FEV<sub>1</sub> and FVC values of the patients with chronic lung disease after rehabilitation [23]. In Takigawa et al.'s study, significant increases were reported in the expected value of FEV<sub>1</sub> after pulmonary rehabilitation

[24]. In Güell et al.'s study the patients with COPD participated in a 12-month rehabilitation program [25]. The patients had respiratory exercises in the first three months, aerobic exercises in the second 3 months, and respiratory and limb coordination exercises in the following six months. After the program, while the FVC value increased, FEV<sub>1</sub> value did not change.

In Sutbeyaz et al.'s study, there were significant increases in FVC, FEV<sub>1</sub> / FVC values of the patients after they had respiratory exercises, air-shifting technique, voluntary isocapnic hyperpnea and shoulder belt exercises for three days a week for six weeks [26]. The results of the present study are consistent with those in the literature.

In their study, Onodera and Yazaki found no changes in PFT values after a 3-week pursed lip and diaphragmatic respiratory exercise [27]. In Kara et al.'s study, PFT values did not change statistically significantly [18]. In Yoshimi et al.'s study, 31 patients underwent a pulmonary rehabilitation program for 2 days a week for 6 weeks, but their FEV<sub>1</sub> values did not change [28]. The results of the present study are consistent with the results of Yoshimi et al.'s study. On the other hand, in other similar studies in the literature, different results were obtained. This difference may have been resulted from many factors such as the characteristics of patients, types of the diseases, stages of the disease, types of the treatment, the environment and duration of respiratory exercises and the type of applications performed within pulmonary rehabilitation.

The literature review revealed that deep breathing exercises performed with an incentive spirometer were effective in reducing postoperative pulmonary complications and encouraged patients to exercise [29,30]. In Aslangiray's study conducted with the patients having undergone coronary artery bypass, the experimental group had a deep breathing exercise training with an incentive spirometer, and it was observed that the exercises positively affected postoperative incentive spirometer volumes [19]. Overend et al. systematically investigated 35 studies and reported that deep breathing exercises performed with an incentive spirometer was effective in reducing postoperative pulmonary complications [29]. The results of the present study are similar to those in the literature. Because the incentive spirometer provides visual feedback for patients, it is thought that the volume averages which increase day to day motivate patients and thus it can be routinely used in nursing practices as an approach improving respiratory functions.

In **Table 3**, the participating patients' oxygen saturation, triflow volume and pulmonary function test values were compared in terms of some variables. The comparison of the participants' mean scores for the oxygen saturation, triflow volume and PFT values obtained on the 1<sup>st</sup> day morning before the exercises and on the 7<sup>th</sup> day evening after the exercises by gender revealed that there were significant

differences between the two genders in terms of the mean scores for the oxygen saturation and FEV<sub>1</sub>/FVC on the 7<sup>th</sup> day evening after the exercises, and for the triflow volume and FEV<sub>1</sub>/FVC on the 1<sup>st</sup> day morning before the exercises ( $p < 0.05$ ). The differences between the other mean scores for the other factors were not significant ( $p > 0.05$ ).

The comparison of the mean scores for the oxygen saturation, triflow volume, and PFT on the 1<sup>st</sup> day evening before the exercises and on the 7<sup>th</sup> day evening after the exercises according to the patients' COPD stages indicated that all their mean scores increased on the 7<sup>th</sup> day evening after the exercises and that there were significant differences between the mean scores for the oxygen saturation on the 7<sup>th</sup> day evening after the exercises, and between the mean scores for the FVC, FEV<sub>1</sub>, FEV<sub>1</sub>/FVC on the 1<sup>st</sup> day morning before the exercises and on the 7<sup>th</sup> day evening after the exercises ( $p < 0.05$ ). Pulmonary function tests play a crucial role in the diagnosis of the disease, and they also have an important role in determining the severity of the disease and in the planning of treatments. In particular, FEV<sub>1</sub> is the parameter based on the classification of COPD severity. In Şirintaş's study (2010), the rehabilitation program conducted in a similar way was determined to significantly affect the FEV<sub>1</sub> and FVC values of the stage II and III COPD patients [31]. In their study, Faager, Stahle and Larsen reported that pursed lip respiratory exercises increased the oxygen saturation rate in the stage II and III COPD patients [17]. The findings of the present study are consistent with those of other studies in the literature.

The comparison of the mean values for the oxygen saturation, triflow volume and PFT were in terms of the age groups of the patients demonstrated that the differences between the oxygen saturation, triflow volume and PFT values were not significant. Given the morbidity of COPD increases with age, is probably due to the fact that the patients' age groups in the sample group were close to each other and that the number of young patients was not high.

The comparison of the mean values for the oxygen saturation, triflow volume and PFT were in terms of the patients' smoking status demonstrated that the differences between the oxygen saturation, triflow volume and PFT values were not significant. Active smoking or exposure to environmental cigarette smoke is the most important risk factors for the development of COPD [32]. Smoking is responsible for 80-90% of lung cancer cases. In Turkey, according to the data released by the Ministry of Health Turkish Public Health Institution Global Adult Tobacco Research conducted in 2012, 27.1% of those aged 15 and over were currently smokers and the incidence of smoking was higher in males than was that in females [33]. The results of the present study showed that cigarette smoking was not effective on oxygen saturation, triflow volume and PFT values. This finding is different from the results in the literature. This difference might be due to the fact that in the

present study, only one-fifth of the patients in the sample group were smokers and that those who were nonsmokers were probably passive smokers.

It was determined that the differences between the mean values for the oxygen saturation, triflow volume and PFT in terms of the patients' performing the deep breathing and coughing exercises were not significant. This difference might also be due to the fact that the patients were not knowledgeable enough about the exercises, that the number of exercising patients was not many and that the patients who exercised did not exercise effectively.

### CONCLUSION AND RELEVANCE TO CLINICAL PRACTICE

Postural drainage and deep breathing-coughing exercises, which are part of the pulmonary rehabilitation program in the care and management of COPD individuals, are effective in increasing oxygen saturation, triflow volume, and pulmonary function tests. It is thought that nurses can take an effective role in training patients on the importance of exercises and how to perform exercises effectively, and in encouraging them to regularly exercise, and the patients can benefit from the exercises for therapy. It is recommended that future studies should be conducted with larger sample groups including both the experimental group and the control group, and that in-service training programs and certificate programs related to pulmonary rehabilitation should be arranged.

### LIMITATIONS

Because this present study included only diagnosed Stage I, Stage II and Stage III COPD patients and was conducted only in one institution, it cannot be generalized to other patient groups or institutions. In addition, because all the patients exercised, they were not assigned to experimental and control groups.

**Author Note 1:** This research was produced from master's thesis which name is "Effect of Postural Drainage and Deep Breathing-Cough Exercises on Haemodynamic Parameters in Patients with COPD"

**Author Note 2:** This research was presented in Adnan Menderes University I. International Health Sciences Congress (Aydın- Turkey, 28 /06 / 2017 - 01/07 / 2017).

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