The Effects of Breathing Exercises and Inhaler Training in Patients with COPD on the Severity of Dyspnea and Life Quality: A Randomized Controlled Trial

YASEMİN CEYHAN (yasemin-ceyhan@hotmail.com)
Ahi Evran Univercity https://orcid.org/0000-0002-2100-5324
PINAR TEKİNSOY KARTIN
Erciyes Üniversitesi: Erciyes Universitesi

Research Article

Keywords: COPD, Inhaler training, Breathing exercises, Dyspnea, Quality of life, Randomized controlled trial

Posted Date: January 11th, 2022

DOI: https://doi.org/10.21203/rs.3.rs-1040020/v1

Abstract

Background: Severe dyspnea and poor quality of life are common in chronic obstructive pulmonary disease (COPD). The most important reason for this situation is the wrong applications in inhaler treatment. In addition, inhaler treatments that supporting non-pharmacological methods increases the effectiveness of the drug. The aim of this study is to determine the effects of breathing exercises and inhaler training for chronic obstructive pulmonary disease patients on the severity of dyspnea and life quality.

Methods: The research is a randomized controlled trial. A total of 67 with COPD who complied. The patients who were randomized in two groups that Intervention 1 group were given pursed lip breathing exercise and inhaler training and Intervention 2 group were given only inhaler training. A follow-up after 4 weeks was carried out in both groups. Patient outcomes in both groups were COPD assessment test (CAT), Modified medical research council (mMRC), and St. George's respiratory questionnaire scales (SGRQ). This study followed CONSORT checklist for randomized conrolled trials. In data analysis independent t, Mann-Whitney U, ANOVA, Wilcoxon analysis, and Pearson Chi-square tests were used.

Results: Pursed lips exercise and inhaler drug use skills of patients in the both group increased ($p<0.001$). The median value of the CAT and mMRC scores are is statistically significant for both groups ($p<0.005$). The mean of life quality scores of patients in both groups decreased and this result was found statistically significant in all sub-dimensions and in the total scale score for two groups ($p<0.001$). Although the increase in the quality of life and the decrease in the severity of dyspnea of the patients in both groups were significant, the two groups were not superior to each other ($p>0.05$).

Conclusions: As a result of the study, it was found that the skill of applying inhaler and life quality of the patients increased, the severity of dyspnea decreased. Supporting inhaler treatments with non-pharmacological methods can increase drug efficacy and quality of life.

Trial Registration: Clinical Trial Registry registration number: NCT04739488. Registered on 21 Feb 2021.

Background

Chronic obstructive pulmonary disease (COPD) is an important respiratory disease both in the world and in Turkey. The most common symptom of COPD, which develops slowly and often occurs in older ages, is dyspnea, which patients define as air hunger or shortness of breath. This condition is usually accompanied by cough, phlegm, wheezing, restriction of daily activities, fatigue, insomnia and pain [1, 2]. Increased symptoms and restriction of daily activities also decrease the life quality of patients [2–6].

The most important approach in relieving dyspnea and other symptoms is an accurate and regular pharmacological treatment [7]. The most effective pharmacological treatment is inhaler drug use. Because inhaler allows the drug to be delivered directly to the airways and causes less side effects compared to systemic treatment [5]. However, the only way to benefit from this effect of the inhaler is to

use the drug correctly. In a systematic review in 2016, studies in the last 40 years were examined and it was reported that inhaler drug misuse had increased severely [8]. Similarly, in many studies it was found that patients used inhaler with wrong techniques [8–10]. When the results of the studies were evaluated, it was seen that most of the errors on the use of inhaler were related to breath. Incomplete or incorrect steps such as failure of expiration before inhaler utilization, not being able to inhale the drug at the appropriate flow rate, not holding the breath for the appropriate time after inhaling the drug suggested that inhaler utilization of the patients should be supported by breathing exercises.

In addition to pharmacological treatment in dyspnea management, the use of non-pharmacological methods such as Pursed Lip Breathing (PLB) leads to better airway patency and alveolar gas exchange for the patient and decrease of dyspnea severity [11]. Particularly, PLB has been reported as B-level evidence in reducing severity of dyspnea. The Canadian Thoracic Society Clinical Practice Guide emphasizes that life quality of the individuals should also be evaluated along with dyspnea in studies related to COPD [5]. Taking all these situations into account it is thought that patients need to use inhaler drugs in the correct steps and support this application with PLB. However, there is no study in the literature in which inhaler training supported by breathing exercise was applied. Therefore, this study was done to determine the effects of breathing exercises and inhaler training for COPD patients on the severity of dyspnea and life quality.

Methods

Study setting

The research was conducted at Ahi Evran University Training and Research Hospital in Kırşehir province located in Central Anatolia Region of Turkey.

Type of study

The study was a randomized control trial conducted from September 2017 to December 2018.

Ethical consideration

In order to carry out the study, institution approval (numbered 10670833/619 and dated 01.08.2017), ethics committee approval (numbered 2017/384 and dated 21.07.2017) and verbal / written voluntary informed consent forms of the participants were taken.

Randomization and participants

All the COPD patients who applied to the chest diseases outpatient clinic of the hospital were included in the study. The patients were selected from among the volunteers followed by the collaborated physician, applying to a single outpatient clinic and meeting the inclusion criteria. In determining patient groups, an independent observer determined the days by drawing lots to reduce bias and prevent patients from affecting each other. The study was first started with the I2 group and continued with the I1 group the next day. The patients included in the study are shown in the CONSORT Flow diagram (Figure 1).

The individuals over the age of 18, who had been diagnosed with COPD for at least three months, using inhalers at least twice a day, misusing their drug, had not previously taken breathing exercise training and had not participated in a rehabilitation program were included in the study [9, 10, 12, 13]. The individuals with mental disorders, communication disabilities, heart disease that could lead to dyspnea, and unstable angina were not included in the study.

Sample size

In determining the number of samples, it was determined that 30 individuals were included in both groups by taking effect size 0.8, type 1 error 0.05, power 0.85. Considering that there may be data loss in the study, it was completed with a total of 67 patients including 32 people in Intervention 1 (I1) group and 35 people in Intervention 2 (I2) group. The sample size was calculated using G*Power version 3.1.9.2.

Intervention protocol

Appropriate training was given to the groups after the patients were randomized into two groups. In accordance with the training content, patients were asked to continue the practices they learned twice a day for four weeks. In addition, the researchers provided consultancy by calling the patients twice a week. After the application was continued for four weeks, the patients were invited to the hospital for re-evaluation.

Intervention 1 group

In the first interview, sociodemographic information of the patients was obtained and their COPD, levels of dyspnea and life quality and their skill of applying inhaler were evaluated. Patients who misused their drug were given training and PLB exercise was taught. In the interview room of the outpatient clinic, the researcher first applied the PLB exercise him/herself and then repeated the application steps for the patient by both explaining and showing them until the patient learned. Then, the application was made together with the patient and the points that the patient was unable to do were corrected. After the application, the patient was rested and the training of inhaler drug use was started.

The researchers provided training with the demonstration method using placebo drug specifically for each type of inhaler used by the patient. The patient was also allowed to repeat the application with a different placebo drug and the training was continued until the incorrect steps were corrected. At the end of the training, by being given leaflets enriched with colorful pictures, the patients were allowed to read at home and remember the steps they had forgotten.

Intervention 2 group

In the first interview, sociodemographic information of the patients was obtained and their COPD, levels of dyspnea and life quality and their skill of applying inhaler were evaluated. Then, each patient was taught the correct application steps according to the type of inhaler s/he used as described above. The difference of this group from the I1 group is that patients were given only training of inhaler drug use, PLB exercise wasn't applied. At the end of the training, inhaler drug use brochures were given.

Data Collection

Forms prepared by the researchers

Patient Information Form, Inhaler Application Skill Chart, Breathing Exercise and Inhaler Application Skill Chart [9, 10, 13, 14]. *Patient Information Form* consisted of 19 questions including sociodemographic and disease features of the patients. *Breathing Exercise and Inhaler Application Skill Chart* consisted of 18 items including the steps of PLB and inhaler utilization to be applied to I1 group. *Inhaler Application Skill Chart* consisted of 10 items including only the skill of applying inhaler to be applied to the I2 group. Correct steps were evaluated as 1 point and wrong steps as 0 points in both skill charts.

COPD assessment test (CAT)

The scale developed by Jones et al [15] is used to measure the health status of individuals with COPD. The Cronbach's α coefficient of the scale in this study was calculated as 0.95 in the first follow-up and last follow-up, and it was found to be highly reliable.

St. George's respiratory questionnaire (SGRQ)

It is a quality of life questionnaire specific to patients with COPD developed by Jones and Forde [16]. Cronbach's α coefficient in this study was calculated as 0.84 in the first follow-up and 0.88 in the second follow-up and the scale was found to be highly reliable.

Modified medical research council (mMRC)

It was developed by the British Medical Research Council in order to provide information about the degree of dyspnea experienced by the patient based on the patient's activity and the patient's perception of the disease [17]. As it is a one-dimensional scale Cronbach's α coefficient could not be calculated.

Data analysis

Data were evaluated with IBM SPSS Statistics 25.0 (Statistical Package for the Social Sciences; IBM Corp., Armonk, New York, ABD) and statistical package program. After evaluations were made with Shapiro Wilk normality test two-sample independent t-test was used for normal distribution, and Mann-Whitney U test was used for non-normal variables. Comparisons of groups over time are made with two-way analysis of variance in repeated measurements for variables with normal distribution. Bonferroni correction was applied while comparing the main effects and intragroup comparisons for variables that did not show normal distribution were made with Wilcoxon analysis. The relationship between categorical variables was examined with the exact method of Pearson Chi-square test. $p<0.05$ value was considered statistically significant in the study. Reliability measurements of the scales were made according to Cronbach's α coefficient.

Results

In the study, 56.3% of the I1 group is between the ages of 60-69, 90.6% are male, 96.9% are married, 56.3% have been diagnosed with COPD for 1-4 years, 75.0% smoked and then quitted smoking and 28.1% drank alcohol and then quitted it. 90.6% of patients described their most common problem as shortness of breath. 40.7% of the patients stated that they stayed in a hospital within the last year and 53.8% stated that the duration of their stay in the hospital was five days or more. In addition, 75.0% of the individuals in this group stated the type of inhaler they used as a metered dose inhaler (MDI) and 37.5% stated that they needed extra inhaler drug use during the day. 48.6% of the I2 group is between the ages of 60-69, 88.6% are male, 94.3% are married, 48.6% have been diagnosed with COPD for 1-4 years, 68.6% smoked and then quitted smoking and 25.7% drank alcohol and then quitted it. 82.9% of patients reported that the problem they complained about most was shortness of breath. 28.6% of the patients stated that they stayed in a hospital within the last year and 60.0% stated that the duration of their stay in the hospital was five days or more. In addition, 74.2% of the patients stated the type of inhaler drug they used as MDI, and 45.7% stated that they needed to use more doses of inhaler drug than prescribed. It was determined that there was no statistical difference between I1 and I2 groups in terms of introductory features ($p>0.05$) (Table 1).

Table 1
Distribution of introductory features of intervention 1 and intervention 2 groups.

	Group						
Introductory Features	**I1 Group** (*n*=32)		**I2 Group** (*n*=35)		**Total** (*n*=67)		**Test**
	n	%	*n*	%	*n*	%	*p*
Age group							
Between 40-49 years	1	18.8	2	5.7	3	4.5	0.937
Between 50-59 years	6	3.1	8	22.9	14	20.9	
Between 60-69 years	18	56.3	17	48.6	35	52.2	
70 years and older	7	21.8	8	22.8	15	22.4	
Gender							
Female	3	9.4	4	11.4	7	10.4	1.000
Male	29	90.6	31	88.6	60	89.6	
Educational status							
Illiterate / Primary school	21	65.6	28	80.0	49	73.0	0.107
Secondary school/High school	8	25.0	4	11.4	12	18.0	
Associate degree/Bachelor's degree	3	9.4	3	8.6	6	9.0	
Marital status							
Married	31	96.9	33	94.3	64	95.5	1.000
Single	1	3.1	2	5.7	3	4.5	
Time of diagnosis							
1-4 years	18	56.3	17	48.6	35	52.2	0.763
5-9 years	5	15.6	8	22.9	13	19.4	
10 years +	9	28.1	10	28.6	19	28.4	
Smoking status							
Smokers	5	15.6	9	25.7	14	20.9	0.598
Ex-smokers	24	75.0	24	68.6	48	71.6	
Non-smokers	3	9.4	2	5.7	5	7.5	

***** Patients gave more than one answer ****** Some patients use more than one inhaler so no comparison could be made.

	Group						
Alcohol drinking status							
Ex-drinker	9	28.1	9	25.7	18	26.9	0.885
Non-drinker	23	71.9	26	74.3	49	73.1	
The most common problems*							
Shortness of breath	29	90.6	29	82.9	58	86.6	0.480
Cough	19	59.4	24	68.6	43	64.2	0.433
Phlegm	16	50.0	23	65.7	39	58.2	0.223
Fatigue	10	31.3	7	20.0	17	25.4	0.401
Insomnia	8	25.0	6	17.1	14	20.9	0.551
Wheezing	8	25.0	12	34.3	20	29.9	0.437
Sweating	4	12.5	10	28.6	14	20.9	0.138
Hospitalization status (Last 1 year)							
Yes	13	40.7	10	28.6	24	35.8	0.763
No	19	59.3	25	71.4	43	64.2	
Duration of hospital stay							
1-4 days	6	46.2	4	40.0	10	43.5	1.000
5 days +	7	53.8	6	60.0	13	56.5	
Type of inhaler**							
MDI	24	75.0	26	74.2	50	37.3	**
Diskus/Discair/Sanohaler	14	43.7	19	25.7	33	24.6	
Neohaler/Aerolizer	14	43.7	12	34.2	26	19.4	
Handihaler	12	37.5	13	37.1	25	18.6	
The need to use an extra inhaler during the day							
Yes	12	37.5	16	45.7	28	41.8	0.806
No	20	62.5	19	54.3	39	58.2	
Training status for inhaler utilization							

***** Patients gave more than one answer ****** Some patients use more than one inhaler so no comparison could be made.

	Group						
Got	18	58.1	26	74.3	44	66.7	0.197
Did not get	13	41.9	9	25.7	22	33.3	

***** Patients gave more than one answer ****** Some patients use more than one inhaler so no comparison could be made.

It was observed that most of the patients made errors in all steps of the breathing exercise application in the first follow-up. These errors were observed as the inability to breathe through the nose in the appropriate time, inability to perform expiration in twice the time of inspiration and with appropriate force, the inability to purse lips as if whistling while exhaling and inability to continue the application for 10 minutes. After the training, it was found that most of the steps were learned and the difference between the two follow-ups was significant ($p<0.001$) (Table 2).

Table 2
Breathing exercise skills of patients in the intervention 1 group at the first and last follow-up.

Steps of Breathing Exercise	I1 Group (*n*=32)				*p**
	Yes		No		
	First follow-up	Last follow-up	First follow-up	Last follow-up	
Sit comfortably and breathe through your nose for 2-3 seconds like smelling flowers	3	32	29	0	**<0.001**
Purse your lips like whistling and exhale slowly.	4	32	28	0	**<0.001**
Try to exhale from just your lips in 4-6 seconds	0	31	32	1	**<0.001**
Exhale like blowing the flame of a candle but not extinguishing it.	1	31	31	1	**<0.001**
Do not inflate your cheeks and do not tighten your abdominal muscles while exhaling	2	31	30	1	**<0.001**
Take a normal comfortable breath after 2 or 3 applications in a row	0	32	32	0	**<0.001**
Continue this exercise for about 10 minutes provided that you rest when you have difficulty	0	32	32	0	**<0.001**
Rest for 10 minutes after the exercise and move on to drug application steps	0	31	32	1	**<0.001**

***** Mc Nemar and Two-Proportions z Test

When the inhaler drug use steps of the patients in the I1 and I2 groups in the study were examined, it was seen that the errors made before the training were quite high in both groups. It was observed that most of

the errors were in steps such as not exhaling before applying the drug, not being able to apply hand-breath coordination, not being able to inhale the breath at the appropriate speed, not being able to hold the inhaled drug for 10 seconds, and not making mouthwash after application. It was found that these steps were learned after the training and the difference between the two follow-ups was significant ($p<0.001$).

The mean scores of the patients received from the inhaler types increased in the last follow-up compared to the first follow-up and this increase was found statistically significant in I1 ($p<0.001$, $p<0.001$, $p<0.001$, $p=0.002$) and I2 ($p<0.001$, $p<0.001$, $p=0.003$, $p=0.002$) groups. The differences between the inhaler scores of the patients in the I1 and I2 groups at the first and last follow-up were similar in all types of inhaler and no statistical significance was found between the differences ($p>0.05$). This shows that the training given to the groups is the same. The distribution of inhaler types was examined according to the first follow-up of the individuals in the I1 and I2 groups and the two groups were found to be similar in this respect ($p>0.05$) (Table 3).

Table 3
Distribution of inhaler score differences of patients in intervention 1 and intervention 2 groups.

Intervention Groups and Tests		**İnhaler Drug Types**			
		MDI	**Diskus/ Discair/ Sanohaler**	**Neohaler/ Aerolizer**	**Handihaler**
Intervention 1 Group (*n*=32)	**First follow-up**	6.0	6.0	6.0	6.5
	M (Q_1-Q_3)	(5.0-7.0)	(5.5-8.0)	(5.5-7.5)	(5.25-7.0)
	Last follow-up	10.0	10.0	10.0	10.0
	M (Q_1-Q_3)	(10.0-10.0)	(10.0-10.0)	(10.0-10.0)	(10.0-10.0)
	Difference*	4.0	4.0	4.0	3.5
	M (Q_1-Q_3)	(5.0-3.0)	(4.5-1.5)	(4.5-2.5)	(4.75-3.0)
	*p***	**<0.001**	**<0.001**	**<0.001**	**0.002**
2Intervention 1 Group (*n*=35)	**First follow-up**	5.0	6.0	6.5	6.0
	M (Q_1-Q_3)	(4.0-7.0)	(5.0-7.0)	(6.0-8.0)	(5.5-7.5)
	Last follow-up	10.0	10.0	10.0	10.0
	M (Q_1-Q_3)	(9.0-10.0)	(9.0-10.0)	(9.0-10.0)	(9.0-10.0)
	Difference*	5.0	3.0	3.0	3.0
	M (Q_1-Q_3)	(5.0-3.0)	(4.0-3.0)	(3.75-2.0)	(4.5-2.5)
	*p***	**<0.001**	**<0.001**	**0.003**	**0.002**
I1 and I2 Groups Difference Comparison *p**		0.464	0.953	0.173	0.390
I1 and I2 Groups First Follow-up Comparison *p**		0.306	0.632	0.460	0.932
* The difference was obtained by subtracting the first follow-up score from the last follow-up score.					
** Since the data are not parametrically distributed, z: Wilcoxon analysis was used.					
*** Since the data are not parametrically distributed, z: Mann-Whitney U test was used.					
M: Median, Q_1: 25. Percentile, Q_3:75. Percentile					

The median value of the CAT score difference of the patients in the I1 group decreased from 35.5 in the first follow-up to 27.0 in the last follow-up and from 34.0 to 29.0 in the I2 group. This decrease indicates

that COPD assessment status of the patients is improving and the result is statistically significant for both groups ($p<0.001$). The difference between the total CAT score in the first and last follow-up of patients in I1 and I2 was found to be 5.5 in I1 and 3.0 in I2 and the result is statistically significant ($p<0.05$). The median value of the mMRC scale score difference of the patients in the I1 and I2 groups decreased from 4.0 at the first follow-up to 3.0 at the last follow-up. This situation revealed that the severity of dyspnea in patients decreased and the result was statistically significant for both groups (I1=$p<0.001$, I2=$p<0.05$). The differences between the mMRC scores of the patients in the I1 and I2 groups at the first and last follow-up was found to be 1.0 in I1 and 0.0 in I2 and the result is statistically significant ($p<0.05$) (Table 4). This result confirms the hypothesis *"H_1: Breathing exercises and inhaler training applied to patients with COPD twice a day for four weeks reduces the severity of dyspnea"*.

Table 4
Distribution of score differences with copd assessment and mmrc scores of the patients in the intervention 1 and intervention 2 groups at the first and last follow-up.

Intervention Groups and Tests		**CAT**	**mMRC**
I1 Group (*n*=32)	**First Follow-Up**	35.5	4.0
	M (Q_1-Q_3)	(30.25-38.75)	(3.0-4.0)
	Last Follow-Up	27.0	3.0
	M (Q_1-Q_3)	(21.0-32.5)	(3.0-3.0)
	Difference*	5.5	1.0
	M (Q_1-Q_3)	(4.0-9.0)	(0.0-1.0)
	*p***	**<0.001**	**<0.001**
I2 Group (*n*=35)	**First Follow-Up**	34.0	4.0
	M (Q_1-Q_3)	(28.0-36.0)	(3.0-4.0)
	Last Follow-Up	29.0	3.0
	M (Q_1-Q_3)	(20.0-34.0)	(3.0-4.0)
	Difference*	3.0	0.0
	M (Q_1-Q_3)	(2.0-5.0)	(0.0-1.0)
	*p***	**<0.001**	**0.001**
Difference comparison of I1 and I2 groups *p**		**0.002**	**0.040**

***** The difference was obtained by subtracting the first follow-up score from the last follow-up score.

****** Since the data are not parametrically distributed, z: Wilcoxon Test was used.

******* Since the data are not parametrically distributed, z: Mann-Whitney U test was used.

M: Median, Q_1: 25. Percentile, Q_3:75. Percentile

The distribution of life quality scores of the patients in I1 and I2 groups at the first and last follow-up is given in Table 5. The mean of life quality scores of patients in both groups decreased in effect, symptom, activity, and overall score of the scale from first follow-up to last follow-up. As the score obtained from the quality of life scale decreases, the life quality of the patients increases. Accordingly, life quality level of the patients in I1 and I2 groups increased compared to their first follow-up. This result was found statistically significant in all sub-dimensions and in the total scale score for two groups (p<0.001) (Table 5).

Table 5
Distribution of life quality scores of the patients in intervention 1 and intervention 2 groups at the first and last follow-up.

SGRQ Sub-Dimensions and Total Score		Intervention 1 (*n*=32) $\bar{x} \pm ss$	Intervention 2 (*n*=35) $\bar{x} \pm ss$	*p**	Group Effect	Time Effect	Group X Time Effect**
Effect	**First follow-up**	50.99±21.22	50.85±19.77	0.978	0.560	**<0.001**	0.136
	Last follow-up	28.71±18.82	34.22±21.12	0.265			
*p**		**<0.001**	**<0.001**				
Symptom	**First follow-up**	65.43±19.06	60.75±17.98	0.598	0.711	**<0.001**	0.199
	Last follow-up	63.08±17.20	59.87±17.26	0.839			
*p**		**<0.001**	**<0.001**				
Activity	**First follow-up**	71.71±15.51	56.61±18.71	0.923	0.943	**<0.001**	0.199
	Last follow-up	71.32±17.56	56.46±17.75	0.974			
*p**		**<0.001**	**<0.001**				
Total	**First follow-up**	59.67±16.54	59.09±17.04	0.888	0.788	**<0.001**	0.281
	Last follow-up	42.49±16.01	45.22±17.26	0.505			
*p**		**<0.001**	**<0.001**				

When the effect of training on the groups was examined, it was found that the groups did not have superiority over each other in sub-dimensions and total scale score and it didn't create a statistically significant difference (p>0.05). When the effectiveness of training on time and among the groups of the patients in I1 and I2 group was analyzed, it was seen that there was no statistically significant difference in sub-dimensions and total scale score (p>0.05). Thus, considering the time effect of I1 group, it was found that it didn't have any superiority over I2 group. According to this conclusion, the hypothesis *"H_2: breathing exercises and inhaler training applied to the patients with COPD twice a day for four weeks improve the quality of life"* is not confirmed.

Discussion

Although correct inhaler utilization is extremely important in reducing complaints that can be experienced by COPD patients, many studies have revealed that a lot of patients misuse inhalers [8–10, 18]. In this study, similar to the literature, it was found that patients made a lot of errors in all types of inhaler. As a result of the failure of effective expiration before using the drug which is the leading cause of the errors, drug particles cannot find the opportunity to be stored in the airways [19]. Göriş et al [9] and Özel et al [18] reported in their studies in that expiration was not performed before using the drug. In addition, the drug must be inhaled at appropriate flow rate in order for the drug particles to reach the airways in the periphery [19]. Takaku et al [10] revealed in their studies in 2017 that the flow rate of the drugs was not appropriate. Similar to the literature, in this study, it was found that patients did not expire before inhaler utilization and were not able to inhale at the appropriate flow rate.

Keeping the drug by holding breath for a certain period of time after the application of the drug is an important step that must be done for sedimentation of the drug particles in the airways. This time is suggested to be approximately 10 seconds [20]. In this study, it was observed that the patients did not pay attention to this step at the first follow-up, but they kept breath for a suitable period after training.

When the differences in scores are examined according to the inhaler types used by the patients it was observed that the lowest score difference in I1 group was in the handihaler group (Table 3). It is thought that this is due to the fact that the patients made errors in the steps related to breath most during the first follow-up and the breathing exercises given to the I1 group were effective. In addition, it has been supported by many studies that handihaler, which is dry powder inhaler type, provides easier use compared to other inhaler types [9, 10, 18]. According to the first follow-up comparison test in Table 3, the groups are similar in terms of the inhaler types used ($p>0.05$). In the same way, the fact that I1 and I2 group difference comparison test was not significant in all inhaler types means that the trainings given were similar ($p>0.05$).

It has been reported in the literature that breathing exercises can increase the volume that patients will inhale before inhaler drug use [19]. In particular, it has been reported that PLB will reduce dyspnea and the number of breath per minute, provide ventilation efficiency so that inhaler drugs will perform better [11]. In this study, the patients in the I1 group were asked to apply PLB at least twice a day for 10 minutes. Initially, only a few of the patients who did not have any knowledge of breathing exercise were seen to try to give their breath as if they were whistling when their symptoms increased with their own effort, but it was understood that they could not perform the application correctly. It was determined at the end of the training that PLB was learned. It has been reported in the literature that PLB exercise provides various benefits for patients with COPD. Decrease in severity of dyspnea and the number of ventilation per minute and increase in oxygen saturation and exercise capacity are among these benefits [13, 21]. In this study, it was observed that patients in I1 group who were taught PLB had superiority over CAT ($p=.002$) and mMRC dyspnea severity ($p=.040$) compared to I2 group (Table 4).

While the symptoms caused by COPD affect daily work of an individual, it also determines the perception of the disease on the individual. Problems created by COPD in patients were evaluated with CAT. It was

found that the CAT score of both groups decreased and the results were significant ($p<0.001$). When the score differences between the groups were examined, the greater effect in the I1 group reveals that breathing exercise applied in addition to inhaler training contributed positively to COPD assessment (Table 4). Similarly, in the literature [22, 23], in studies involving inhaler training and breathing exercises given to patients with COPD it was reported that the total CAT score of the intervention group patients decreased and the result was significant compared to the control group ($p<0.05$).

The effect of trainings on dyspnea severity of patients was evaluated by mMRC scale. Accordingly, it was revealed that the trainings given were effective in I1 group ($p<0.001$) and I2 group ($p=.001$). According to the score differences between the groups, the effect in the I1 group was higher and it was found that breathing exercise applied in addition to inhaler training contributed positively to perception of dyspnea (Table 4). In the literature [5, 9, 11, 22, 24, 25], many studies reporting that the training given to patients with COPD contributed positively to the severity of dyspnea supports the results of this study.

Airway obstruction and accompanying symptoms in COPD have a negative effect on the quality of life [5, 6]. In the study, the effect of the training given to the patients on the quality of life was examined and it was seen that there were improvements in both groups in the sub-dimensions and overall score of the quality of life scale at the last follow-up compared to the first follow-up. Reporting in the studies conducted with COPD patients that the given trainings improve the quality of life [5, 9, 25–27] is similar to the quality of life findings of this study.

In the study, quality of life did not make any difference in terms of trainings given to I1 and I2 groups. It is an expected situation according to the literature that PLB exercise given to the I1 group, unlike I2 group, creates significance in terms of quality of life [3, 5, 9]. In the study conducted by Doğan [23] within the planned training given to the patients with COPD, it was reported that after the PLB training, the scores of sub-dimensions of quality of life scale and total scale score of the intervention group decreased and quality of life increased. Similarly, in this study, it was seen that total quality of life score of I1 group which included patients given PLB training was better compared to I2 group. However, there was no statistical significance between the two groups in terms of the quality of life scale (Table 5). Some features of the I2 group in the study were thought to affect this significance. Especially, the longer time of diagnosis of I2 group shows that the patients adapt better to COPD. Studies have reported that as the time of diagnosis increases, learning to live with the disease can be positively affected [9, 28]. In addition, the statements of the patients in the I2 group that they received more inhaler training when they were first diagnosed, stayed less in the hospital in the last year and their stay was shorter, and they experienced less symptoms such as shortness of breath, fatigue, and insomnia, are the factors that may cause difference between the two groups. The increase in shortness of breath, which is one of the important symptoms of COPD, brings with it the symptoms of insomnia and fatigue. These symptoms affecting the patient significantly decrease the quality of life [2, 6, 29].

The feeling of shortness of breath, in particular, is an important factor that affects the daily routine and care actions of an individual, ultimately decreasing their quality of life. In his study, Demir et al [3]

examined the relationship between dyspnea and quality of life and reported that the quality of life decreased as the severity of dyspnea increased. In their systematic review Geddes et al [30] reported that the quality of life will increase with the decrease in the severity of dyspnea in COPD patients, but more detailed studies are needed to provide evidence-level thesis. In this study, the fact that the dyspnea level of the patients was found to be high and quality of life was low showed similarity with the literature.

Conclusions

According to the results of the study, it has been found that PLB exercise and inhaler training applied to the patients with COPD improves breathing exercise and inhaler using skills, reduces the negative effects of COPD on the individual, relieves the severity of dyspnea, and improves the quality of life. In line with these results, trainings for inhaler drug use by nurses, teaching non-pharmacological methods such as PLB exercise, the support of nurses for patients with the evidence based practices in COPD by following the current literature, establishing special units under the leadership of COPD nurses in hospitals and conducting regular patient interviews in hospitals and supporting the research results by planning a larger sample and with a longer time interval can be suggested.

Limitations

The limitations of the study are that patients with COPD living outside the city center were not included in the study due to low possibility for follow-up, verbal statements that the patients applied the training they received correctly were accepted and the patients could not be evaluated in the long term as the study lasted four weeks. Besides, the research is limited only to the group in which it is conducted and cannot be generalized.

Abbreviations

COPD
Chronic Obstructive Pulmonary Disease
CAT
COPD Assessment Test
mMRC
Modified Medical Research Council
SGRQ
St. George's Respiratory Questionnaire
CONSORT
Consolidated Standards of Reporting Trials
PLB
Pursed Lip Breathing

Declarations

Authors' contributions

All authors contributed to the study concept and design, drafting of the manuscript, and critical revisions. All authors approved the final version of the manuscript submitted.

Acknowledgements

The authors thank copd patients.

Funding

This study was supported by Erciyes University Scientific Research Projects Unit with the project coded TDK-2018-7775.

Availability of data and materials

Applicable

Ethics approval and consent to participate

This study is conducted in accordance with the consensus ethical principles derived from international guidelines including the Declaration of Helsinki. The study was registered at ClinicalTrials.gov as NCT04739488.

Consent for publication

Not applicable

Competing interests

No conflict of interest

References

1. Birol L. Respiratory system diseases and nursing care. In: Akdemir N, and Birol L, editors. Internal Diseases and Care. Ankara, Turkey: System Offset; 2005. p. 309-396.
2. Kocabas A, Atıs S, Coplu L, et al.Yıldırım, N. Chronic obstructive pulmonary disease (COPD) protection, diagnosis and treatment report 2014. Turk Thorac J. 2014;15:1-11.
3. Demir G, Akkoca O, Dogan R, et al. Evaluation of dyspnea and quality of life in COPD. Tuberculosis and Thorax. 2003;51:365-372.
4. Registered Nurses Association of Ontario (RNAO). Nursing care of dyspnea: The 6th vital sign in individuals with chronic obstructive pulmonary disease (COPD). Ontario, Totonto: 2005.
5. Marciniuk DD, Goodridge D, Hernandez P, et al. Managing dyspnea in patients with advanced chronic obstructive pulmonary disease: A Canadian Thoracic Society clinical practice guideline. Can Respir

J. 2011;18(2):69-78.

6. Negi H, Sarkar M, Raval A, et al. Health-related quality of life in patients with chronic obstructive pulmonary disease in North India. JPGIM. 2014;60(1):7-11.
7. Global Initiative for Chronic Obstructive Lung Disease. Global strategy for the diagnosis, management, and prevention. A guide for health care professionals 2019 report. GOLD: 2019.
8. Sanchis J, Gich I, Pedersan S. Systematic review of errors in inhaler use: Has patient technique improved over time? Chest. 2016;150(2):394-406.
9. Goris S, Tasci S, Elmali F. The effects of training on inhaler technique and quality of life in patients with COPD. J Aerosol Med Pulm Drug Deliv. 2013; 26(6):336-344.
10. Takaku Y, Kurashima K, Ohta C, et al. How many instructions are required to correct inhalation errors in patients with asthma and chronic obstructive pulmonary disease? Respir Med. 2017;123:110-115.
11. Sutcu Cicek H, Akbayrak N. The effects of breathing exercises on pulmonary functions tests and arteriel blood gas for the patients with chronic obstructive pulmonary disease (COPD). Gülhane Medical Journal. 2004;46:1-9.
12. Leiva-Fernández J, Vázquez-Alarcón RL, Aguiar-Leiva V, et al. Efficacy of an educational intervention in primary health care in inhalation techniques: Study protocol for a pragmatic cluster randomised controlled trial. Trials. 2016;17(144):1-8.
13. Mayer AF, Karloh M, dos Santos, K, et al. Effects of acute use of pursed-lips breathing during exercisein patients with COPD: A systematic review and meta-analysis. Physiotherapy. 2018;104(1):9-17.
14. Roberts SE, Schreuder FM, Watson T, et al. Do COPD patients taught pursed lips breathing (PLB) for dyspnea management continue to use the technique long-term? A mixed methodological study. Physiotherapy. 2017;103:465-470.
15. Jones PW, Harding G, Berry P, et al. Development and first validation of the COPD Assessment Test. Eur Respir J. 2009;34:648-654.
16. Jones PW, Forde Y. St George's respiratory questionnaire for COPD patients (SGRQ-C) manual. Version 1.1. St George's University of London. 2008;1-15.
17. Bestall JC, Paul EA, Garrod R, et al. Usefulness of the medical research council (MRC) dyspnea scale as a measure pulmonary disease. Thorax. 1999;54:581-586.
18. Ozel F, Cıray Gunduzoglu N, Durmaz Akyol A. COPD and asthma patients' skills of using ınhaler devices and satisfaction situatio. AUHSJ. 2018;9:266-271.
19. Erk M. Inhalation techniques. Turk Thorac J. 2002;3:7-13.
20. Coady TJ, Davies HJ, Barnes P. Evaluation of a breath actuated pressurized aerosol. Clin Exp Allergy. 1976;6:1-6.
21. Cabral LF, D'elia TC, Marins DS. Pursed lip breathing improves exercise tolerance in COPD: A randomized crossover study. Eur J Phys Rehabil Med. 2015;51(1):79-88.

22. Tuluce D, Kutluturkan S, Cetin N, et al. The effect of the patient coaching on the dispnea, cough and sputum symptoms of the monitored patients with chronic obstructive pulmonary disease (COPD): A pilot study. GUJHS. 2016;5:32-41.
23. Dogan A. Evaluation of the impact (effect) of planned nursing education on quality of life and anxiety in COPD patients. [master's thesis]. Gaziantep: Hasan Kalyoncu Univercity; 2018.
24. Akinci AC, Olgun N. The effectiveness of nurse-led, home-based pulmonary rehabilitation in patients with COPD in Turkey. Rehabil Nurs. 2011;36(4):159-165.
25. Borge CR, Hagen KB, Mengshoel AM, et al. Effects of controlled breathing exercises and respiratory muscle training in people with chronic obstructive pulmonary disease: Results from evaluating the quality of evidence in systematic reviews. BMC Pulm Med. 2014;14:184-199.
26. Yorgancıoglu A. Quality of life in chronic respiratory diseases. In: Erk M, and Ergün P, editor. Pulmonary Rehabilitation. Istanbul, Turkey: Turkish Thoracic Society; 2009. p. 66-83.
27. Folch-Ayora A, Orts-Cortés MI, Macia-Soler L, et al. Patient education during hospital admission due to exacerbation of chronic obstructive pulmonary disease: Effects on quality of life-controlled and randomized experimental study. Patient Education and Counseling. 2019;102(3):511-519. doi: 10.1016/ j.pec.2018.09.013.
28. Leiva-Fernández J, Leiva-Fernández F, García-Ruiz A, et al. Efficacy of a multifactorial intervention on therapeutic adherence in patients with chronic obstructive pulmonary disease (COPD): A randomized controlled trial. BMC Pulm Med. 2014;14(70):1-12.
29. Mollaoglu M, Fertelli TK, Özkan F. Fatigue and disability in elderly patients with chronic obstructive pulmonary disease (COPD). Archives of Gerontology and Geriatrics. 2011;53:93-98.
30. Geddes EL, O'Brian K, Reid WD, et al. Inspiratory muscle training in adults with chronic obstructive pulmonary disease: An update of a systematic review. Respir Med. 2008; 102:1715-1729.

Figures

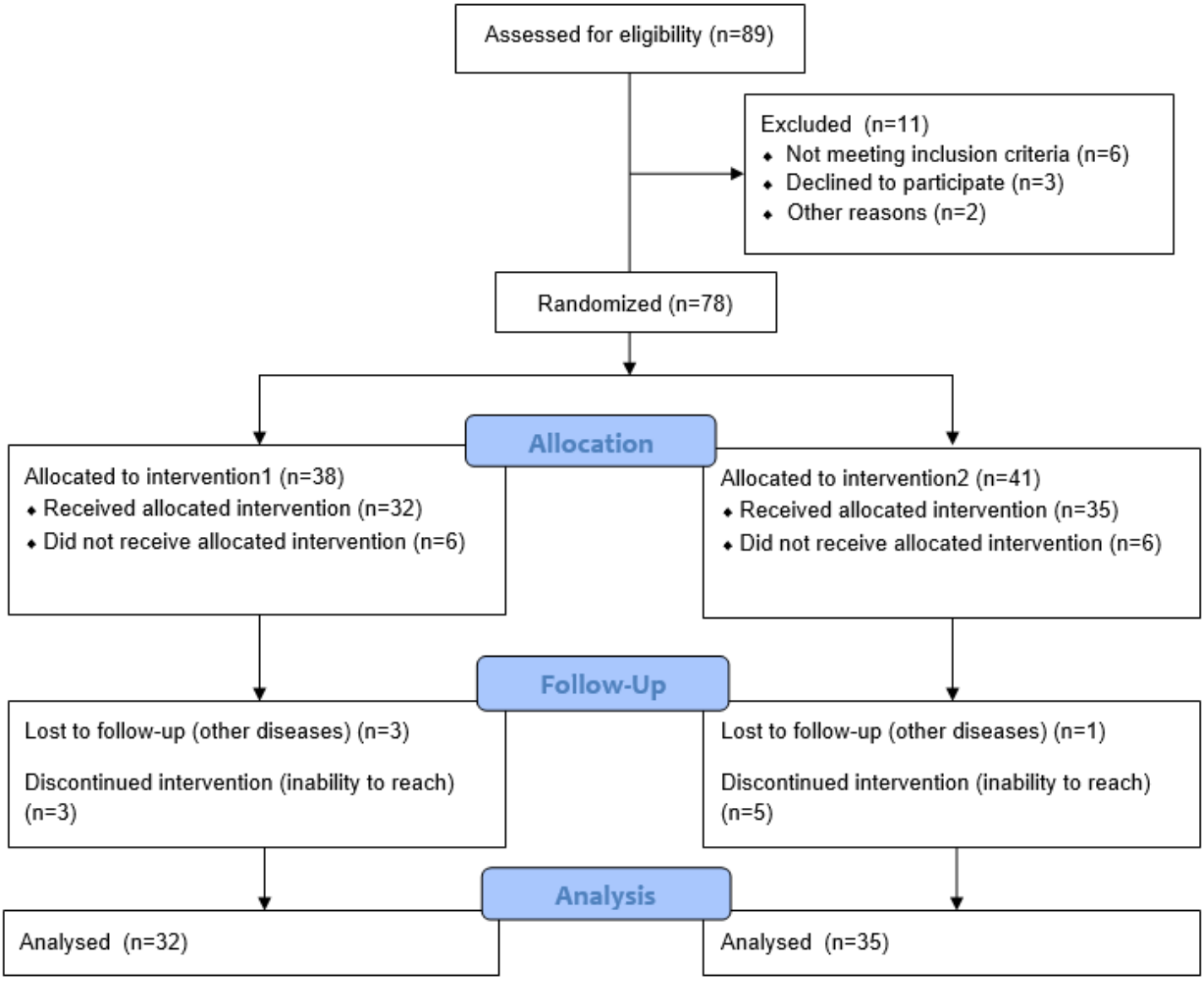

Figure 1

CONSORT 2010 Flow Diagram