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Determination of Sleep Quality and Affecting Factors in COPD Patients

Burcu ÇUVALCI[1] and Sevilay HİNTİSTAN[2]

1 Recep Tayyip Erdoğan University, Vocational School of Health Services Elderly Care Programme, Turkey, e-mail: burcu.cuvalci@erdogan.edu.tr
2 Karadeniz Technical University, Health Sciences Faculty, Internal Medicine Nursing Department, Turkey, e-mail: sevilayhindistan@gmail.com
*Correspondence: burcu.cuvalci@erdogan.edu.tr

Abstract

Patients with Chronic obstructive pulmonary disease (COPD) often have difficulties in falling and remaining a sleep due to obstruction of their air passages. In these patients, the sleep quality can be improved by determining and regulating the factors affecting sleep quality. This study was carried out to determine the sleep quality and related factors of patients with chronic obstructive pulmonary disease (COPD). This descriptive and cross-sectional study was conducted between January 2014 and January 2015 with 80 COPD inpatients in the Chest Disease Clinic of Farabi Hospital, Faculty of Medicine of Karadeniz Technical University of Trabzon. Data were collected using face to face interview technique with Patient Information Form and Pittsburgh Sleep Quality Index (PSQI). Number, percentage, mean, Mann-Whitney U and Kruskal-Wallis Analysis of Variance tests were used to evaluate the data. The global PSQI score of patients was 9.38±3.17 and sleep quality of 97.5% of patients was poor. There was a statistically significant difference between "the sleep quality" with "gender, comorbid chronic diseases, experiencing drug-related side effects, exercising to alleviate COPD symptoms, shortness of breath, sleep location, type of bed, cleaning secretions before sleeping, interrupted sleep, using COPD aids while sleeping and difficulties in daily activities due to sleep problems" of COPD patients (p=0.000). This study showed that the sleep quality of COPD patients was very poor. Interventions should be planned and implemented to improve the factors that negatively affect sleep quality in COPD patients.

Key words: COPD, nursing, chronic disease, sleep, sleep quality.

1 Introduction

Chronic obstructive pulmonary disease (COPD) is progressive, characterized by airflow limitation, and not fully reversible. It is also preventable and treatable. COPD is associated with increased chronic inflammatory response of airways and lungs against harmful gases and particulates (GOLD, 2017).

COPD has a high morbidity and mortality rate throughout the world and Turkey, and it is one of the major health problems resulting in disability and death (GOLD, 2017). In 2014 COPD was the 11th most common illness in the world, and it is expected to rise to fifth place by 2030. Furthermore, COPD was the fourth cause of death in 2010 and is predicted to be the third cause of death in 2030 (MoH, 2014; Turkish Thoracic Society, 2014). In Turkey, more than half of respiratory-related deaths in 2012 were caused by COPD, the third most common cause of death among respiratory system diseases, and it was the eighth most common disease for the year 2014 (Turkish Thoracic Society, 2014; Turkish Statistical Institute, 2014).

A sound and restful sleep is an indispensable requirement to maintain optimal physical and mental health and a good quality of life. Sleep is a state of unconsciousness in which an individual can be awakened by external stimuli. It is a physiological condition that changes and becomes regular and repetitive, with increased insensitivity to external stimuli. A quality sleep is characterized by a person's feeling fit and ready for the day upon awakening (Potter et al., 2016). Quality sleep positively affects an individual's cognitive functions of productivity, memory and concentration. It also contributes to physical and psychological well-being. Conversely, disturbances in sleep quality decrease a person's quality of life by causing anxiety, depression, agitation, apathy, fatigue, impaired concentration and lapses in memory (Potter et al., 2016; Orth et al., 2008; Zohal et al., 2013).

In patients with COPD, sleep quality may be poor and sleep disturbances are frequent. Insomnia, night awakenings, increased daytime sleepiness, obstructive sleep apnea syndrome and nocturnal oxygen desaturation are found in these patients (Orth et al., 2008; Zohal et al., 2013). In COPD, respiration and gas exchange are often adversely affected by airway resistance and obstruction. Oxygen saturation is reduced, hypoxia and hypercapnia may develop, and functional residual capacity falls well below the normal level (Agusti et al., 2011). In these cases, the patient struggles to breathe, and difficulties are experienced in falling and staying a sleep.

A decline in sleep quality in COPD patients is caused by dyspnea, cough, sputum, deterioration of ventilation/perfusion balance, and increased respiratory effort. Additional causes include comorbidities such as depression, diabetes mellitus, cardiovascular system (CVS), and medicines used to treat the disease (Ort et al., 2008; Saaresranta et al., 2005). In COPD, a nightly sleep deprivation can lead to impaired pulmonary function by causing a temporary decrease in forced vital capacity and volume 1 of expiration (Agusti et al., 2011).

Sleep disturbances are common in COPD patients (Chang et al., 2016; Akinci et al., 2018). Indeed, over time, sleep disturbances in COPD patients may exacerbate symptoms of the disease, the emergence of CVS diseases, and the development of depression. They also decrease a person's quality of life by negatively affecting cognitive functions (Agusti et al., 2011). Adetiloye et al. (2018) found that COPD patients had a change in sleep patterns due to illness, and Kuyucu et al. (2011) reported that sleep problems in COPD patients were a secondary comorbid disease associated with COPD (Adetiloye et al., 2018; Kuyucu et al., 2011).

Determination of sleep quality and factors affecting sleep quality in COPD patients may lead to new ways of improving sleep quality, treatment compliance, and pulmonary function.

2 Materials and Methods

2.1 Study Design

The study was designed using a descriptive and cross-sectional model.

2.2 Sample and Setting

The study population consisted of 100 patients who were hospitalized between January 2014 and January 2015 with the diagnosis of COPD in the Chest Diseases Clinic of Farabi Hospital, Faculty of Medicine of Karadeniz Technical University of Trabzon, Eastern Black Sea region in Turkey. The sample of the study was calculated with the formula used to determine the number of individuals in the sample when the number of individuals in the population is known and 80 patients were identified to represent the population (Sümbüloğlu and Sümbüloğlu, 1994).

The study included only patients who were 18 years and older and who were staying in in the Chest Diseases Clinic due to diagnosis of COPD. Participants could not have a psychiatric or diagnosed sleep disorder. They also needed to exhibit a correct orientation to persons, place, and time, the ability to communicate verbally, and a willingness to participate in the research.

2.3 Ethical Considerations

Ethical suitability and approval for the study was determined and obtained from the Clinical Research Ethics Committee of the Faculty of Medicine, Karadeniz Technical University (Number: 24237859-298). If the participants were reluctant to sign a written consent form, verbal consent was obtained by the principal investigator.

2.4 Data Collection and Instruments

The data were collected by the investigator to complete the Patient Information Form and the Pittsburgh Sleep Quality Index (PSQI).

Patient Information Form: After a review of the literature, a Patient Information Form with 11 questions was created by the researcher (Zohal et al., 2013; Agusti et al., 2011; Saaresranta et al., 2005). Patient Information Form had 11 questions to determine the some COPD and sleep characteristics of the patients. These included gender, comorbid chronic diseases, experience drug-related side effects, exercises due to COPD, shortness of breath, sleep location, type of bed, clean secretions before sleeping, clean secretions before sleeping, interrupted sleep, use COPD aids while sleeping and difficulties in daily activities due to sleep problems.

Pittsburgh Sleep Quality Index (PSQI): The PSQI is an index developed in 1989 by Buysse, Reynolds, Monk, Berman, Kupfer (1989) (Buyse et al., 1989). The index contains 24 questions which quantitatively measure sleep quality and define "good" and "bad" sleep. The PSQI consists of 19 self-rated questions and five questions rated by the patient's bedpartner or roommate. The latter five questions are used for clinical information only and are not tabulated in the scoring of the PSQI. The 19 self-rated questions assess a wide variety of factors relating to sleep quality which include estimates of sleep duration and latency and the frequency and severity of specific sleep-related problems. These 19 items are grouped into seven component scores, each weighted equally on a 0-3 scale. These components are as follows: Subjective sleep quality, Sleep latency, Sleep duration, The habitual sleep efficiency, Sleep disturbance, Use of sleeping medications, and Daytime dysfunction. The seven component scores are then calculated to yield a global PSQI score, which has a range of 0-21; higher scores indicated worse sleep quality. The index does not indicate sleep disorder or the prevalence of sleep disorders. However, a global PSQI score of five or more indicates poor sleep quality (Buyyse et al., 1989). The validity and reliability study of the PSQI in Turkey was determined by Agargun et al. (1996) (Agargun et al., 1996). The Cronbach alpha internal consistency coefficient of the PSQI was 0.80. This value indicates that the internal consistency of the scale is high. In this study, the PSQI Cronbach alpha internal consistency factor was calculated as 0.70.

2.5 Procedure

The face-to-face interviews with patients were held in a private room at the Chest Diseases Clinic at a convenient time for the patient and researcher. It took about 20 minutes to fill out the Patient Information Form and the PSQI.

2.6 Data Analysis

The Statistical Package for Social Sciences for IBM SPSS Statistics 22.00 software was used to perform statistical data analysis. Number, percentages and average scores, and the Mann Whitney U test were used in the two groups and the Kruskal Wallis Variance

Analysis tests were used in groups of three and above. The results were evaluated in 95% confidence intervals and a significance level of p <0.05.

3 Results and Discussion

The mean scores of the PSQI subcomponents of COPD patients were: Subjective sleep quality 1.66±0.71; sleep latency 1.88±0.86; sleep duration 1.14±0.96; the habitual sleep efficiency 1.49±1.12; sleep disturbance 1.93±0.59; and daytime dysfunction 1.29±0.75. The mean PSQI global score of the patients was 9.38±3.17.

The mean scores of the PSQI subcomponents of COPD patients were as shown in Figure 1.

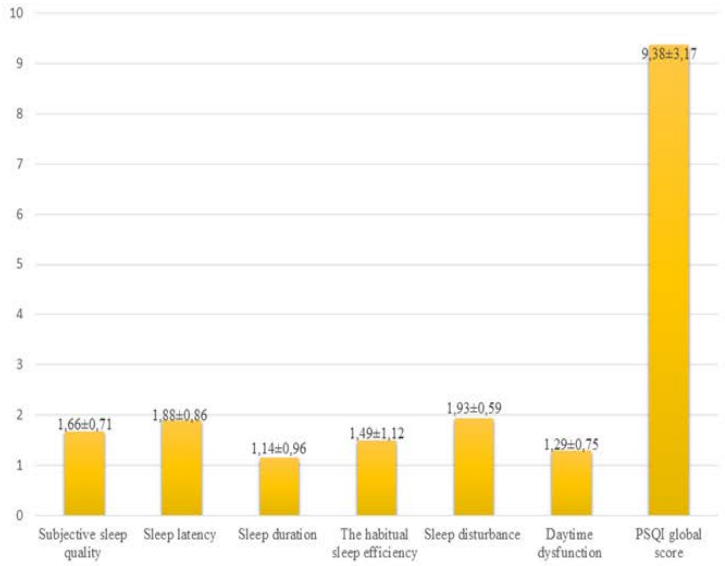

Figure1. PSQI subcomponents and global score averages of COPD patients

PSQI= Pittsburgh sleep quality index

It was determined that 97.5% of COPD patients had poor sleep quality, and 2.5% had good sleep quality. Sleep quality of COPD patients is shown in Figure 2.

Figure2. Sleep quality of COPD patients

According to some characteristics of COPD patients, the score average of PSQI are shown in Table 1. There was a statistically significant difference between the sleep quality of COPD patients and gender (p=0.026); comorbid chronic disease (p=0.048); patients who experienced drug-related side effects (p=0.000); patients who used exercises to alleviate COPD symptoms (p=0.013); patients with shortness of breath (p=0.012); sleep location (p=0.003); type of bed (p=0.013; patients who cleaned secretions before sleeping (p=0.047), interrupted sleep (p=0.018); patients who used COPD aids while sleeping (p=0.003), and patients with difficulties in daily activities due to sleep problems (p=0.000) (Table 1).

Table1. PSQI score averages according to some characteristics of COPD patients (n= 80)

Some Characteristics of Patients	Pittsburgh Sleep Quality Index				
		n	%	X±SD	p
Gender	Female	24	30.0	10.50±2.73	Z= -2.222
	Male	56	70.0	8.89±3.24	p= 0.026
Comorbid Chronic Disease[a]	Yes	49	61.5	9.85±3.10	Z= 1.977
	No	31	38.5	8.57±3.17	p= 0.048
Experience Drug-related Side Effects[b]	Yes	56	70.0	10.27±3.12	Z= 3.869
	No	24	30.0	7.29±2.17	p= 0.000
Exercise due to COPD[c]	Yes	16	20.0	11.13±3.18	Z= 2.376
	No	64	80.0	8.94±3.03	p= 0.013
Shortness of Breath	Yes	72	90.0	9.69±3.07	Z= 2.499
	No	8	10.0	6.50±2.67	p= 0.012
Sleep Location	Bedroom	61	76.2	8.77±2.92	Z= -2.961
	Living Room	19	23.8	11.32±3.21	p= 0.003
Type of Bed	Double bed	49	61.2	8.57±2.82	
	Single bed	17	21.3	10.12±2.95	KW= 12.678
	Sponge bed	10	12.5	11.70±3.49	p= 0.013
	Cotton / Wool Bed	4	5.0	10.25±4.57	
Clean Secretions Before Sleeping	Yes	35	43.8	10.14±3.06	Z= -1.984
	No	45	56.2	8.78±3.15	p= 0.047
Interrupted Sleep	Yes	66	82.5	9.77±3.21	Z= 2.374
	No	14	17.5	7.50±2.21	p= 0.018
Use COPD Aids While Sleeping[d]	Yes	16	20.0	11.25±2.17	Z= 3.017
	No	64	80.0	8.94±3.23	p= 0.003
Difficulties in Daily Activities Due to Sleep Problems[e]	Yes	48	60.0	10.65±3.02	Z= 4.497
	No	32	40.0	7.47±2.34	p= 0.000

COPD: Chronic obstructive pulmonary disease,

PSQI= Pittsburgh sleep quality index

a=cardiovascular diseases, diabetes mellitus, renal problems, hematological problems; b=oral instability, metallic taste, headache, palpitations, nausea, insomnia, tremor, hypotension; c=breathing exercises, coughing exercises, walking/running; d=oxygen cannula, oxygen concentrator, continous positive airway pressure/bi-level positive airway pressure (CPAP/BIPAP) (Continuous Positive Airway Pressure/Two-Level Positive Airway Pressure); e=cooking, cleaning, bathing.

Patients with COPD had a mean PSQI score of 9.38±3.17 and had poor sleep quality. In accordance with our study, other studies have reported the global PSQI score of COPD as 12.9±4.3 (Akinci et al., 2018); 7.8±4.9 (El-Fattah et al., 2018); 12.3±5.09 (Khalil et al., 2019); 8.03±3.66 (Zohal et al., 2013) and that patients had poor sleep quality. Our own study found that 97.5% of COPD patients experienced poor sleep quality. Similarly, Akinci et al. determined that 94% of COPD patients had poor sleep quality, while the Scharf et al. study reported the rate at 77.7% for COPD patients (Akinci et al., 2018; Scharf et al., 2011).

The subjective sleep quality, a subcomponent of PSQI, determines "how patients assess their sleep qualities in full". The current study determined that patients had a 1.66±0.71 average of "subjective sleep quality" and that patients evaluated their sleep qualities as only slightly better than “poor”. Still, other studies conducted differently from ours found that COPD patients had higher subjective average sleep quality scores and worse subjective sleep quality (Zohal et al., 2013; Akinci et al., 2018).

Sleep latency assesses “the amount of time of going from being fully awake to sleeping”. In our study, the mean sleep latency score of the patients was 1.88±0.86, indicating that the sleep latency of the patients varied between 31-60 minutes. As with our study, Adetiloye et al. also found that the average sleep latency score of patients with COPD was 1.85±0.86 (Adetiloye et al., 2018). Our study results revealed that COPD patients’ mean score of "sleep duration" was 1.14±0.96, indicating that the sleep duration of patients was more than five but less than six hours. This result is similar with the study of Chang et al. which the mean duration of the sleep score of COPD patients was 1.11±0.94 (Chang et al., 2016). However, the Chen et al. study reported the mean duration of sleep in COPD patients as 0.86±1.12, indicating that the sleep duration of the patients in our study was shorter than that of the patients in this study (Chen et al., 2016).

“The habitual sleep efficiency” is the sum of the time spent awake during the night and increases as a result of frequent awakening at night (Buysse et al., 1989). In our study, the average score of the "the habitual sleep efficiency", which covers the length of time

patients spent in bed and sleeping, was 1.49±1.12. Similarly, Zohal et al. found that the average habitual sleep efficiency point average of COPD patients was 1.4±0.9 (Zohal et al., 2013). The average sleep activity score of the patients was determined as 0.82±1.12 for Chen et al. and 0.73±1.04 for Chang et al (Chang et al., 2016; Chen et al., 2016). However, our study results determined that the patients were less likely to sleep than the patients in these studies.

In this study, the patients' mean score of sleep disorder (waking at midnight or early in the morning, waking to go to the sink, shortness of breath, coughing in sleep, feeling excessively cold or hot, bad dreams, pain while asleep and other causes) was 1.93±0.59. This result indicated that patients experienced sleep disorders one to three times in a week. Chen et al. found that the average score of sleep disorders in COPD patients was 1.25±0.57 (Chen et al., 2016). Yet patients in our study were more likely to have sleep disorders than those in the Chen et al. study.

"Daytime dysfunction" determines how often patients are trying to stay awake during their day-to-day activities (driving, eating, social interactions, etc.) and the degree of difficulty this creates in their daily routines. The mean score for daytime dysfunction of COPD patients in this study was 1.29±0.75. The mean score of daytime dysfunction in COPD patients was determined as 0.48±0.66 for Chang and 0.40±0.61 for Chen et al. (Chang et al., 2016; Chen et al., 2016). The patients in our study struggled more often to stay awake during the day than the patients in the aforementioned studies.

In our study, the sleep quality of female COPD patients (10.50±2.73) was worse than male patients (8.89±3.24), and it was statistically significant ($p<0.05$). Similarly Geiger-Brown et al. found the sleep quality of female COPD patients worse than male COPD patients. Furthermore, similar with Geiger-Brown et al., the current study too showed the sleep quality of patients with comorbid chronic disease (9.85±3.10) to be significantly worse (Geiger-Brown et al., 2015). Studies have reported that comorbid chronic diseases adversely affect the severity and prognosis of COPD (Ministry of Health, 2014). Airflow restriction and hyperinflation in COPD affect cardiac function and gas exchange, and inflammation in airways becomes systemic. These processes can lead to the development of chronic diseases such as cardiovascular system diseases, diabetes mellitus, anemia, osteoporosis and depression (Turkish Thoracic Society, 2014).

Another important issue is that COPD patients' sleep quality may be adversely affected by the side effects of drugs used (GOLD, 2017; Turkish Thoracic Society, 2014). In our study, sleep quality (10.27±3.12) was significantly worse in patients who had experienced side effects of COPD medications. The long-term and multiple use of drugs in the treatment of COPD is thought to reduce sleep quality by causing drug interactions. In addition, several drugs used to treat COPD are known to interfere with sleep quality. These include theophylline, salbutamol and terbutaline, which are used to provide bronchodilation. Roflumilast, which is used for anti-inflammatory purposes, and Bupropion Hydrochloric Acid, which is used in smoking cessation treatment, also cause insomnia and reduce sleep quality (GOLD, 2017; Turkish Statisticsl Institue, 2014). These drugs also decrease sleep activity and total sleep duration by increasing the number of times patients awaken during the night, thus decreasing deep sleep and REM sleep (Weitzenblum and Chaouat,2004).

Our study results showed that the sleep quality of COPD patients who exercise was significantly worse (11.13±3.18). Airflow restriction and hyperinflation in COPD affect cardiac function and gas exchange, and inflammation in airways becomes systemic. These processes can lead to the development of chronic diseases such as CVS diseases, diabetes mellitus, anemia, osteoporosis and depression (GOLD, 2017). Our study also found that the sleeping quality of the patients who exercised was considered to be poor because they did not have a regular exercise routine and thus overexerted their physical capacity at times. The Global Alliance Against Chronic Respiratory Disease (2017) emphasizes that COPD patients should exercise as much as they can, but they should avoid very strenuous exercises (GOLD, 2017). McDonnell et al. reported that pulmonary rehabilitation increased sleep quality in COPD patients, and Chen et al. reported a close relationship between exercise capacity and sleep quality of COPD patients (Chen et al., 2016; McDonnell et al., 2014). Nunes et al. found that exercises such as walking or swimming negatively affected the sleep quality of COPD patients (Nunes et al., 2013). In addition, Hartman et al. reported that nightly sleep breaks and getting out of bed significantly affected patients' daytime activities (Hartman et al., 2015).

Patients with COPD are said to have poor sleep quality due to shortness of breath, which suggests that the prognosis is worse (Turkish Thoracic Society, 2014; Akinci et al., 2018; Weitzenblum and Chaouat,2004). In parallel with the literature, the sleep quality of patients with shortness of breath in our study was found to be significantly worse. Nunes et al. reported a significant association between sleep disturbance and factors affecting night sleep quality in COPD patients, which supports our study (Nunes et al., 2013). Increased respiratory effort in COPD has been shown to increase alertness and cause severe sleep problems (Orth et al., 2008).

Preliminary factors for quality sleep quality include sleeping in one's own bedroom and in a double bed. Patients also feel more confident when they are able to sleep with their partner in a double bed where they can move comfortably at night. A study has reported that factors such as heat, light and sound are part of a person's sleeping routine and that sleeping in the usual place affects sleep quality (Bano et al., 2014). In our study, sleep quality of patients who had cleared their secretions in the respiratory tract before sleep was significantly worse than patients who had not done so. This suggests that patients who feel the need to clear the upper airway of secretions, obstructions, and suputum experience more symptoms that prevent them from breathing comfortably, and these symptoms cause sleep disturbances and worsen sleep quality.

The sleep quality of patients who experience interrupted sleep was found to be significantly worse (9.77±3.21). The Orth study reported that patients with COPD often have arousal and more interrupted sleep due to increased respiratory resistance, low oxygen

saturation, tired breathing muscles and increased respiratory effort (Orth et al., 2008). However, Hartman et al. found no significant difference between interrupted sleep and sleep quality in COPD patients (Hartman et al., 2015).

Orth et al. also reported that the use of sleep aid devices to treat COPD may improve sleep quality (Orth et al., 2008). Contrastly, the sleep quality of patients using sleep aid devices as part of their treatment was noted to be significantly worse in our study. This was because approximately half of the patients were 65 years of age or older (43.8%), and more than half had a comorbid chronic disease (61.5%). Seventy percent had experienced side effects associated with drugs; 90.0% had shortness of breath, and patients did not know how to effectively use these devices to treat their COPD.

Sleep quality was reported to be significantly worse in patients who experienced problems in their daily activities (10.65±3.02). Patients with COPD suffer respiratory symptoms, and for this reason sleep quality is adversely affected and patients often experience fatigue during the day (Saaresranta et al., 2005). Chen et al. noted that there may be a relationship between daytime fatigue and sleep quality (Chen et al., 2016).

4 Strengths and Limitations

We acknowledge that there are limitations to this study. This study was conducted in only one city in Turkey. Thus, the sample in this study reflects only one area of Turkey, and the study results may be generalized only to the sample group.

5 Conclusion

In conclusion, our study results clearly indicate that almost all COPD patient participants had experienced poor sleep quality. COPD patients' sleep quality has been shown to be correlated with gender, comorbid chronic disease, side effects associated with drugs, exercise due to chronic obstructive pulmonary disease, shortness of breath, sleeping location, type of bed, the cleaning of secretions before sleeping, and the use of special devices for COPD while sleeping. Failure to successfully resolve sleep problems in COPD patients may lead to negative outcomes. In fact, sleep quality deterioration in these patients can exacerbate the development of many comorbid diseases. Thus, patients' sleep quality should be carefully assessed even if COPD patients have not reported sleep-related complaints. Ultimately, the aim of health professionals who care for COPD patients is to be able to improve patients' sleep quality and overall health status. This will require controlling the development of comorbid chronic disease, achieving successful symptom management, minimizing the side effects associated with drugs, ensuring proper use of special devices for COPD while sleeping, encouraging correct and adequate exercise and improving the physical conditions of patients' sleeping locations.

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