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The effect of progressive muscle relaxation on the management of fatigue and quality of sleep in patients with chronic obstructive pulmonary disease: A randomized controlled clinical trial

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ABSTRACT

Objective: To assess the effect of progressive muscle relaxation (PMR) on fatigue and sleep quality of patients with chronic obstructive pulmonary disease (COPD) stages 3 and 4.
Materials and methods: The pretest posttest clinical trial recruited 91 patients COPD grades 3 and 4. Following random assignment of subjects, the treatment group (n = 45) performed PMR for eight weeks and the control group (n = 46) received routine cares. At baseline and after the intervention, fatigue and sleep quality was assessed. Data obtained were analyzed in SPSS.
Results: It was determined that PMR decreased patients' fatigue level and improved some sleep quality subscales including subjective sleep quality, sleep latency, sleep duration and habitual sleep efficiency, but no improvement was found in global sleep quality and other sleep subscales.
Conclusion: An eight-week home-based PMR program can be effective in reducing fatigue and improving certain subscales of sleep quality in patients with COPD stages 3,4. (IRCT2016080124080N3).

1. Introduction

Chronic Obstructive Pulmonary Disease (COPD) is a progressive chronic lung disease and one of the main causes of mortality worldwide. It is estimated that 210 million people are living with this disease, and COPD is anticipated to become the third leading cause of mortality in the world by 2030 [1]. A survey study conducted in Iran has reported the prevalence of COPD 5.7% [2].

Due to the obstruction in airflow, patients with COPD experience symptoms such as dyspnea, coughing, and fatigue (Cochrane). Fatigue is a complex and multidimensional stressful sensation [3] and the second most common symptom in COPD patients [4]. In a study, almost all COPD patients (95.3%) had experienced high levels of physical fatigue [3]. Tissue oxidation and muscle atrophy, changes in muscle structure, sleep disturbances, stress, medication side-effects, and eating disorders are among factors causing fatigue in COPD patients [5]. Fatigue in COPD patients is a debilitating symptom that leads to diminished exercise capacity and difficulty in performing routine daily activities [5,6]. The results of a study showed fatigue and fatigue-induced functional limitations are mainly affected by psychological and physiological factors such as insomnia, dyspnea, and symptoms of depression and surfactant protein D [4]]. Fatigue is associated with exacerbation of health status, increased burden of disease, poor social participation, reduced focus on the bodily sensation, poor sleep quality, and reduced level of physical activity [7]. In patients with COPD, fatigue is a predictor of mortality. However, it is often overlooked despite its high prevalence and important outcomes such as impaired quality of life (QOL) and increased risk of hospitalization [4].

Patients with COPD often report sleep impairment, and next to dyspnea and fatigue, disturbed sleep is the most common symptom in these patients [8]. A descriptive study reported poor sleep quality

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in 74.8% of COPD patients [9]. These patients suffer from a delay in falling asleep, a delay in onset of sleep, frequent waking, use of hypnotics, and daytime sleepiness [10].

In COPD patients, sleep can have side-effects such as significant hypoxemia and hypercapnia, especially during rapid eye movement (REM) sleep [11]. They experience abnormalities in ventilation to perfusion ratio (V/P) while sleeping, due to airflow obstruction, hyperinflation, respiratory muscle dysfunction and use of medications such as diuretics and steroids [12]. A regression analysis showed that sleep disturbance predicts both exacerbated incidence of COPD and the use of respiratory-related emergency utilities [13]. Another study showed that sleep deprivation affects Forced Vital Capacity (FVC) (−5%) and Forced Expiratory Volume (FEV) (−6%) [12]. Moreover, poor sleep quality can lead to impaired cognition [8] and impaired COPD self-management behaviors [13]. Sleep quality is an important aspect of life and determinant of physical dimension of QOL [14], and even survival in COPD patients [13]. However, like fatigue, assessment and management of sleep quality in COPD patients has been neglected, and it is necessary to address management of these two symptoms in clinical research and practice [12,15].

Some guidelines have introduced pulmonary rehabilitation as the first line in the management of COPD symptoms [9], and several studies have shown the effect of pulmonary rehabilitation in improving QOL, exercise tolerance, and reduced daily symptoms [16]. In a study conducted by Zakeri-Moghadam et al. the effect of breathing exercises in reducing the severity of fatigue [17] and In another study, the effect of breathing exercises in improving sleep quality in COPD patients was determined [18]. Although the benefits of pulmonary rehabilitation in COPD patients is clear, its costs, a lack of staff and equipment, and patients' inadequate compliance and participation in these programs are reasons why complementary medicine and alternative exercises such as controlled PMR or home-based exercises have been recommended [16]. PMR was developed by Jacobson in 1920s [19], and its effects such as reduced anxiety, diverting attention from pain, relieving muscle strain and contractions, facilitating sleep, and reducing sensitivity to fatigue made it an inseparable part of complementary medicine and holistic care of patients with COPD [20]. The effects of PMR have been recognized in reducing anxiety and depression in a variety of conditions including asthma, coronary artery bypass surgery, and chemotherapy-induced nausea in cancer patients also improving QOL of patients with endometriosis under Gonadotropin-Releasing Hormone (GnRH) agonist therapy [21]. In another study, the effects of acute PMR and music were observed in improving anxiety, dyspnea, breathing rate, pulse rate, and systolic blood pressure in COPD patients [22].

However, only a few studies have examined the effect of PMR and other relaxation techniques in improving sleep quality and fatigue in COPD patients [19]. The effectiveness of these techniques in the management of COPD symptoms is not clear, and only some studies have examined the effects of techniques such as Yoga, Tai Chi, and biofeedback on mental health, respiratory capacity, respiratory muscle strength, and QOL [23,24]. Moreover, rehabilitation studies, especially in Asian countries, have so far mainly focused on medications, training, oxygen-therapy, and respiratory and traditional exercises [9]. Thus, given the prevalence of COPD-related sleep disturbances and fatigue and the effect of these symptoms on the QOL and health outcome measures [15], and also given contradictions relating to the effect of relaxation techniques on COPD symptoms, short period of intervention, methodological differences in these studies [22,24,25] and single-group participants [19], the present study was conducted to assess the effect of PMR (as a complementary medicine method) on sleep quality and severity of fatigue in patients with COPD stages 3 and 4. PMR can improve adaptation of these patients to fatigue and poor sleep quality.

2. Materials and methods

2.1. Study design

This pretest-posttest clinical trial was conducted on two groups.

2.2. Participants

A total of 91 COPD patients attending the respiratory clinic of Shohada Teaching Hospital in the city of Khorramabad affiliated to Lorestan University of Medical Sciences (West of Iran) between July 2016 and March 2017 were recruited for this randomized controlled study.

The inclusion criteria were COPD diagnosed by the physician (based on physical examination and spirometry indices), living in the city (Khorramabad) for more than six months, fatigue score≥36 based on Fatigue Severity Scale (FSS), sleep disturbance score of 21 based on Pittsburgh Sleep Quality Index (PSQI), patients with COPD stage 3 or 4 (based on GOLD 2007), no comorbidities such as neurological diseases, acute myocardial infarction, or cancer, 45–70 years of age, BMI<30, no psychiatric disorders such as anxiety or severe cognitive impairment, having a CD player at home, no hearing problems, the ability to read and write, and willingness to take part.

The exclusion criteria were hospitalization during the study, exacerbation of the disease, stressful life events (death of a family member, etc.) participation in other rehabilitation, relaxation and meditation programs, such as Yoga, and discontinuation of exercises. The present study was approved by the Ethics Committee of the Lorestan University of Medical Sciences (ID: Lums.-REC.1395.107) and performed in accordance with the Declaration of Helsinki. Informed consent was obtained from all participating patients. The trial was registered on the Clinical Trials Registry (ID: IRCT2016080124080N3).

A total of 155 eligible consecutive patients were interviewed, and 55 patients were excluded for various reasons (Fig. 1). A total of 100 patients met the inclusion criteria and consented to take part in the present study. Before randomization, all patients' clinical assessment and pulmonary function measurements had been performed by a pulmonologist at the respiratory clinic.

The patients were randomly assigned to PMR (n = 50) and control (n = 50) groups using block randomization with randomly selected block sizes of 4 and an allocation ratio of 1:1. PMR and control group patients were matched in terms of severity of the disease. Based on two-sided $\alpha = 0.05$, power = 0.8, and an effect size = 0.65, the sample size was determined 40 patients for comparison of means between the two groups [26]. With an anticipated 25% dropout rate and to ensure adequacy of final sample size, 50 patients were selected per group. However, a total of 91 patients took part in the study, including 45 in the PMR group and 46 in the control. The reasons for participants' dropping out were patient's death in the course of the study (n = 3 from control group and n = 2 from PMR; 2) and loss of contact (n = 1 from control group and n = 3 from PMR).

2.3. Blinding

Neither the researcher who collected data before and after PMR nor patients had knowledge of allocations into treatment and control groups. Treatment and control groups were trained and exercised in different times and places.

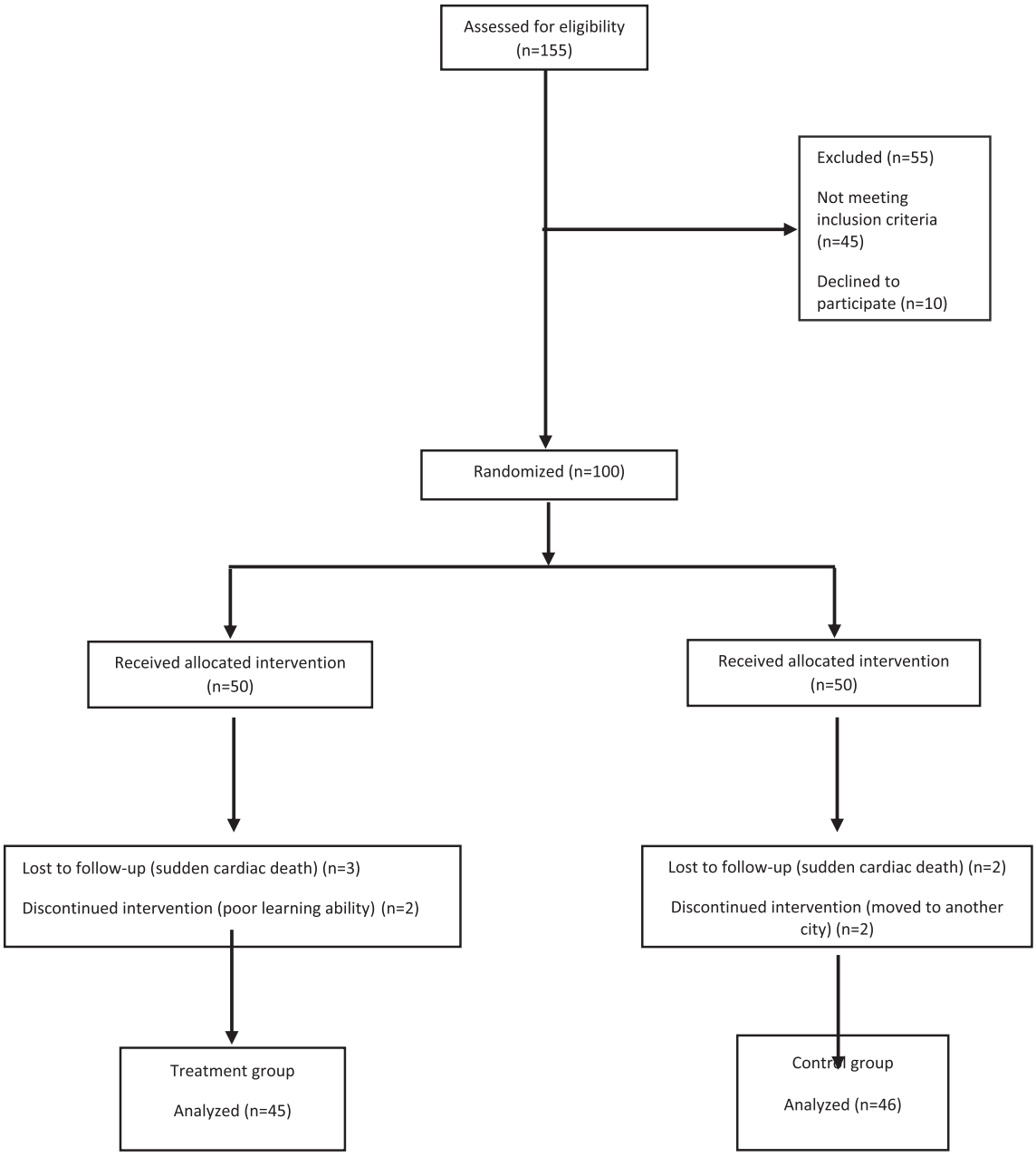

Fig. 1. Consort flow diagram.

2.4. Measurements

Demographic and clinical details questionnaire: This questionnaire contained 13 questions on age, gender, occupation, education, diagnosis of disease, duration of disease, GOLD grade, comorbidities, medication history, anemia, smoking, BMI, and respiratory function indices (FVC and FEV1).

2.4.1. Fatigue

Fatigue was assessed using the Iranian version of FSS [27], which is a 9-item self-administered questionnaire. Patients were asked to rank nine statements according to their level of agreement. Each item scored from 0 to 7 points (strong disagreement = 0 and strong agreement = 7). Scores of 36 and higher (out of maximum 63) indicate significant fatigue [28]. The qualitative content validity of FSS has been confirmed in previous studies conducted in Iran, and its reliability has been determined between 0.78 and 0.95 using test-retest method [27].

2.4.2. Sleep quality

PSQI was designed by Buysee et al. (1989) [29]. PSQI measures subjective sleep quality, especially over a one-month period. PSQI contains 19 items in seven subscales, including subjective sleep quality, sleep duration, sleep disturbance, sleep latency, sleep efficiency, use of sleep medications, and daytime dysfunction. Items are scored according to a 4-point Likert scale from 0 to 3 points. Subscales' scores are added to a global PSQI score. Total score of the questionnaire ranges from 1 to 21 points, where scores higher than 5 indicate poor sleep quality and scores less than 5 show absence of sleep disturbance. Validity and reliability of PSQI have been confirmed in many studies conducted in Iran, such that in one study, reliability was reported 0.85 with internal consistency

(Cronbach's alpha) method [30]. In the present study, reliability was confirmed with Cronbach's alpha of 0.82 for the global PSQI, and between 0.85 and 0.92 for subscales.

2.5. Intervention

The PMR group received PMR training over eight weeks, which included Bernstein and Borkovec standardized and validated procedures [31], performed based on Jacobson's classic muscle relaxation program [32].

This technique involves systematic relaxation of the major muscle groups of the body aiming at physical and psychological relaxation. For PMR group, PMR exercise included 112 individual PMR exercise sessions, twice a day, every weekday for eight weeks. Before commencing, a half hour introductory session was held for each patient individually regarding exercise principles and objectives. Furthermore, a trained researcher explained the importance of improving sleep quality and reducing fatigue in COPD patients at the respiratory clinic. Following this introductory session, the way to perform exercises such as muscle relaxation and contraction was practically shown to patients over the next half hour. In this session, patients were taught how to relax and contract their 16 main muscles including muscles of the right hand and forearm, right biceps, left hand and forearm, left biceps, forearm, upper section of cheeks and nose, lower section of cheeks and nose, neck and throat, chest, shoulders and upper part of back, abdominal region and stomach, right thigh, right calf, right foot, left thigh, left calf, and left foot) as previously described [33]. They were asked to focus on feelings associated with tensing of the muscle groups and maintain tension for a maximum of 5–7 s, and then relax muscles for 30–40 s. To ensure that these exercises had been learned, patients performed exercises for 20 min under the supervision of the researcher. Exercises were taught by the researcher and repeated by patients in a clean and quiet room with dimmed lighting in the respiratory clinic.

An educational booklet, describing mechanisms and benefits of PMR, and an audio CD as a home-based exercise guide for patients was given to participants. This CD had been prepared by the Student Research Committee of Khoramabad School of Nursing and Midwifery, and contained training on breathing control and 16-muscle relaxation. Patients were asked to use headphones and perform exercises twice a day (8–10 a.m. and 20–22 p.m.) (30 min each time) in a quiet place when they were least tired, and in a comfortable position wearing loose clothing. A form was given to patients in order to record exercise duration, frequency, and possible problems. Every week, patients were phoned and given necessary instructions on exercises or resolving possible problems during exercise. Patients' daily notes were received at the end of the intervention. Analysis of the date in daily forms showed mean exercise duration of 50 min and frequency of 1.8 times for each patient. All patients attended the clinic with their families. Therefore, in order to increase compliance to home-based exercises, contents of the booklet were explained to families, and they were asked to encourage the patients to perform their daily exercises. Two weeks after the first introductory session, patients were invited to the respiratory clinic again and performed exercises under the supervision of the researcher. Patients in the control group received routine nursing cares including training on the timely use of medication, breathing exercises such as pursed-lip breathing. In the posttest stage, eight weeks after completion of home-based daily exercises, patients were invited to the respiratory clinic and assessed by the researcher using FSS and PSQI.

2.6. Statistical analysis

Statistical analysis of data was performed in SPSS-16 (SPSS Inc.). The two groups' baseline demographic and clinical characteristics were compared using independent *t*-test for continuous variables and Chi-square or Fisher's exact test for stratified data. The difference between patients' mean scores of fatigue and sleep quality before and after PMR was assessed using paired *t*-test. A P-value<0.05 was considered as statistically significant for all tests. Wilcoxon signed-rank and paired t tests were used to assess training-induced changes before and after the intervention within a particular group.

3. Results

All patients received optimal medical therapy including bronchodilators (Beta2-agonists) and corticosteroids. No significant alterations in medications had been implemented in groups during the study. All patients tolerated PMR during treatment and assessment, and 100% of the intervention group patients complied with PMR.

3.1. Baseline characteristics

A total of 91 patients (37 women and 54 men) completed the study. Their mean age was 57.14 ± 11.8 years, and 73 patients (80.21%) were in the severe state of the disease (GOLD3). No significant difference was observed between the two groups in baseline demographic characteristics including age, gender, GOLD grade, BMI, pulmonary function indices, medications, smoking, disease diagnosis, duration of disease, comorbidities, anemia, occupation, or education ($P > 0.05$) (Table 1). BMI score was higher than 25 in 26 patients (57.77%) from the treatment group and 24 patients (52.17%) from the control. Between 5 and 10 years had elapsed since the diagnosis of the disease in the majority of patients. Comorbidities in 42% of patients included hypertension, diabetes, and Coronary Heart Disease (CHD). The two groups were statistically similar in terms of fatigue and sleep quality before the intervention ($P > 0.05$) (Tables 1 and 2).

3.2. Fatigue

The between-group analysis showed a significant difference between the two groups in terms of mean score of fatigue, and also the within-group analysis showed a significant improvement in fatigue in the treatment group after PMR, but no such an improvement in the control group despite the reduced severity of fatigue. A significant group*time interaction was observed for fatigue ($P < 0.05$) (Table 2) (Fig. 2).

3.3. Sleep quality

The between-group analysis showed no significant difference between the groups in terms of mean score of global sleep quality, and the between-group analysis of sleep quality subscales also showed significant differences between the two groups in mean scores of subjective sleep quality, sleep latency, sleep duration, and habitual sleep efficiency. The within-group analysis showed significant improvements in the global sleep quality and all its subscales in the treatment group, but in the control group, this improvement was observed in global sleep quality and subscales of sleep latency, sleep duration, sleep disturbances, and daytime dysfunction ($P < 0.05$) (Table 2).

Table 1
Baseline demographic characteristics of treatment and control groups.

Characteristics	Treatment group (n = 45) Mean ± SD	Control group (n = 46) Mean ± SD	P-value
Age (years)	57.37 ± 12.8	56.89 ± 14.6	0.86
Male/female, n	30/15	24/22	0.20
BMI, kg/m^2	26.4 ± 5.5	26.2 ± 3.2	0.84
FVC, l, mean (SD)	2.14(0.6)	2.12(0.8)	0.18
FEV1, l,mean(SD)	1.19(0.12)	1.17(0.15)	0.26
GOLD grade (III/IV), n	37/8	36/10	0.79
Disease diagnosis(emphysema/bronchitis), n (%)	15/30 (33.3%/66.7%)	14/32(30.4%/69.6%)	0.82
Smoking, pack-years	38.79 ± 14.22	36.73 ± 66.26	0.76
Smoking (non/ex-smoker), n (%)	14/31 (31.1%/68.9%)	19/27 (41.3%/58.7%)	0.28
Duration of disease (years) n (%)			
1 to 5 years	17 (37.7)	14 (43.5)	0.53
5 to 10 years	17 (37.7)	20 (30.4)	0.41
>10 years	11 (24.6)	12 (26.1)	0.37
Other morbidities, n (%)			
Hypertension	16 (35.5)	14 (30.4)	0.63
Dyslipidemia	6 (13.3)	7 (15.2)	0.22
Diabetes	14 (31.1)	18 (39.1)	0.35
Coronary heart disease	20 (44.4)	17(36.9)	0.48
Anemia (yes/no)), n (%)	5/40(11.11%/88.8%)	8/38(17.39%/82.6%)	0.31
Live with(%)			
Alone	4(8.9)	3(6.5)	0.72
Family	41(91.1)	43(93.5)	0.66
Employment(%)			0.60
Retired	18(40)	22(47.8)	
un employed	11(24.4)	14(30.4)	
Part-time	5(11.1)	3(6.5)	
Full-time	11(24.4)	7(15.2)	
Education(%)			0.19
Illiteracy	14(31.1)	22(47.8)	
Primary	19(42.2)	10(21.7)	
Secondary	7(15.6)	8(17.4)	
Tertiary or above	5(11.1)	6(13)	

BMI, body mass index; GOLD, The Global Initiative for Chronic Obstructive Lung Disease; FVC, forced volume capacity; FEV1, forced expiratory volume in 1 s.

Table 2
Effects of progressive muscle relaxation on Fatigue, sleep quality.

Characteristics	Treatment Group (n = 45)				Control group (n = 46)				Treatment Effect, p
	Before Mean ± SD	After Mean ± SD	Mean Difference ± SD	Group Difference, p	Before Mean ± SD	After Mean ± SD	Mean Difference ± SD	Group Difference, p	
Fatigue Severity Scale(0–63)	46.75 ± 14.60	24.66 ± 16.17	−22.08 ± 13.77	<0.001	42.43 ± 13.61	41.13 ± 14.73	−1.30 ± 5.20	0.148	<0.001
Subjective sleep quality	1.20 ± 0.72	0.53 ± 0.54	0.66 ± 0.60	<0.001	1.30 ± 0.62	1.21 ± 0.55	0.08 ± 0.55	0.29	<0.001
Sleep latency	1.60 ± 1.26	0.82 ± 0.93	0.77 ± 0.82	<0.001	1.80 ± 1.08	1.50 ± 0.98	0.30 ± 0.51	<0.001	<0.001
Sleep duration	0.87 ± 0.82	01.77 ± 0.92	0.90 ± 1.08	<0.001	0.97 ± 0.97	1.34 ± 0.97	0.36 ± 1.08	0.02	<0.001
Habitual sleep efficiency	0.33 ± 0.67	0.00	0.33 ± 0.67	0.002	0.18 ± 0.44	0.13 ± 0.34	0.04 ± 0.30	0.32	0.01
Sleep disturbances	1.51 ± 0.50	1.06 ± 0.49	0.44 ± 0.50	<0.001	1.32 ± 0.47	1.15 ± 0.41	0.17 ± 0.38	0.04	0.07
Use of sleeping medication	0.33 ± 0.90	0.26 ± 0.80	0.06 ± 0.39	0.026	0.28 ± 0.86	0.30 ± 0.83	-.02 ± 0.49	0.76	0.34
Daytime dysfunction	0.57 ± 0.58	0.35 ± 0.60	0.22 ± 0.47	0.003	0.54 ± 0.62	0.43 ± 0.58	0.10 ± 0.31	0.02	0.17
Global PSQI	6.33 ± 3.41	3.37 ± 2.36	2.95 ± 2.36	<0.001	6.41 ± 3.12	5.58 ± 2.94	0.82 ± 1.33	<0.001	0.08

X, mean; SD, standard deviation; PSQI, Pittsburgh Sleep Quality Index.

4. Discussion

According to the present study results, PMR program significantly reduces fatigue, but has no effect on global sleep quality and its subscales of sleep disturbances, use of sleeping medications, and daytime dysfunction. Although the efficacy of relaxation techniques is not clear in the management of COPD symptoms in some studies, other studies have shown the effects of these techniques on mental health in the form of increased perception of self-control, reduced anxiety, and improved quality of life [24]. One study showed the effect of combined PMR with music in reducing anxiety, dyspnea, and modification of vital signs in COPD patients [22].

The number of studies where relaxation exercises for COPD patients are performed is quite limited but the findings of some studies on the effect of PMR on fatigue in COPD patients agree with the present study results. Sahin et al. reported the effect of PMR in reducing fatigue in stage 3 and 4 patients after 8 weeks [19]. The effect of PMR on fatigue can be attributed to the fact that sympathetic activity is moderated during muscle relaxation, and vasomotor center relaxes, and therefore fatigue is reduced [34]. Zakeri-Moghadam et al. found that breathing relaxation program improves the severity of fatigue and dyspnea in patients [17]. These results can reflect the fact that PMR positively improves pulmonary function and exercise capacity, and thus relieves dyspnea and fatigue [19].

The results for other chronic diseases such as patients with

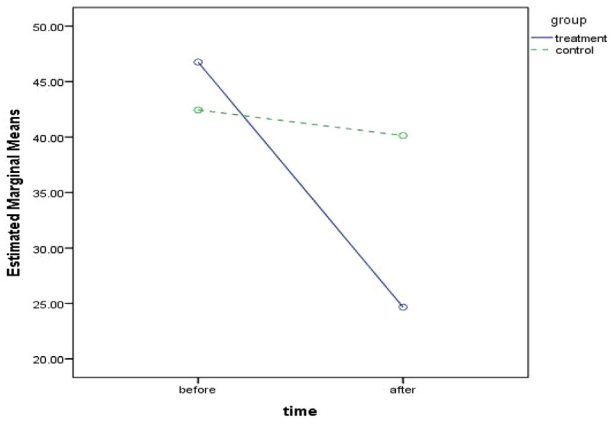

Fig. 2. Fatigue changes before (time1) and after (time2) PMR in the treatment and control group.

multiple sclerosis show that PMR reduces patients' fatigue level [20]. Moreover, the effects of other relaxation techniques on COPD patients concur with present study results. Polat and Erguney observed that reflexology reduces dyspnea and fatigue in COPD patients by creating physiological relaxation and increasing hemostasis [35]. By reducing the severity of fatigue, patients can be expected to take part in pulmonary rehabilitation programs [3], increase performance, improve daily activities, and promote self-care.

An important finding in the present study was that PMR did not affect the global sleep quality and some of its subscales. Few studies have explored the effect of PMR on sleep quality, but the studies conducted on patients with pulmonary arterial hypertension revealed that PMR had no significant effect on certain health outcomes such as the physical component of QOL [36,37], or the 6-min walking distance [37]. The present study showed the effect of PMR in improving certain subscales of sleep quality, namely subjective sleep quality, sleep latency, duration of sleep, and habitual sleep efficiency. Sahin et al. also observed the effect of PMR on global sleep quality and all of its subscales [19]. Regarding the different effects of relaxation techniques [22] and PMR on health outcomes such as sleep quality, it can be inferred that sleep quality is multifactorial, such that a review of literature shows that sleep disturbance is associated with coughing, dyspnea, COPD severity score [13], psychological distress and pain [8]. Furthermore, hypercapnia is a strong stimulant in provoking arousals [12]. Patients in the present study were in stages 3 and 4, and also almost 42% of them had comorbidities such as heart disease and diabetes, and these factors can affect the effect of PMR on sleep quality.

To improve sleep quality, some studies have recommended considering BMI [15] and interactions between obstructive sleep apnea (OSA) and COPD [14]. It is worth noting that sleep disturbance was considered an inclusion criterion in the present study, and the severity of sleep disturbance in these patients can affect the results.

4.1. Limitations

The interactions of dyspnea, OSA, and COPD were not assessed in the present study, and can be considered in future studies. Moreover, although PSQI is a valid tool for assessing dimensions of sleep, it is possible that other factors involved in sleep disturbance are not assessed with this questionnaire. Thus, studies that include objective measures of sleep such as polysomnography can help clarify other sleep parameters such as sleep efficiency or sleep architecture [14]. Despite sample size adequacy, the present study was conducted in a clinic, which limits the generalizability of the results obtained. In the present study, data were collected only before and after the intervention. Thus, data collection occasions should be increased in future studies, and this can better reflect short-term, mid-term, and long-term effects of interventions.

5. Conclusion

The present study showed that eight weeks of home-based PMR is a valuable intervention for reducing fatigue and improving certain components of sleep quality in COPD stages 3 and 4 patients. Management of symptoms is among objectives of nurses providing care for patients with chronic diseases. Thus, in cardiac-pulmonary rehabilitation clinics, nurses can teach them relaxation techniques such as PMR while assessing sleep and fatigue of COPD patients. Patients can perform these exercises under the supervision of nurses at home as a complementary therapy. In the present study, the effect of PMR on patients requiring acute care was not assessed. It is therefore recommended that factors affecting sleep and fatigue such as depression, pain, and dyspnea be considered in the future, and the effect of PMR on the duration of hospital stay, pulmonary function, perceived stress and also sleep quality in hospitalized patients be studied.

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Conflicts of interest

The authors confirm that there are no known conflicts of interest.

Authorship

All authors made significant contributions to the study design, acquisition of data, drafting of the article, and final approval of the article.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.ctcp.2018.01.010.

References

[1] B. McCarthy, D. Casey, D. Devane, K. Murphy, E. Murphy, Y. Lacasse, Pulmonary Rehabilitation for Chronic Obstructive Pulmonary Disease, The Cochrane Library, 2015.
[2] H. Sharifi, M.R. Masjedi, H. Emami, M. Ghanei, A. Eslaminejad, G. Radmand, et al., Burden of obstructive lung disease study in Tehran: prevalence and risk factors of chronic obstructive pulmonary disease, Lung India: Off. Organ of Indian Chest Soc. 32 (6) (2015) 572.
[3] C.J. Wong, D. Goodridge, D.D. Marciniuk, D. Rennie, Fatigue in patients with COPD participating in a pulmonary rehabilitation program, Int. J. Chronic Obstr. Pulm. Dis. 5 (2010) 319.
[4] M. Kentson, K. Tödt, E. Skargren, P. Jakobsson, J. Ernerudh, M. Unosson, et al., Factors associated with experience of fatigue, and functional limitations due to fatigue in patients with stable COPD, Ther. Adv. Respir. Dis. 10 (5) (2016) 410–424.
[5] M. Mollaoglu, T.K. Fertelli, F.Ö. Tuncay, Fatigue and disability in elderly patients with chronic obstructive pulmonary disease (COPD), Arch. Gerontol. Geriatr. 53 (2) (2011) e93–e98.

[6] M. Andersson, C. Stridsman, E. Rönmark, A. Lindberg, M. Emtner, Physical activity and fatigue in chronic obstructive pulmonary disease—a population based study, Respir. Med. 109 (8) (2015) 1048–1057.
[7] M.A. Spruit, J.H. Vercoulen, M.A. Sprangers, E.F. Wouters, Fatigue in COPD: an important yet ignored symptom, Lancet Respir. Med. 5 (7) (2017) 542–544.
[8] M.J. Hynninen, S. Pallesen, J. Hardie, T.M. Eagan, B. Bjorvatn, P. Bakke, et al., Insomnia symptoms, objectively measured sleep, and disease severity in chronic obstructive pulmonary disease outpatients, Sleep Med. 14 (12) (2013) 1328–1333.
[9] M.A. Zohal, Z. Yazdi, A.M. Kazemifar, P. Mahjoob, M. Ziaeeha, Sleep quality and quality of life in COPD patients with and without suspected obstructive sleep apnea, Sleep disorders (2014) 508372.
[10] C. Enz, S. Brighenti-Zogg, E.H. Steveling-Klein, S. Dürr, S. Maier, D. Miedinger, et al., Predictors of increased daytime sleepiness in patients with chronic obstructive pulmonary disease: a cross-sectional study, Sleep Disord. (2016) 1089196.
[11] S.J. Crinion, W.T. McNicholas, Sleep-related disorders in chronic obstructive pulmonary disease, Expet Rev. Respir. Med. 8 (1) (2014) 79–88.
[12] W.T. McNicholas, J. Verbraecken, J.M. Marin, Sleep disorders in COPD: the forgotten dimension, Eur. Respir. Rev. 22 (129) (2013) 365–375.
[13] T.A. Omachi, P.D. Blanc, D.M. Claman, H. Chen, E.H. Yelin, L. Julian, et al., Disturbed sleep among COPD patients is longitudinally associated with mortality and adverse COPD outcomes, Sleep Med. 13 (5) (2012) 476–483.
[14] X. Soler, C. Diaz-Piedra, A.L. Ries, Pulmonary rehabilitation improves sleep quality in chronic lung disease, COPD 10 (2) (2013) 156–163.
[15] A.G.M. Cavalcante, P.F.C. de Bruin, V.M.S. de Bruin, E.D.B. Pereira, M.M. Cavalcante, D.M. Nunes, et al., Restless legs syndrome, sleep impairment, and fatigue in chronic obstructive pulmonary disease, Sleep Med. 13 (7) (2012) 842–847.
[16] J.-J. Fu, J. Min, P.-M. Yu, V.M. McDonald, B. Mao, Study design for a randomised controlled trial to explore the modality and mechanism of Tai Chi in the pulmonary rehabilitation of chronic obstructive pulmonary disease, BMJ open 6 (8) (2016), e011297.
[17] M. Zakerimoghadam, K. Tavasoli, A.K. Nejad, S. Khoshkesht, The effect of breathing exercises on the fatigue levels of patients with chronic obstructive pulmonary disease, Acta Med. Indones. 43 (1) (2011) 29–33.
[18] S. Pedramrazi, Y.H. Khezri, S. Nejati, A. Kazemnejad, Determining effect of controlled breathing on sleep quality in patient with chronic obstructive pulmonary disease, Nurs. Pract. Today 2 (2) (2015) 69–75.
[19] Z.A. Şahin, N. Dayapoğlu, Effect of progressive relaxation exercises on fatigue and sleep quality in patients with chronic obstructive lung disease (COPD), Compl. Ther. Clin. Pract. 21 (4) (2015) 277–281.
[20] N. Dayapoğlu, M. Tan, Evaluation of the effect of progressive relaxation exercises on fatigue and sleep quality in patients with multiple sclerosis, J. Alternative Compl. Med. 18 (10) (2012) 983–987.
[21] L. Zhao, H. Wu, X. Zhou, Q. Wang, W. Zhu, J. Chen, Effects of progressive muscular relaxation training on anxiety, depression and quality of life of endometriosis patients under gonadotrophin-releasing hormone agonist therapy, Eur. J. Obstet. Gynecol. Reprod. Biol. 162 (2) (2012) 211–215.
[22] V. Singh, V. Rao, Comparison of the effectiveness of music and progressive muscle relaxation for anxiety in COPD—a randomized controlled pilot study, Chron. Respir. Dis. 6 (4) (2009) 209–216.
[23] M.E. Hyland, D.M. Halpin, S. Blake, C. Seamark, M. Pinnuck, D. Ward, et al., Preference for different relaxation techniques by COPD patients: comparison between six techniques, Int. J. Chronic Obstr. Pulm. Dis. 11 (2016) 2315.
[24] E. Volpato, P. Banfi, S.M. Rogers, F. Pagnini, Relaxation techniques for people with chronic obstructive pulmonary disease: a systematic review and a meta-analysis, Evid. base Compl. Alternative Med. (2015) 628365.
[25] S. Ikemata, Y. Momose, Effects of a progressive muscle relaxation intervention on dementia symptoms, activities of daily living, and immune function in group home residents with dementia in Japan, Jpn. J. Nurs. Sci. 14 (2) (2017) 135–145.
[26] D.F. Polit, C.T. Beck, Nursing Research: Principles and Methods, Lippincott Williams & Wilkins, 2004.
[27] N. Ghotbi, N. Nakhostin Ansari, S. Fetrosi, A. Shamili, H. Choobsaz, Fatigue in Iranian Patients with Neurological Conditions, 2014.
[28] L.B. Krupp, Fatigue in multiple sclerosis, CNS Drugs 17 (4) (2003) 225–234.
[29] D.J. Buysse, C.F. Reynolds, T.H. Monk, S.R. Berman, D.J. Kupfer, The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research, Psychiatr. Res. 28 (2) (1989) 193–213.
[30] M. Saeedi, T. Ashktorab, K. Saatchi, F. Zayeri, S. Amir Ali Akbari, The effect of progressive muscle relaxation on sleep quality of patients undergoing hemodialysis, Iran J Crit Care Nurs 5 (1) (2012) 23–28.
[31] D.A. Bernstein, T.D. Borkovec, Progressive Relaxation Training: a Manual for the Helping Professions, 1973.
[32] E. Jacobson, Progressive Relaxation, 1938.
[33] W. Wang, G. He, M. Wang, L. Liu, H. Tang, Effects of patient education and progressive muscle relaxation alone or combined on adherence to continuous positive airway pressure treatment in obstructive sleep apnea patients, Sleep Breath. 16 (4) (2012) 1049–1057.
[34] R. Ranjita, A. Hankey, H. Nagendra, S. Mohanty, Yoga-based pulmonary rehabilitation for the management of dyspnea in coal miners with chronic obstructive pulmonary disease: a randomized controlled trial, J. Ayurveda Integr. Med. 7 (3) (2016) 158–166.
[35] H. Polat, S. Ergüney, The effect of reflexology applied to patients with chronic obstructive pulmonary disease on dyspnea and fatigue, Rehabil. Nurs. 42 (1) (2016) 14–21.
[36] M.-R. Isa, F.M. Moy, A.-H.A. Razack, Z.M. Zainuddin, N.-Z. Zainal, Impact of applied progressive deep muscle relaxation training on the health related quality of life among prostate cancer patients—a quasi experimental trial, Prev. Med. 57 (2013) S37–S40.
[37] Y. Li, R. Wang, J. Tang, C. Chen, L. Tan, Z. Wu, et al., Progressive muscle relaxation improves anxiety and depression of pulmonary arterial hypertension patients, Evid. base Compl. Alternative Med. (2015) 792895.