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Effect of Breathing Exercises on Fatigue Dimensions in Patients with COPD

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Abstract

Objective: Fatigue is known as an important and multidimensional symptom in patients with chronic obstructive pulmonary disease (COPD). Pulmonary Rehabilitation (PR) is one of the effective ways to reduce fatigue and improve the quality of life in patients with COPD. However, equal recovery to all dimensions of fatigue is unclear after the rehabilitation program. This study aims to determine the effect of breathing exercises on the fatigue dimensions in patients with COPD

Method: This study aimed to determine the effect of breathing exercises on fatigue dimensions in patients with COPD. The population in this clinical-trial research included 70 COPD patients who had been hospitalized in the Thorax Ward of Razi Hospital in Rasht. The samples were divided into two groups of 35 subjects, by which the control group was tried to be in a separate room from the experimental group. The experimental group participated in the breathing exercises program where the patients were asked to perform their respiratory exercises 4 times a day for 10 days. The control group received the routine care. Dimensions of fatigue (physical, general, mental, reduced activity, and reduced motivation) were measured and compared in both groups. SPSS (version 21) was used to analyze the data and descriptive and inferential tests were used.

Results: There were significant statistical improvements in mean score of fatigue dimensions after breathing exercises, general fatigue ($p=0.0001$), physical exhaustion ($p=0.0001$), reduced activity ($p=0.0001$) and reduced motivation ($p=0.0001$), but there was no significant difference in mental fatigue. Predictors of changes in total fatigue score, breathing exercises ($p<0.0001$) and Salbutamol spray ($p<0.013$) were considered as two factors affecting fatigue score changes in multiple analysis.

Conclusion: According to the obtained findings, breathing exercises are effective in many dimensions of fatigue as a non-pharmacological, low-cost, and safe method in care-and-treatment process in patients with COPD, but their effect on mental fatigue, as an important dimension, requires different plans and designs in doing breathing exercises.

Keywords: Chronic obstructive pulmonary disease, Fatigue, Breathing exercises

Introduction

Chronic obstructive pulmonary disease (COPD) is one of the most common chronic diseases (1). The Global Institute for Chronic Obstructive Lung Disease (GOLD) estimates that by 2020, COPD will have ranked third among the world's sixth most common causes of death and will have been the fifth disabling disease (2,3). Two important symptoms in patients with COPD, which are also among the common complaints, are shortness of breath (dyspnea) and fatigue (3-5). Fatigue is an important and multi-dimensional symptom in patients with COPD (6,7). Fatigue impedes the fulfillment of individual and social roles and has a significant negative effect on the economic status and quality of life of affected people as well (2). Fatigue is experienced by approximately 43-58 percent of people with COPD (3). There is also a strong correlation between fatigue and conditions such as anxiety, petulance, depression, and sleep quality (8). Fatigue is a multidimensional concept, understanding different aspects of fatigue will help nurses for better planning and implementation of strategies to relieve fatigue in patients. (7). Today, pulmonary rehabilitation (PR) is developed as a non-pharmacological approach focusing on the needs of patients and their families. PR aims to help patients achieve independence and maintain the maximum level of autonomy and function in society (9,10). Breathing exercises are important parts of pulmonary rehabilitation, which can improve airway function and increase respiratory function (11). Breathing exercises in patients with COPD, such as pursed-lip breathing (PLB) and diaphragmatic breathing (DB), aim to improve respiratory pattern through reducing respiratory rates (12). The study conducted by Zakerimoghadam et al. (2006) showed that doing breathing exercises was effective in reducing fatigue in patients with COPD (4). Izadi Avanji et al. (2006), in the same vein, demonstrated that pursed-lip breathing (PLB) exercises improved pulmonary function, arterial blood gases, and increased the daily life activities (13).

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A study by Lewko et al. (2014) in London also revealed that low levels of activities as well as general and physical fatigue all improved seven weeks after a rehabilitation program, whereas there was no significant difference in reduced motivation or mental fatigue after this period (6). Although fatigue is an inevitable phenomenon in patients with COPD, health-care providers, unfortunately, pay little heed to fatigue and its rate when examining clinical symptoms of patients with COPD (1,7). Therefore, in order to reduce costs and manpower and to promote health, and since nurses spend more time with patients, it is necessary to focus on non-pharmacological, low-cost and non-invasive methods as an effective way to reduce the level of fatigue, thereby improving the level of health and quality of life for these patients (3). This study aims to determine the effect of breathing exercises on the fatigue dimensions in patients with COPD.

Materials and Methods

In this clinical trial study, the subspecialized pulmonology ward of Razi Hospital in Rasht was selected as the research environment. The study population included all COPD patients hospitalized in the pulmonology ward (Razi hospital) from 22/05/2015 to 14/11/2015. Sample size, with a confidence coefficient of 95% and a test power of 95% using Zakeri Moghaddam et al.'s findings (4), was determined so that there were 29 subjects in each group, and finally, considering the probability of drop-outs, 35 individuals were considered for each group. The inclusion criteria for the study were: definite diagnosis of COPD by a physician; having no underlying illness (unstable angina, uncontrolled cardiac arrhythmia, uncontrolled hypertension); having no known defect in the respiratory system caused by other diseases other than COPD; not using fatigue reducers such as Amantadine; ability to speak Farsi; and being in the 2nd or 3rd stage of the disease based on GOLD classification. The exclusion criteria were: not doing recommended exercises; It should be noted that two patients in the control group and two patients in the experimental group died and one in the experimental group was excluded due to lack of cooperation. Data were collected using a questionnaire (demographic and disease-related data) and Multi-dimensional Fatigue Inventory (MFI). The MFI includes five distinct dimensions including general fatigue, physical fatigue, mental fatigue, reduced activity and reduced motivation. Each dimension consists of four questions and answers are collected in a 5-point scale. Therefore, the total score for each dimension will be between 4-20 and the total fatigue score which is determined by the sum scores of dimensions will fall between 20-100 where a higher score will indicate severer fatigue. The validity and reliability of this questionnaire have been set out in English (14,15). To assess the reliability of the questionnaire was completed within 15 days by 20 patients in two stages. The correlation coefficient between two stages Cronbach's alpha coefficient was used to determine the internal consistency of fatigue dimensions instrumentation. The obtained Cronbach's Alpha coefficient (α= 0.756) means that the questions on fatigue dimensions instrumentation have a reliable internal

consistency to determine the fatigue.

Procedure: due to the fact that the patients were hospitalized in both control and experimental groups, random sampling was not possible. Patients in the control group were placed in a separate room from the patients in the experimental group so as not to have them observe the exercises done by the experimental group. Rooms for experimental and control groups were selected arbitrarily. Data collection was done in both groups before and after intervention by the researcher's colleague who was not aware of the groups. A checklist containing demographic and disease-related data was completed for both groups. Moreover, the MFI was also completed by a questioner prevent probable bias once before intervention for both experimental and control groups. The researcher followed the breathing exercises for 10 days and then the multidimensional fatigue inventory was completed in both experimental and control groups again. The control group received routine cares while the experimental group received routine cares and took part in breathing exercises program

Patients hospitalized at subspecialized pulmonology ward of Razi Hospital in Rasht were taught breathing techniques for 30 minutes face-to-face training and they were given a training booklet. The breathing exercises done by the patients were then monitored and corrected by the researcher. In adopting effective breathing techniques, patients were taught how to use their breaths in PLB and DB and how to cough efectively. Patients did the abovementioned exercises 4 times a day (not doing breathing exercises received a zero score and the maximum amount of doing them received four scores) each time for 15 minutes over 10 days. The researcher monitored breathing exercises every time as long as the patients were hospitalized. After being discharged from the hospital, the MFI was completed by the questioner.

Statistical Analyzes

Data analysis was carried out using descriptive and analytical statistics (multivariate regression, paired t-test, independent t-test, Pearson correlation coefficient) in SPSS version 21 at a significance level of $P<0.05$.

Results

Thirty-six obese children (17 males) were enrolled in the study. Physical characteristics (mean +/- SD) were showed in Table 1. Scoring for nasal obstruction, tonsils hypertrophy and palate position (% in the population study) were calculated and showed in Table 1. Sleep respiratory polysomnographic results are summarized in Table 2.

Correlation coefficients (r) between phase angle (degrees) and respiratory polysomnographic results are shown in Table 2. Phase angle correlated significantly with PTT Ar/I ($P<0.005$), even after adjusting for nasal patency, tonsil hypertrophy, palate position, or BMI (Z-score), but not with AHI and ODI. Figure 1 shows the correlation (mean and 95% C.I.) between phase angle and PTT Ar/I (obese children with AHI > 1.4/hr are shown as non-filled squares.

Table 1: Frequency Distribution of Demographic and Disease-related Data in Patients with COPD in Experimental and Control Group

Variables			Groups		P
			Control	Experimental	
Age (Year)		Mean ± SD	72.10±77.67	68.11±23.15	**[1]0.086
Gender		Female	5(14.3)	8(22.9)	**[2]0.356
		Male	30(85.7)	27(77.1)	
Education		Illiterate	26(74.3)	20(57.1)	*0.275
		>Diploma	8(22.9)	12(34.3)	
		Diploma	1(2.9)	3(8.6)	
Career		Unemployed	0(0)	1(2.9)	*0.569
		Housewife/husband	2(5.7)	5(14.3)	
		Retired	8(22.9)	6(17.1)	
		Self-employed	9(25.7)	10(28.6)	
		Farmer	16(45.7)	13(37.1)	
Residency		City	20(57.1)	17(48.6)	*0.473
		Village	15(42.9)	18(51.4)	
Smoking (cigarette)		Yes	27(77.1)	30(85.7)	*0.356
		No	8(22.9)	5(14.3)	
Smoking withdrawal Time (Year)		Does’nt consume cigarettes	8(22.9)	5(14.3)	*0.063
		Has not quitted	13(37.1)	7(20)	
		>5	6(17.1)	14(40)	
		5-15	6(17.2)	3(8.6)	
		15<	2(5.7)	6(17.1)	
(cigarette) Cumulative consumption (pack/ year)		Mean ± SD	44.43±03.86	50.46±34.87	**0.563
History of other diseases	**Diabetes**	Yes	7(20)	6(17.1)	*0.759
		No	28(80)	29(82.9)	
	Hyperlipidemia	Yes	4(11.4)	6(17.1)	0.495*
		No	31(88.6)	29(82.9)	
	Blood pressure	Yes	18(51.4)	15(42.9)	0.473*
		No	17(48.6)	20(57.1)	
	Heart disease	Yes	8(22.9)	11(31.4)	0.42*
		No	27(77.1)	24(68.6)	
Number of hospitalization in the hospital		No hospitalization	1(2.9)	0(0)	0.478*
		Less than 3 times	10(28.6)	13(37.1)	
		More than 3 times	24(68.6)	22(62.9)	

**Chi2*
***t-test*

The findings also showed that there was no statistical difference in control group before and after intervention regarding mean and standard deviation as well as changes in mean score of fatigue dimensions (general fatigue, physical exhaustion, reduced activity, reduced motivation, mental fatigue, and total fatigue score). But there was a significant difference (P=0.0001) in the experimental group before and after intervention regarding mean and standard deviation as well as changes in mean score of fatigue dimensions except mental fatigue (Figure 1, Table 2).

In Table 3 and figure 2, which compare mean changes in total fatigue score in terms of breathing exercises, it can be seen that there is a significant and inverse statistical difference between (doing) breathing exercises and changes in the total fatigue score, i.e. the more breathing exercises are used, the lower the fatigue score will be. So, the highest score of fatigue reduction was observed in experimental group with regular breathing exercises, experimental group with irregular breathing exercises, and control group who did not do the exercises at all.

Table 4, which indicates the regression coefficients of the predictive factors for changes in the total fatigue score with individual, social, and disease-related variables, shows that from among individual, social, and disease-related variables, breathing exercises and Salbutamol spray were respectively the strongest and the second effective factors in the changes in the total fatigue score.

Table 2: Comparison of Mean and Standard Deviation and Changes in the Mean Scores of all Fatigue Dimensions in Control and Experimental Groups before and after Intervention (Int.)

Variable	Control group			Experimental group			P
	Mean ± SD (Before Int.)	Mean ± SD (After Int.)	Mean Changes	Mean ± SD (Before Int.)	Mean ± SD (After Int.)	Mean Changes	
General fatigue	15.3±76.12	15.88±2.68	-0.12	15.3±78.08	53.9 ±2.78	6.25	0.0001
Physical fatigue	17.1±76.85	1±18.7	-0.24	17.47±83.1	12.2±22.88	5.25	0.0001
Reduced activity	17.3±39.20	27.18±1.79	-0.88	17.09±1.94	4±11.66	6.09	0.0001
Reduced motivation	12.2±7.22	13.2±27.74	-0.58	10.97±2.78	34.8±2.54	2.63	0.0001
Mental fatigue	9.15±4.48	8.4±73.78	0.42	7.3±56.78	6.3±44.78	1.13	0.253
Total fatigue	72.76±11.01	74.8±15.48	-1.39	68.7±88.84	47.10±53.98	21.34	0.0001

Table 1: Comparison of Mean Changes in Total Fatigue Score Based on the Status of Breathing Exercises

Group	Variable	Frequency	Mean	SD	P
Experimental	Irregular	18	19.72	8.24	0.0001
	Regular	14	23.43	10.66	
Control		33	-1.39	8.76	
Sum total		65	9.8	14.57	

Table 2: Estimation of regression coefficients of predictors of changes in total fatigue score in patients with COPD

Variable	Non-standard coefficients		Standard coefficients	T	P	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Bottom line	Upper line
Constant value	-37.763	5.317		-7.102	0.0001	-48.388	-27.138
breathing exercises	34.409	3.378	0.789	10.185	0.0001	27.658	41.160
Constant Value	-42.871	5.48		-7.823	0.0001	-53.826	-31.916
breathing exercises	33.963	3.245	0.779	10.466	0.0001	27.476	40.45
Salbutamol spray	8.728	3.249	0.189	2.546	0.013	1.874	15.581

Discussion

The present study showed that the MFI mean scores before intervention in both control and experimental groups were the highest in terms of physical exhaustion, reduced activity, general fatigue, reduced motivation, and mental fatigue, respectively. Thus, physical exhaustion and mental fatigue had the highest and the lowest mean scores in both groups, respectively. The results of Wong et al.'s (2010) research also revealed that almost all patients with COPD had a high level of physical exhaustion (95.3%), reduced activity (88.1%), reduced motivation (83.3%), mental fatigue (69.9%) and general fatigue (54.5%) (8). Baghai-Ravary et al. (2009) by the same token demonstrated that patients with COPD suffered from fatigue more than healthy subjects in the study (16). Peters et al., (2011) also found that 50% of patients with chronic obstructive pulmonary disease suffered from fatigue, and these patients were more restricted in many aspects of their health, quality of life, and performance (17). Theander (2004), also showed that fatigue was a common symptom in patients with COPD which affected patients' performance and needed to be investigated and professionally intervened (18). Doing breathing exercises as a non-pharmacological, low-cost, and safe method in care-and-treatment process of patients with COPD could significantly improve fatigue (general fatigue, physical fatigue, reduced activity, and reduced motivation) except mental fatigue in the experimental group compared to the control group. In this regard, according to Lewko et al.'s (2014) study, only 23 patients demonstrated significant reduction in 'reduced activity, general fatigue, and physical fatigue' by completing the rehab program, but there was no reduction in the scores of 'mental fatigue and reduced motivation'. The fact that breathing exercises did not have any effects on mental fatigue in the current study could be due to the type of the proposed program and the lack of a long-term follow-up. Perhaps sessions on cognitive therapy and management of depression along with breathing exercises can affect mental fatigue in these patients. Lacasse et al. (2007) showed a significant reduction in fatigue scores after a rehabilitation program (19).

The results of this study showed that the reduction in COPD patients' fatigue scores was due to their breathing pattern change. There was a significant and inverse statistical difference between (doing) breathing exercises and changes in the total fatigue score, i.e. the more breathing exercises were used, the lower the fatigue score would be. These patients can use effective breathing patterns (DB, PLB, and effective cough) rather than ineffective ones to control and improve the disease symptoms and therefore increase their quality of life. The study conducted by Deng et al. (2013) revealed that after carrying out pulmonary rehabilitation program, there was a significant decrease in the total fatigue score as well as the mean scores of fatigue dimensions in the experimental group compared with the control group (5).

The results of Zakerimoghadam's (2006) study indicated that there was a significant difference between the experimental and control groups after the intervention in terms of severity of fatigue (4).

. In this regard, Lewko et al. (2009) conducted a study on physiological and psychological predictors of fatigue in patients with COPD. The results indicated that general fatigue predictors included depression and reduced arterial oxygen saturation. Physiological fatigue predictors included depression and age. The predictors of reduced activity included depression. Reduced motivation predictors included shortness of breath, depression, and reduced arterial oxygen saturation, and predictors of mental fatigue included depression and reduced arterial oxygen saturation (20).

Conclusion

Considering care-and-treatment process of patients with COPD, the findings of this study showed that doing breathing exercises as a non-pharmacological, low-cost, and safe method could significantly improve fatigue, except mental fatigue, in patients in the experimental group (compared to the patients in the control group). The impact of breathing exercises on mental fatigue, as an important dimension, needs different designs in doing such exercises.

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