The Effect of Dyspnea on the Cognitive Status in Patients with Chronic Obstructive Pulmonary Disease (COPD)

Kronik Obstrüktif Akciğer Hastalığı (KOAH) Olanlarda Dispnenin Bilişsel Duruma Etkisi

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ABSTRACT

Aim: The aim of this study is to examine the effect of the dyspnea on cognitive status in patients with chronic obstructive pulmonary diseases (COPD).

Material and Methods: The universe of this descriptive study consist of 315 COPD patients. Data were collected with a Questionare, Medical Research Council Scale (MRCS) and Standardize Mini Mental State Examination (SMMT-E). In the analyses of the data, descriptive statistics, independent t-test, one-way analysis of variance and regression and Tamhane T2 analysis were employed.

Results: The mean age of the patients participating the study was 54.06 (11.41) years. 38% of the patients were determined to experienced moderate dyspnea (2.20±0.95). The patients' cognitive status mean scores were found low (21.38±5.74) and 58.7% had cognitive impairment. It was determined in multiple regression analysis that severe dyspnea level, inadequacy in dyspnea management, associating dyspnea with breathlessness, feeling of low mood and fear of death, use of oxygen tube and bipod at home were associated with cognitive status. Moreover, it was found that 31% of the variance in the cognitive level of the patients was explained by the independent variables related to dyspnea (R2 = 0.581; adjusted R2= 0.311). It was found that there was a strong positive correlation between dyspnea and cognition status (r=-0.705, p=0.000).

Conclusion: It was determined that dyspnea effects to SMMT-E and therefore it could be advised to taking measures to reduce dyspnea COPD patients.

Keywords: Cognitive status, Dyspnea, COPD

ÖZ

Amaç: Bu çalışmada KOAH hastalarında dispnenin bilişsel duruma etkisini incelemek amaçlanmıştır.

Gereç ve Yöntemler: Tanımlayıcı tipte tasarlanan çalışmanın örneklemini 315 KOAH hastası oluşturmuştur. Verilerin toplanmasında Kişisel Bilgi Formu, Medical Research Council Scale (MRCS) ve Standardize Mini Mental değerlendirme testi (SMMT-E) kullanılmıştır. Verilerin değerlendirilmesinde; yüzdelik, student t testi, tek yönlü varyans analizi, Pearson korelasyon testi, çoklu regresyon analizi ve Tamhane T2 post-hoc testi kullanılmıştır.

Bulgular: Çalışmaya katılan hastaların yaş ortalaması 54.06 (11.41) yıldır. Hastaların %38'inin orta düzeyde dispne (2.20±0.95) yaşadığı belirlenmiştir. Hastaların bilişsel durum puan ortalamalarının düşük düzeyde (21.38±5.74) olduğu ve %58.7'sinde bilişsel durumda bozulma olduğu saptanmıştır. Çoklu regresyon analizinde şiddetli dispne düzeyi, dispne yönetimindeki yetersizlik, dispneyi nefessizlik, moral bozukluğu ve ölüm korkusu hissi ile ilişkilendirme, evde oksijen tüpü ve bibap kullanımının bilişsel durumla ilişkili olduğu saptanmıştır. Hastaların bilişsel düzeyindeki varyansın %31'inin dispne ilişkili bağımsız değişkenler tarafından açıklandığı saptanmıştır (R2 = 0.581; adjusted R2= 0. 311). Dispne düzeyi ile bilişsel durum arasında negatif yönde, güçlü düzeyde ilişki olduğu saptanmıştır (r=-0.705, p=0.000).

Sonuç: KOAH hastalarında dispne düzeyinin bilişsel durumu etkilediği ve bu nedenle hastalara dispnenin azaltılmasına yönelik önlemlerin alınması önerilmektedir.

Anahtar Sözcükler: Bilişsel durum, Dispne, KOAH

INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is characterized by progressive airflow obstruction and is a crucial respiratory tract illness causing significant mortality and morbidity all across the world (1). COPD is one of the top three diseases causing death throughout the world (2). COPD is an inflammatory process that develops in association with harmful gases and particles, especially cigarette smoke, is not fully reversible, and is a progressive disease (3,4). The above-mentioned inflammation affects the lungs and is preventable, and there are treatment options that alleviate its symptoms. In flare-up periods, the severity and negative effects of COPD increase, and the accompanying comorbidities affect its prognosis (5).

COPD requires hospitalization and professional healthcare during flare-up periods (4-9). Patients have intense anxiety, hopelessness, and stress due to being in need of healthcare for a long period along with constant drug use and sudden flare-ups as well as COPD-related physiological problems (8,9). Dyspnea is known as the most common symptom that causes stress in COPD patients (10). Individuals having dyspnea have no idea about how long the dyspnea will last, and they experience the fear of the unknown (11-13).

Dyspnea is defined as an unpleasant or uncomfortable breathing feeling and a personal experience of respiratory distress produced by sensations that vary in intensity (14,15). Dyspnea emerges in association with disorders occurring in several systems, not solely as a consequence of a single pathophysiological mechanism (16). Dyspnea and stress cause COPD patients primarily to have cognitive impairment. Besides, dyspnea paves the way for hypoxemia in COPD patients. Cognitive impairment in COPD patients is a multi-factorial process associated with a decrease in physical activity and cerebral blood flow, tissue hypoxia, systemic inflammation, and oxidative stress (17). In previous studies, it was stated that cognitive functions were adversely affected especially in COPD patients who gravely suffered from hypoxemia. In the study performed by Hung et al. to compare the control group with groups of patients with severe and non-severe COPD, it was found that COPD patients obtained lower cognitive scores (18).

In this context, this study aims to analyze the relationship of cognitive level with dyspnea, which is a negative experience for COPD patients.

MATERIAL and METHODS

This study was conducted as descriptive, cross-sectional, and correlational research to analyze the effect of dyspnea on the cognitive state of COPD patients. Before the study, permission was received from the Health Department of the province where the research was carried out, and also, ethical endorsement for the research was obtained from the Clinical Trials Ethics Committee of Tokat Gaziosmanpaşa University (No: 2021/22). After patients consented that they voluntarily participated in the study upon being informed about the research, the research data were collected.

Research Design and Participants

This research was carried out from 20 January 2022 to 20 March 2022 at pulmonology clinics of the two public hospitals in the Black Sea Region of Turkey. The research population was the COPD patients who applied to these hospitals on the above dates. As per the power analysis, the sample size was calculated as 112 (n=112). The GOLD system categorizes airflow limitation into stages. In patients with FEV1/FVC <0.70: GOLD 1 - mild: FEV1 ≥80% predicted, GOLD 2 - moderate: 50% ≤ FEV1 <80% predicted, GOLD 3 - severe: 30% ≤ FEV1 <50% predicted and GOLD 4 - very severe: FEV1 <30% predicted. COPD patients in all stages (stages I, II, III, IV according to the GOLD 2022 guideline) were included in the study to determine the effect of various severity of dyspnea on cognitive status. It was not taken into account whether the patients were stable or in the exacerbation. The study was finalized with 315 patients who were selected for the sample with the purposive sampling method, satisfied the inclusion criteria designated for the research, and agreed to participate in the study.

The researcher collected the research data by using the face-to-face interview method in the patient rooms. The researcher read aloud the data collection form to each patient and filled the data collection form with answers given by the patient.

Initially, a total of 323 COPD patients took part in the study. However, afterward, eight patients were excluded from the research as six patients did not want to participate in the research, one patient had a visual problem, and one patient failed to fully answer the questions in the data collection form. Therefore, the data collected from 315 patients were included in the analysis conducted in the context of the research.

Inclusion Criteria

1. Being diagnosed with COPD according to the GOLD 2022 guideline (2)
2. Being aged 18 years or above
3. Having no communication barrier
4. Being hospitalized at a pulmonology clinic of the aforementioned hospitals
5. Agreeing to participate in the research

Exclusion Criteria

1. Being aged below 18 years
2. Having an audiovisual communication barrier

3. Not being hospitalized at a pulmonology clinic of the aforementioned hospitals

4. Refusing to participate in the research

Data Collection Tools

The Personal Information Form that was created in light of expert opinions, the Standardized Mini-Mental State Examination, and the Medical Research Council Scale were used as data collection tools in the research. Information about measurement tools used in the research were presented below:

The Medical Research Council Scale (MRCS)

The MRCS is a scale measuring the effects of dyspnea on daily life activities and the perceived shortness of breath. It was developed by Fletcher (1952) (17). The MRCS was created on the basis of a variety of physical activities producing the feeling of dyspnea. The MRCS has five items. Upon reading choices for each MRCS item, patients are supposed to select the choice that best describes the degree of respiratory distress experienced by them. MRCS items are scored from 0 to 4 points. The MRCS was previously used in numerous studies to evaluate the dyspnea perception (9,19,20).

The Standardized Mini-Mental State Examination (SMMSE)

Developed by Folstein et al., this measurement tool is a test that is easy to administer and presents information about the degree of cognitive impairment (21). It has parts that assess functions such as orientation, registration, attention & calculation, spontaneous recall, language, and visual construction. The validity and reliability study for the SMMSE designed for the educated was performed in Turkish by Güngen et al. whilst the validity and reliability study for the SMMSE for the uneducated (SMMSE-U) that was designed for individuals with education below five years was conducted in Turkish by Babacan Yıldız et al. (21,22). In the current study, the SMMSE-U was used. The maximum score to be obtained from this measurement tool is 30 points. Even if different cut-off points serve as a reference for the evaluation of scores, a score of 23 points or below is in general accepted as an indicator of the presence of cognitive impairment in the respondent. In the evaluation of scores, a score of 21-23 points refers to mild cognitive impairment while a score of 20 points or below points to a moderate or advanced cognitive impairment. It is put forward that, in the case of mild cognitive impairment, a person can continue to live without any external assistance even if the person has problems with work and social environment in the clinical sense, however, in the case of moderate or advanced cognitive impairment, the person may need assistance to continue to live (21,22).

Statistical Analysis

After the research data were coded by researchers, they were analyzed with the Statistical Package for Social Science 25.0. In the context of the evaluation of research data, descriptive characteristics were expressed as numbers and percentages, the student's t-test was used in the comparison of two independent groups whilst the one-way analysis of variance (ANOVA) was utilized in the comparison of more than two independent groups, and additionally, in the framework of comparing more than two independent groups, the Tamhane's T2 test as a post hoc analysis method was employed to identify which group had a statistically significant difference from other groups. Moreover, the relationship between variables was identified with Pearson's correlation test. The multiple regression analysis was used in the identification of predictor variables affecting the predicted variable. Obtained results were evaluated at a 5% statistical significance level ($p < 0.05$) and a 95% confidence interval.

RESULTS

In this study that evaluated the effect of the dyspnea level on the cognitive state in COPD patients, a total of 315 patients took part. In this regard, it was discerned that the mean age of the participant patients was 54.06±11.41 years, and of all participant patients, 56% were male, 37% were primary school graduates, 91% were married, 57% were not working, 48% had an income equaling their expenses, and 38% did not smoke (Table 1).

Additionally, upon the review of participant patients' COPD-related and treatment-related characteristics, it was identified that, of all patients, 43% were diagnosed with COPD for 11-20 years, 65% had comorbidities accompanying COPD, 62% visited a doctor for health controls on a regular basis, 54% were hospitalized once or twice in the last year, 68% had a caregiver, 45% had their spouses as the caregiver, 90% had people around to share their sad and happy memories (38% of these patients received support from their spouses at such moments), 63% regularly used their drugs, 57% received COPD-related training (66% of these patients received training from the doctor), 75% had no history of having a psychiatric disease, 62% did not receive any psychiatric therapy, and 39% had no willingness to receive psychological assistance (Table 2).

Besides, Table 1 and Table 2 displayed the comparison of patients' mean SMMSE-U scores as per their certain characteristics. In this regard, there were statistically significant differences in patients' mean SMMSE-U scores as per gender, marital status, employment status, the status of having comorbidities accompanying COPD, the status of having a history of having a psychiatric disease, the status of receiving psychiatric therapy, the status of regularly using drugs,

Table 1: The analysis of patients' cognitive levels as per certain variables

Sociodemographic characteristics	SMMSE-U	
	n (%)	Mean±SD
Age (Year±SD)	(<24 points)	21.38±5.74
	185 (58.7)	(11.00-29.00)
Gender n(%)		
Female	140 (44.5)	22.10±5.79
Male	175 (55.6)	20.80±5.65
p		0.045
Education level n(%)		
Illiterate	20 (6.3)	20.75±3.35
Literate	35 (11.1)	21.57±5.71
Primary school	115 (36.5)	20.13±6.08
High school	95 (30.2)	21.05±4.76
University	50 (15.9)	25.00±6.09
p		**<0.001**
Post Hoc (University)		**<0.001***
Marital status n(%)		
Married	285 (90.5)	21.16±5.68
Single	30 (9.5)	23.40±5.98
p		**0.043**
Employment status n(%)		
Working	135 (42.9)	22.33±5.44
Not working	180 (57.1)	20.66±5.87
p		**0.011**
Perceived income level n(%)		
Income below expenses	135 (42.9)	22.18±4.50
Income equaling expenses	150 (47.6)	20.00±6.11
Income above expenses	30 (9.5)	24.66±60.88
p		**<0.001**
Post Hoc (Income above expenses)		**<0.001***
Status of cigarette smoking n(%)		
Yes, smoking	91 (28.9)	24.65±4.28
No, never smoked	118 (37.5)	21.30±5.29
Smoked but quit smoking	106 (33.7)	18.65±5.90
p		**<0.001**
Post Hoc (Yes, smoking)		**<0.001**

and the health professional giving the COPD-related training (p<0.05). On the other hand, there was no statistically significant difference in patients' mean SMMSE-U sores as per the status of having social support and the status of receiving COPD-related training (p>0.05).

Also, it was found that patients who were university graduates, had income above expenses, were smoking, were diagnosed with COPD for 1-10 years, would like to receive psychological assistance, and visited a doctor for health controls partially on a regular basis obtained higher mean SMMSE-U scores than other corresponding groups of patients, and also, patients who were hospitalized three times or more in the last year, and had a caregiver obtained lower mean SMMSE-U scores than other corresponding groups of patients, and these differences between groups of patients in terms of mean SMMSE-U scores were statistically significant (p<0.05) (Table 1, Table 2).

Furthermore, Table 3 presented patients' views about dyspnea. When patients were asked the question, "What does dyspnea make you feel?", 85% of them stated that they would be short of breath/their breath would be insufficient, 82% of them said that they had the feeling of suffocation, and 77% of them told that they had the fear of death (Table 3).

Moreover, Table 4 indicated the analysis of participant patients' mean SMMSE-U scores as per their dyspnea-related characteristics. It was discerned that, of all patients, 52% defined breathing as "existence, living, life, water", 38% experienced moderate dyspnea according to MRCS scores, 56% felt incompetent in the management of dyspnea, and 57% used inhaler at home (Table 4).

Next, upon the examination of patients' mean SMMSE-U scores as per their dyspnea-related characteristics, it was identified that patients who had highly severe dyspnea according to MRCS scores, felt incompetent in the management of dyspnea, and used an oxygen tube and bipod at home obtained lower mean SMMSE-U scores than other corresponding groups of patients, and these differences between groups of patients in terms of mean SMMSE-U scores were statistically significant (p<0.05) (Table 4).

A multiple regression analysis was conducted to identify the effects of patients' dyspnea-related characteristics on their cognitive levels. It was found that the multiple regression model with 12 predictor variables was statistically significant (F (12-302) = 12.830. p<.001), and these variables explained 31% of the total variance in the predicted variable of cognitive state (R^2 = 0.581; adjusted R^2= 0. 311) (Table 5). It was discerned that the dyspnea level, the competence in the management of dyspnea, the feeling of being short of breath, the feeling of disappointment, and the fear of death were significant factors affecting the cognitive state. Average decreases in the mean of SMMSE-U scores were successively 1.62 units (p<.001, % 95 CI=2,091-1,154), 1.62 units (p=.016, % 95 CI=2,943-0,302), 3.18 units (p<.001, % 95 CI=4,875-1,480), 2.44 units (p=.005, % 95 CI=4,151-0. 730), and 2.21 units (p=.003, %95 CI=772-3,642) for each increase of one unit in the dyspnea level, the competence in

Table 2: The analysis of cognitive status and disease-related parameters

Disease-related variables	SMMSE-U* (n=315)	p
Duration of being diagnosed with COPD		
1-10 years [131 (%41.6)]	23.61±5.48	
11-20 years [135 (%42.9)	20.20±5.58	<0.001
21 years or above [49 (%15.9)]	18.65±4.68	
Post Hoc (1-10 years)		<0.001**
Status of having comorbidities accompanying COPD		
Yes [206 (65.4)]	19.48±5.59	
No [109 (34.6)]	24.96±4.07	<0.001
Status of having a history of having a psychiatric disease		
Yes [80 (25.4)]	19.56±5.15	
No [235 (74.6)]	22.00±5.81	0.001
Status of receiving psychiatric therapy		
Yes [120 (38.1)]	19.70±5.62	
No [195 (61.9)]	22.41±5.58	<0.001
Status of having the willingness to receive psychological assistance		
Yes, I did [47 (14.9)]	20.97±4.02	
I had willingness but I did not receive psychological assistance [78 (24.8)]	19.41±5.50	
No, I did not [124 (39.4)]	21.68±6.55	<0.001
I would like to receive psychological assistance [66 (21.0)]	23.42±4.64	<0.001*
Post Hoc (I would like to receive psychological assistance)		
Status of visiting a doctor for health controls on a regular basis		
Yes [194 (61.6)]	21.11±5.91	
No [26 (8.3)]	19.38±5.12	0.030
Partially [95 (30.2)]	22.47±5.38	0.030
Post Hoc (Partially)		
Status of being hospitalized in the last year		
Never [61 (19.4)]	26.40±2.43	
Once or twice [169 (53.0)]	22.02±5.13	<0.001
Three times or more [85 (27.0)]	16.49±4.79	<0.001
Post Hoc (Three times or more)		
Status of having a caregiver		
Yes [214 (67.9)]	19.78±5.84	
I need a caregiver but there is no one to provide me with care [32 (10.2)]	24.25±2.85	
I do not need a caregiver [69 (21.9)]	25.01±4.03	<0.001
Post Hoc (Yes)		<0.001
Status of having social support		
Yes [284 (90.2)]	21.31±5.77	
No [31 (9.8)]	22.00±5.50	0.528
Status of regularly using drugs		
Yes [197 (62.5)]	20.90±6.17	
No [17 (5.4)]	24.88±5.31	
Partially [101 (32.1)]	21.71±4.66	0.018
Post Hoc (Yes)		0.025
Status of receiving COPD-related training		
Yes [178 (56.5)]	21.59±5.93	
No [137 (43.5)]	21.10±5.50	0.451
Health professionals giving the COPD-related training		
Doctor [118 (66.3)]	22.72±5.63	
Nurse [60 (33.7)]	19.38±5.91	<0.001

*Mean±SD: Mean ± Standard Deviation, **: Tamhane's T2 test

the management of dyspnea, the feeling of of being short of breath, the feeling of disappointment, and the fear of death. It was identified that variables of the feeling of suffocation, the feeling of hopelessness, experiencing depression, the feeling of having a squeezing tape around the chest, the feeling of guilt/regret, crying from time to time, and the burning sensation in the chest affected the cognitive level, however, these effects were not statistically significant (p>0.05) (Table 5) (Figure 1).

Lastly, exhibited the analysis of the correlation between patients' cognitive and dyspnea levels. In this regard, there was a statistically significant strong negative correlation between cognitive state and dyspnea level (r=-0.705, p=0.000).

Table 3: COPD patients' views on dyspnea

What dyspnea makes the patient feel * a	Findings (n=315)
Feeling that the breath will be insufficient/Feeling of being short of breath	268 (85.1)
Feeling of suffocation	258 (81.9)
Feeling of hopelessness	143 (45.4)
Feeling of having a squeezing tape around the chest	134 (42.5)
Feeling of disappointment	47 (14.9)
Feeling of guilt/regret	76 (24.1)
Crying from time to time	65 (20.6)
Burning sensation in the chest	74 (23.5)
Fear of death	244 (77.5)
Experiencing depression	152 (48.3)

*Data are presented as n(%). a: More than one choice was selected. Selected choices were expressed as numbers and percentages.

Table 4: The analysis of COPD patients' cognitive levels as per their dyspnea-related characteristics

		SMMSE-U	
		(Mean±SD)	p
Dyspnea levels as per MRCS scores *			
Mild	84 (26.7)	27.02±2.71	
Moderate	119 (37.8)	21.56±4.75	**<0.001**
Severe	77 (24.4)	17.84±3.75	
Highly severe	35 (11.1)	15.00±5.24	
Breathing means *			
Existence, living, life, water	164 (52.1)	21.70±5.73	
Blessing, gift, great chance, treasure	54 (17.1)	21.61±5.94	0.071
Struggle, impossibility, challenging endeavor, fatigue	61 (19.4)	21.70±5.19	
Insatiable taste, flavor, comfort	36 (11.4)	19.00±6.04	
Status of having competence in the management of dyspnea*			
Yes	20 (6.3)	23.00±5.28	
No	176 (55.9)	19.86±5.88	**<0.001**
Partially	119 (37.8)	23.34±4.91	
Type of device used at home b *			
Oxygen tube	145 (46.0)	19.82±5.69	**<0.001**
Nebulizer	135 (42.9)	21.51±5.70	0.713
Oxygen concentrator	55 (17.5)	21.49±5.91	0.876
Bipod	50 (15.9)	18.50±6.84	**<0.001**
Inhaler	180 (57.1)	21.01±5.63	0.187

*Data are presented as n(%). a: Tamhane's T2 test, b: More than one choice was selected. Selected choices were expressed as numbers and percentages.

Table 5: The effects of dyspnea-related characteristics on the cognitive level

Predictor variables	B	SE	Beta	95% CI Lower	95% CI Upper
Constant p	24.444	1.140	- .000	22.201	26.687
Dyspnea level [a] p	-1.622	.238	-.356 **.000**	-2.091	-1.154
Status of having competence in the management of dyspnea [b] p	-1.623	.671	-.141 **.016**	-2.943	-.302
Feeling that the breath will be insufficient/Feeling of being short of breath p	-3.178	.863	-.194 **.000**	-4.875	-1.480
Feeling of suffocation p	-.015	.784	-.001 .984	-1.559	1.528
Feeling of hopelessness p	-1.029	.586	-.089 .080	-2.183	.125
Feeling of having a squeezing tape around the chest p	.730	.632	.063 .249	-.514	1.974
Feeling of disappointment p	-2.441	.869	-.149 **.005**	-4.151	-.730
Feeling of guilt/regret p	1.143	.687	.085 .097	-.208	2.494
Crying from time to time p	.024	.725	.002 .974	-1.403	1.451
Burning sensation in the chest p	1.512	.771	.112 .051	-.004	3.028
Fear of death p	2.207	.729	.160 **.003**	.772	3.642
Experiencing depression p	-1.141	.629	-.099 .071	-2.380	.098

[a]: Patients who had highly severe dyspnea were included in the analysis, [b]: Patients who felt incompetent in the management of dyspnea were included in the analysis.

The cognitive state was designated as the predicted variable in the multiple regression analysis. β: Standardized Beta coefficient; SE: Standard error. $R^2 = 0.581$; adjusted $R^2 = 0.311$.
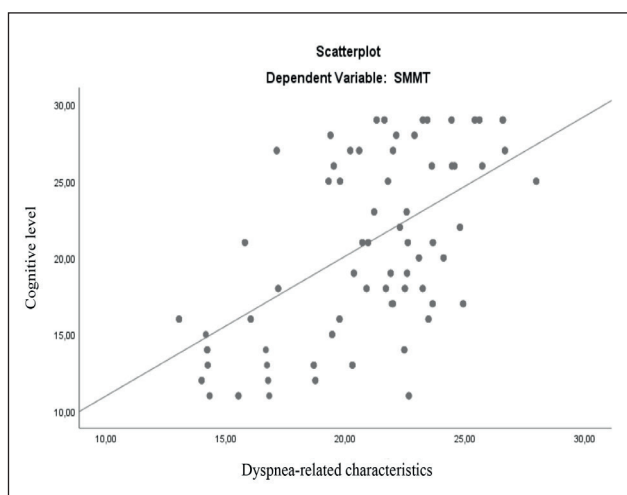

Figure 1: The multiple regression analysis on the effects of dyspnea-related characteristics on the cognitive level

DISCUSSION

This study analyzed COPD patients' dyspnea and cognitive levels and the relationship between these two variables. According to results obtained in the study, 38% of the patients were found to have moderate dyspnea. Besides, it was identified that patients obtained a low mean cognitive state score from the SMMSE-U (21.38±5.74 points) and 58.7% of them had cognitive impairment. The cognitive state in COPD patients is affected by socio-demographic variables such as gender, marital status, employment status, education level, and the perceived income level. Moreover, COPD-related and treatment-related characteristics such as the status of having comorbidities accompanying COPD, the status of having a history of having a psychiatric disease, the status of receiving psychiatric therapy, the status of having the willingness to receive psychological

assistance, the health professional giving the COPD-related training, the status of cigarette smoking, the duration of being diagnosed with COPD, the status of visiting a doctor for health controls on a regular basis, the status of being hospitalized in the last year, the status of having a caregiver, and the status of regularly using drugs affected the cognitive state.

Upon the review of the relevant literature, it was discerned that 22.6-39.4% of the COPD patients had cognitive impairment (23-26). In the study by Ozyemisci-Taskiran et al., it was reported that 22.6% of the COPD patients having acute flare-ups had cognitive impairment (<24 points) (24). In the study by O'Conor et al, it was put forward that 37.7% of the COPD patients had cognitive impairment (<24 points) (23). In the study by Antonelli-Incalzi et al., it was found that 35.5% of the patients with stable COPD had cognitive impairment (26). In the study by Roncero et al., it was stated that 39.4% of the COPD patients had cognitive impairment (<27 points) (25). In our study, 58.7% of the patients had cognitive impairment. Differences between the above-cited studies in terms of the percentages of patients having cognitive impairment can be explained by the fact that these studies were performed in different countries in different periods under different circumstances. Also, it is considered that the high percentage of patients having cognitive impairment in our study may have been connected with the collection of data from hospitalized patients and the conduct of data collection during the COVID-19 pandemic.

Cognitive impairment can reduce COPD patients' abilities to adhere to drug regimens, adjust their drugs as a response to respiratory symptoms, and self-manage the disease (27). A large financial burden can be imposed on healthcare services due to problems likely to develop along with cognitive impairment. The cognitive impairment was identified with adverse consequences such as the increase in morbidity and mortality rates in COPD patients. Therefore, to avoid the development of negative health outcomes for COPD patients, the early diagnosis of cognitive impairment is important (25). If the factors affecting the cognition are realized, the cognitive impairment can be diagnosed earlier and COPD patients who are at higher risk can be identified. In our study, it was found that socio-demographic variables such as gender, marital status, employment status, the education level, the perceived income level, besides COPD-related and treatment-related characteristics such as, the status of having comorbidities accompanying COPD, the status of having a history of having a psychiatric disease, the status of receiving psychiatric therapy, and the health professional giving the COPD-related training the status of cigarette smoking, the duration of being diagnosed with COPD, the status of having the willingness to receive psychological assistance, the status of visiting a doctor for

health controls on a regular basis, the status of being hospitalized in the last year, the status of having a caregiver, and the status of regularly using drugs affected the cognitive state. In a similar vein to the findings of our study, the study by Roncero et al. reported that factors such as age, education level, the status of having a caregiver, the duration of being diagnosed with COPD, the status of being hospitalized in the last year, the status of using an oxygen tube at home, dyspnea level, depression, and social support affected the cognitive state in COPD patients (25). In the study by Ozyemisci-Taskiran, it was asserted that age, education level, and depression were factors affecting the cognitive state (24). In the study by Thakur et al., it was stated that the education level and the status of cigarette smoking were the factors affecting the cognitive state (27).

As per the examination of the relevant literature, it was discerned that COPD patients' mean MRCS scores ranged from 2.2 to 2.8 for dyspnea (28,29). In the study by Cleutjens et al., the mean dyspnea score was found as 2.2±1.0 points (28). In the study by Dal Negro et al., the mean dyspnea score was reported as 2.8±0.7 points (29). In this respect, the mean MRCS score of 2.20±0.95 points in our study was in a similar vein to the findings in the relevant literature.

Hypoxia is known to have led to cognitive impairment by affecting the memory. Also, it was identified that the perception, attention, and short-term memory were significantly impaired in hypoxemic COPD patients, and the cause of this cognitive impairment was associated with neurophysiological events such as the sustained presence of a reduced prefrontal cortex circulation (29). Knowing the dyspnea-related factors that affect the cognitive state will be of use to the follow-up and the management of the cognitive state. In our study, it was found that highly severe dyspnea, incompetence in the management of dyspnea, identification of dyspnea with the feeling of being short of breath, the feeling of disappointment, and the fear of death, and the use of an oxygen tube or bipod at home were the dyspnea-related factors that affected the cognitive state. In a similar vein to the findings of our study, the study by Roncero et al. stated that there was a statistically significant difference in the cognitive level as per the dyspnea level, which was measured with the MRCS, and the dyspnea level affected the cognitive state (25). In the study by Thakur et al., the hypoxemia was reported as the most significant risk factor for cognitive impairment in COPD patients (27).

In the correlation analysis conducted in this study, a statistically significant strong negative relationship between dyspnea level and cognitive state was identified (r=-0.705, p=0.000). In our study, the cognitive impairment identified even in COPD patients with moderate dyspnea and the aggravation of cognitive state along with the increase in dyspnea level indicate that the dyspnea affects the cogni-

tive state. In a systematic review and meta-analysis, it was reported that there was a negative relationship between hypoxia and cognitive state (30). Thus, dyspnea negatively affects the cognitive state.

In conclusion, it is discerned that the cognitive state got worsened as the dyspnea level increased. The use of an oxygen tube and bipod at home, the incompetence in the management of dyspnea, the feeling of being short of breath, and the fear of death were dyspnea-related factors that affected the cognitive state. It was found that there was a statistically significant strong negative relationship between the dyspnea level and cognitive state.

The findings obtained in this study will help clinicians better understand the dyspnea-related factors that contribute to the cognitive impairment in COPD patients. When there is an impairment in a COPD patient's cognitive state, clinicians can think that dyspnea is likely to be linked to this problem. It can be necessary to put in place a mechanism to closely follow up on the cognitive state of COPD patients who have highly severe dyspnea, feel incompetent in the management of dyspnea, and identify dyspnea with the feeling of being short of breath, the feeling of disappointment, and the fear of death.

Secondly, this study provided data that would offer a better understanding of socio-demographic characteristics and COPD-related and treatment-related factors that were associated with cognitive impairment. In this context, it was found that patients who used an oxygen tube or bipod at home, had relatively low-level education, were married, were not working, quit smoking, were diagnosed with COPD for 21 years or longer, had a history of having a psychiatric disease, received psychiatric therapy, had the willingness to receive psychological assistance, did not visit a doctor for health controls on a regular basis, were hospitalized three times or more in the last year, had a caregiver, had social support, regularly used their drugs, and received COPD-related training from a nurse had lower cognitive levels than other respective groups of patients. Identifying the factors associated with cognitive impairment in COPD patients can help to provide information about how to apply cognitive rehabilitation.

Thirdly, the findings of this study demonstrated that there was a negative relationship between dyspnea and cognitive state in COPD patients. This finding stresses the importance of paying attention to dyspnea and cognitive functions in the treatment of COPD patients. Along with the use of cognitive therapies, there will be an enhancement in COPD patients' cognitive levels, and this situation will be accompanied by an improvement in COPD patients' dyspnea levels.

It is recommended that findings obtained in this study be verified and researched in prospective studies to be per-

formed with larger populations. Also, it is considered that interventional studies aimed at the management of dyspnea and the improvement of cognitive state should be conducted.

The design of the study as cross-sectional research is accepted as a limitation. Also, not addressing the partial pressure of oxygen (PaO_2) that is closely associated with dyspnea and cognitive level in COPD patients is another limitation of this research.

Author Contributions

Concept: **Döndü Şanlıtürk, Nurgül Kaplan,** Design: **Döndü Şanlıtürk, Nurgül Kaplan,** Supervision: **Döndü Şanlıtürk,** Resource - **Döndü Şanlıtürk,** Materials: **Döndü Şanlıtürk, Nurgül Kaplan,** Data Collection and/or Processing: **Döndü Şanlıtürk, Nurgül Kaplan,** Analysis and/or Interpretation: **Döndü Şanlıtürk, Nurgül Kaplan,** Literature Search: **Döndü Şanlıtürk, Nurgül Kaplan,** Writing: **Döndü Şanlıtürk, Nurgül Kaplan,** Critical Reviews: **Döndü Şanlıtürk, Nurgül Kaplan.**

Conflicts of Interest

There is no conflict of interest in our study.

Ethical Approval

Ethics committee approval was received for this study from Clinical Trials Ethics Committee of Tokat Gaziosmanpaşa University (No: 2021/22)

Review Process

Extremely peer-reviewed and accepted.

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