THE MEDICAL BULLETIN OF
SISLI ETFAL HOSPITAL

DOI: 10.14744/SEMB.2024.42709
Med Bull Sisli Etfal Hosp 2024;58(2):179–188

Original Research

What are the Barriers of Chronic Obstructive Pulmonary Disease (COPD) Patients in Smoking Cessation?

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Abstract

Objectives: Smoking is the major determinant of developing chronic obstructive pulmonary disease (COPD). A substantial proportion of patients with COPD continue smoking although they have significant respiratory symptoms, exacerbation history and comorbidities. We aimed to find the associated factors and clinical features of the patients who maintain smoking.

Methods: 200 current smokers and 132 former smokers with a spirometry-confirmed diagnosis of COPD were recruited from the outpatient department. Demographic characteristics, smoking backgrounds, treatment status, comorbidities, exacerbation history of the previous year, pulmonary function tests, blood biochemistry, dyspnea scales, symptom scores, and BECK anxiety scores were all recorded.

Results: No age and gender differences were found between current and former smokers. Compared to former smokers, current smokers were less qualified, had more cardiovascular diseases, more frequently exposed to tobacco smoke at home and at work place, more severe pulmonary function impairment, longer duration of COPD, longer time of smoking, earlier age of commencement in smoking, higher scores of BECK anxiety scores (BAI), higher levels of inflammatory markers in blood tests $p<0.05$. In multivariable analysis, lower values of FEV_1%, higher scores of CAT and BAI, higher levels of platelet and CRP were found to decrease the likelihood of smoking cessation $p<0.05$. Additionally having diabetes, coronary artery disease and hypertension were inversely correlated with quitting smoking $p<0.05$.

Conclusion: COPD is a systemic inflammatory disease. We found over half of the patients with COPD were currently smoking, despite the severity of their airflow limitation, symptoms and even the comorbidities. Furthermore, 2 out of 5 of the current smokers reported having moderate to severe anxiety. Dyspnea and inflammatory markers had negative effects on smoking cessation, and anxiety might be the cause that led these patients to keep smoking.

Keywords: Anxiety, COPD, former smokers, smoker patients, tobacco

Please cite this article as "Ozkarafakili MA, Yangin M, Ayhan Albayrak G, Bardakci MI. What are the Barriers of Chronic Obstructive Pulmonary Disease (COPD) Patients in Smoking Cessation?. Med Bull Sisli Etfal Hosp 2024;58(2):179–188".

Tobacco smoke is one of the leading causes of chronic obstructive pulmonary disease (COPD), which is a complex inflammatory disease characterized by increased respiratory effort due to persistent airflow limitation.[1] However, a substantial proportion of patients continue smoking even after being diagnosed with COPD and the disease goes on as a public health challenge all over the world. The prevalence of COPD is 19.2% in our country and 31.2% of the population over the age of 15 is smoking according to the latest national reports.[2,3] It is well-known that smok-

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Submitted Date: December 11, 2023 **Revised Date:** January 26, 2024 **Accepted Date:** March 05, 2024 **Available Online Date:** June 28, 2024

ing cessation is the first and most effective step in slowing the progression of COPD.[4] Quitting smoking relieves respiratory symptoms, prevents lung function parameters from declining, moreover increases the response to bronchodilator therapy or inhaled corticosteroids and lowers the rates of hospital admission and mortality.[5] Therefore, the need to stop smoking is much more urgent for patients with COPD than for regular smokers. As previous studies indicated, the duration of smoking, the physical dependency upon nicotine, higher anxiety scores and younger age were the factors supposed to be the causes of continued smoking among patients with COPD.[6] Besides, numerous studies have shown a link between cigarette smoking and an increase in anxiety symptoms or disorders due to the role of neurotransmitter systems, inflammation and oxidative stress.[7] This addiction research was designed for understanding the clinical and functional background of COPD patients who quit smoking and those did not, furthermore, to find out how all physical and psychological conditions may interact in motivation to quit in COPD patients.

Methods

This was a single-center observational study conducted in the outpatient clinic of the Department of Chest Diseases after the approval of the Institutional Ethics Committee (No: 2409). We included 332 patients who had been diagnosed with COPD and followed up at least for 2 years in the outpatient department from August to October 2023. COPD diagnosis was based on spirometry with a postbronchodilator forced expiratory volume in 1 second / forced vital capacity <0.7 according to the latest GOLD document.[1] The patients who never smoked in a lifetime, who smoked fewer than 10 pack-years, who had an acute exacerbation in the past four weeks and who had psychiatric diseases were excluded. All participants were provided with a written consent form and the study was performed in compliance with the Declaration of Helsinki.

Demographic information, physician-diagnosed comorbidities, marital status, education level, occupational details, exacerbation history of the previous year and treatment procedures were recorded. Modified Medical Research Council (mMRC) and Borg dyspnea scale, COPD assessment test (CAT) scores, and BECK anxiety inventory (BAI) scores were all noted.[1] The fasting venous blood samples of the patients were collected for complete blood count and blood chemistry during the admission.

Current smokers were defined as the individuals who smoked more than 100 cigarettes in their lifetime and smoked in the last 28 days while the ones who smoked more than 100 cigarettes in their lifetime but did not smoke in the last 28 days were called former smokers.

Pulmonary function tests were performed by an experienced technician and all spirometric flow-volume curves were recorded according to American Thoracic Society guidelines.[8] The best of the consecutive three spirograms that met the criteria was accepted. Forced expiratory volume in 1 second (FEV_1), forced vital capacity (FVC) and FEV_1/FVC were measured and expressed as a percentage of the predicted values based on age, sex, height and body weight. Afterwards, the FEV_1% predicted was used to classify the severity of COPD: FEV_1 ≥80% predicted = mild (GOLD 1), 50% ≤FEV_1 <80% predicted = moderate (GOLD 2), 30% ≤FEV_1 <50 % predicted = severe (GOLD 3), and FEV_1 <30% predicted = very severe (GOLD 4) COPD.[1]

CAT is a respiratory questionnaire for measuring the impact of COPD on a patient's life, which consists of 8 items with scores ranging from 0 to 5.[1] It is used for evaluating the symptoms such as cough, respiratory effort on exercise, sleep and energy status of the patients. The higher the total scores mean a severe impairment in health status or a poorer control of the disease.

mMRC dyspnea scale is developed to assess the effects of breathlessness on everyday life which is in the self-administered format.[1] It consists of 5 items in which the statements are about the functional impact of breathlessness on an individual's daily life which leads to a grade from 0 to 4. mMRC score 2 is the cut-off value in the assessment of COPD patients according to GOLD recommendations.

The modified Borg scale is another dyspnea scale and a subjective evaluation method measuring the severity of the patient's shortness of breath during resting or physical activity which the patient rates from 0 to 10.[1]

BECK anxiety inventory is a widely used, self-report instrument for assessing the symptoms of anxiety which is designed with 21 items.[9] For each item, the patient selects a response from 0 to 3, and 3 indicates the concerns are "unbearable". The sum of the scores varies from 0 to 63. A total score of <21 refers to mild, 22-35 to moderate and>36 as severe anxiety. We applied the validated Turkish versions of the CAT, mMRC, Borg scale and BECK anxiety inventory in a face-to-face interview with the patients.[9-11]

Statistics

IBM SPSS Statistics 26.0 (Version 26.0. Armonk, NY: IBM Corp.) and MS-Excel 2016 programs were used in the statistical analysis. The compatibility of the variables in the study with normal distribution was evaluated graphically and with Kolmogorov-Smirnov test. Mean and standard deviation were used for variables with normal distribution, and median (minimum; maximum) was used for variables that were determined not to show normal distribution as descriptive statistics.

The comparison of sociodemographic and health-related characteristics according to the groups of current smokers and former smokers was analyzed by Pearson Chi-square and Mann Whitney U test. Pearson correlation analysis was performed for the relationship between Beck Anxiety scores and the clinical variables. In the multivariate analysis between smokers and quitters, the relationship between the variables was examined using logistic regression analysis and the Hosmer-Lemeshow test. Statistical hypotheses were evaluated by taking the Type-I error level α=0.05.

Results

The comparison of demographic features and clinical characteristics of the current smokers and the former smokers with COPD were documented in Table 1 and Table 2. A total of 332 patients with COPD were eligible for the study. 132 (39.8%) were former and 200 (60.3%) were current smokers.

61.5% of current smokers and 53.8% of former smokers were males. The median age for current smokers was 62 years, and 66 years for former smokers for which there was no statistical difference, whereas 61.5% of current smokers and 47.7% of former smokers were <65 years old ($p<0.05$). Among the study participants, those who were married, had completed their university education, had GOLD stage 1- 2 COPD, experienced no more than one exacerbation in the previous year, had lower scores on the BECK anxiety scale were primarily former smokers ($p<0.05$). The former smokers group were more likely to live with a child below 14 years at home, and have not a smoker among their parents, households or workplace, compared to the current smokers ($p<0.05$).

Current smokers were less qualified with lower numbers of patients with university graduates (35.5% vs. 55.3%, $p<0.05$) but they did not differ for employment status when compared to former smokers ($p>0.05$). In current smokers, the start age of smoking was younger (a median of 20 vs. 22 ages, $p<0.05$) and the duration of smoking was found to be longer than the former smokers (a median of 44 vs. 12 years, $p<0.05$) however, the amount of smoking as a pack for days was not statistically different between the two groups ($p>0.05$).

Compared with the former smokers, the current smokers group had more severe airflow limitation (median FEV_1% predicted 51% vs. 61.5%, $p<0.001$), had higher mMRC and CAT scores (median 2 vs. 2, $p<0.001$ 24 vs. 20, $p<0.001$ respectively), had higher BECK anxiety scores (median 19.5 vs. 14, $p<0.05$) and had higher numbers of patients in moderate to severe (GOLD 3-4) stages of COPD (41% vs. 23.5% $p<0.05$). Among the current smokers, while a greater number of patients had an exacerbation history of 2 or more for the last year 52.5% vs. 34.1%, $p<0.001$), no difference was noted between the groups in admission to the emergency room in the past year ($p>0.05$). The duration of COPD was longer for current smokers (median 10 vs. 9 years, $p<0.05$) than the former smokers. There were no differences among the current and former smokers regarding the presence of comorbidities ($p>0.05$), whereas coronary artery disease and hypertension were more common among the patients who continued smoking ($p<0.05$). When we examined the blood chemistry and complete blood count, the current smokers had higher white blood cell count, hemoglobin, platelet and C-reactive protein levels than the former smokers ($p<0.05$).

Based on the clinical characteristics of COPD, a multivariable analysis was performed to identify the factors related to quitting smoking. According to the Hosmer–Lemeshow test, the model represented the data well ($p > 0.05$). Nagelkerke's R2 statistic showed that there is a relationship of approximately 76.0% between the dependent variable and the independent variables. The effects of smoking cessation were not observed to be influenced by mMRC scores, COPD GOLD stages, the number of exacerbations in the previous year, or the values of WBC and hematocrit variables ($p>0.05$). According to that analysis, the FEV_1% value was positively associated with the likelihood of quitting smoking, but the CAT and BECK anxiety levels were negatively correlated ($p<0.05$). Additionally, the blood levels of CRP and platelet had an inverse effect on smoking cessation ($p<0.05$) (Table3). Besides having diabetes, coronary artery disease, or hypertension had a negative effect on patients' efforts or motivation in smoking cessation.

In multivariable analysis, age, gender, marital status, education, or having children <14 years of age at home have not been found to be effective factors in smoking cessation ($p>0.05$). Living among smokers in the family or at work, starting to smoke at a young age, and smoking for a long time had no impact on quitting smoking at all ($p>0.05$) (Table 4).

Discussion

COPD is the archetype of smoking-induced lung disease. [1] According to the results of our study, more than half of COPD patients have continued to smoke even 10 years after receiving a COPD diagnosis, regardless of age and gender. In a US-based study, almost 1 in 2 middle-aged patients with COPD and 1 in 3 patients having physician-diagnosed chronic diseases reported active cigarette smoking. [12] The World Health Organization considers smoking as

Table 1. Differences between demographic and clinical characteristics of current and former smokers with COPD

	Total	Current smokers	Former smokers	p
Participants, n (%)	332	200 (60.2)	132 (39.8)	
Sex, n (%)				
Male	194 (58.4)	123 (61.5)	71 (53.8)	0.163[a]
Female	138 (41.6)	77 (38.5)	61 (46.2)	
Age (year) mean+SD, n (%)	63.02±8.33	62.92±7.85	63.18±9.04	0.184[b]
<65 ages	186 (56.0)	123 (61.5)	63 (47.7)	**0.013**[a]
>65 ages	146 (44.0)	77 (38.5)	69 (52.3)	
Marital status n (%)				
Unmarried	121 (36.4)	64 (32.0)	57 (43.2)	**0.038**[a]
Married	211 (63.6)	136 (68.0)	75 (56.8)	
Education, n (%)				
Primary school/High school	188 (56.6)	129 (64.5)	59 (44.7)	**<0.001**[a]
University	144 (43.4)	71 (35.5)	73 (55.3)	
Employment status, n (%)				
Not-working	151 (45.5)	86 (43.0)	65 (49.2)	0.264[a]
Working	181 (54.5)	114 (57.0)	67 (50.8)	
Amount smoked, n (%)				
<2 pack/day	230 (69.3)	139 (69.5)	91 (68.9)	0.914[a]
≥2 pack/day	102 (30.7)	61 (30.5)	41 (31.1)	
Comorbidities, n (%)				
-	84 (25.3)	44 (22.0)	40 (30.3)	0.089[a]
+	248 (74.7)	156 (78.0)	92 (69.7)	
Diabetes, n (%)				
-	204 (36.4)	127 (63.5)	77 (58.3)	0.344[a]
+	128 (63.6)	73 (36.5)	55 (41.7)	
Coronary artery disease, n (%)				
-	306 (92.2)	120 (60.0)	106 (80.3)	**<0.001**[a]
+	26 (7.8)	80 (40.0)	26 (19.7)	
Hypertension, n (%)				
-	310 (93.4)	148 (74.0)	110 (83.3)	**0.046**[a]
+	22 (6.6)	52 (26.0)	22 (16.7)	
Smokers among the household, n (%)				
-	141 (42.5)	46 (23.0)	95 (72.0)	**<0.001**[a]
+	191 (57.5)	154 (77.0)	37 (28.0)	
Children <14 years at home, n (%)				
-	199 (59.9)	138 (69.0)	61 (46.2)	**<0.001**[a]
+	133 (40.1)	62 (31.0)	71 (53.8)	
Tobacco exposure at work place, n (%)				
-	226 (68.1)	119 (59.5)	107 (81.1)	**<0.001**[a]
+	106 (31.9)	81 (40.5)	25 (18.9)	
Smokers among the parents, n (%)				
-	155 (46.7)	67 (33.5)	88 (66.7)	**<0.001**[a]
+	177 (53.3)	133 (66.5)	44 (33.3)	
Exacerbation history of the past year, n (%)				
≤1 / year	182 (54.8)	95 (47.5)	87 (65.9)	**0.001**[a]
≥2 / year	150 (45.2)	105 (52.5)	45 (34.1)	
Admission to emergency room last year				
-	169 (50.9)	103 (51.5)	66 (50.0)	0.088[a]
≤1 / year	73 (22)	50 (25)	23 (17)	
≥2 / year	90 (27.1)	47 (23.5)	43 (32.6)	

Table 1. Cont.

	Total	Current smokers	Former smokers	p
Hospitalization with AECOPD last year, n (%)				
-	273 (82.2)	162 (81.0)	111 (84.1)	0.471[a]
+	59 (17.8)	38 (19.0)	21 (15.9)	
LTOT at home, n (%)				
-	281 (84.6)	164 (82.0)	117 (88.6)	0.101[a]
+	51 (15.4)	36 (18.0)	15 (11.4)	
NPPV at home, n (%)				
-	255 (76.8)	147 (73.5)	108 (81.8)	0.079[a]
+	77 (23.2)	53 (26.5)	24 (18.2)	
ICU admission with AECOPD last year, n (%)				
-	307 (92.5)	181 (90.5)	126 (95.5)	0.094[a]
+	25 (7.5)	19 (9.5)	6 (4.5)	

[a]: Pearson Chi square, [b]: Mann Whitney U test. Data are presented as n %, mean±standard deviation, otherwise median (minimum; maximum). COPD: Chronic obstructive pulmonary disease, SD: Standard deviation, AECOPD: Acute exacerbation of chronic obstructive pulmonary disease, LTOT: Long term oxygen treatment, NPPV: Noninvasive positive pressure ventilation, ICU: Intensive care unit

Table 2. Differences in clinical characteristics between current and former smokers with COPD

	Total	Current smokers	Former smokers	p
BECK Anxiety Inventory scores	17.70±7.73	18.86±8.05	15.93±6.88	**0.001**[b]
Mild, n (%) (BAI<21)	219 (66.0)	114 (57.0)	105 (79.5)	**<0.001**[a]
Moderate and severe, n (%)(BAI ≥22)	113 (34.0)	86 (43.0)	27 (20.5)	
mMRC scores	2.03±0.58	2.14±0.41	1.86±0.73	**<0.001**[b]
Duration of COPD (year)	12.24±6.84	14.08±7.43	9.45±4.63	**<0.001**[b]
BORG scale	3.67±1.16	3.64±1.09	3.72±1.26	0.658[b]
Years of smoking	32.18±16.32	44.00±8.16	14.27±5.98	**<0.001**[b]
Start age of smoking (year)	21.24±6.12	18.88±3.87	24.83±7.10	**<0.001**[b]
Body Mass Index kg/m^2	25.43±2.95	25.48±3.22	25.36±2.50	0.971[b]
White blood cell count 10^9/L	8.06±1.89	8.26±1.91	7.77±1.84	**0.019**[b]
Hemoglobin g/L	14.25±1.48	14.40±1.50	14.04±1.44	**0.016**[b]
Hematocrit (%)	42.95±5.89	43.04±5.58	42.81±6.36	0.630[b]
Platelet 10^9/L	238.73±65.09	260.38±65.52	205.95±48.86	**<0.001**[b]
C- reactive protein mg/L	5.72±6.71	6.92±7.46	3.91±4.86	**<0.001**[b]
FEV_1 % predicted	54.92±13.06	51.39±12.38	60.28±12.26	**<0.001**[b]
FVC % predicted	74.81±16.52	73.36±17.84	76.99±14.08	0.091[b]
FEV_1/FVC %	74.90±11.16	72.28±12.13	78.87±8.06	**<0.001**[b]
COPD Stages				
GOLD 1-2	219 (66.0)	118 (59.0)	101 (76.5)	**0.001**[a]
GOLD 3-4	113 (34.0)	82 (41.0)	31 (23.5)	
CAT (COPD assessment test) scores	21.61±6.12	23.91±5.00	18.11±6.03	**<0.001**[b]

[a]: Pearson Chi square, [b]: Mann Whitney U test. Data presented as mean±standard deviation, otherwise median (minimum; maximum). COPD: Chronic obstructive pulmonary disease, BAI: Beck Anxiety Inventory, mMRC: Modified medical research council, FEV_1: Forced expiratory volume in 1 second, FVC: Forced vital capacity, FEV_1/FVC: Forced expiratory volume in 1 second/ Forced vital capacity

the longest-lasting and fastest-growing epidemic in civilization which is one of the most widely used stimulants.[13] Türkiye has achieved success in smoking cessation in regard to the WHO Project between 2008 and 2012, but the reports have shown an increase in smoking rates and a decrease in smoking cessation efforts in recent years for both men and women.[14] A subset of studies investigating the smoking rates among COPD patients worldwide revealed a prevalence of 34.5% to 49.1% whereas 60.2% of our study participants were current smokers.[12]

Table 3. Factors associated with smoking cessation based on the clinical characteristics of COPD in multivariable analysis

Variable	OR (Odds Ratio)	% 95 Confidence Interval (CI)	p
FEV_1 % predicted	1.622	1.306– 2.016	**<0.001**
COPD GOLD Stages			
GOLD 1-2	Reference		
GOLD 3-4	1.494	0.369 – 6.058	0.574
mMRC	1.372	0.590 – 3.191	0.463
CAT	0.740	0.647 – 0.847	**<0.001**
WBC	1.108	0.893 – 1.374	0.351
Hematocrit	1.071	0.988 – 1.160	0.096
Platelet	0.980	0.972 – 0.989	**<0.001**
C-reactive protein	0.918	0.852 – 0.988	**0.023**
BECK anxiety inventory scores			
Mild	Reference		
Moderate and severe	0.267	0.106 – 0.674	**0.005**
Exacerbation history			
≤1/ year	Reference		
≥ 2/ year	2.194	0.867 – 5.55	0.097
Smokers among the parents			
-	Reference		
+	0.510	0.224-1.162	0.109
Diabetes			
-	Reference		
+	0.184	0.040 – 0.857	**0.031**
Coronary artery disease			
-	Reference		
+	0.102	0.023 – 0.455	**0.003**
Hypertension			
-	Reference		
+	0.150	0.036 – 0.616	**0.009**

Hosmer – Lemeshow test, Nagelkerke R2analysis. COPD: Chronic obstructive pulmonary disease, FEV_1: Forced expiratory volume in 1 second, mMRC: Modified medical research council, CAT: COPD assessment test, WBC: White blood cell count

Patients with COPD who were able to stop smoking were found to be older and to have a more advanced disease in earlier studies.[15,16] The researchers explained this as the patients whose physical activities were less restricted or who had less breathing difficulties did not attempt to quit smoking.

In contrast to prior research, our group of patients who have continued to smoke had a greater amount of dyspnea, symptoms, acute COPD exacerbations, and anxiety than the individuals who had given up smoking.[15,16] Interestingly, GOLD stages or mMRC scores seemed not to influence the likelihood of smoking cessation in our patients who were active smokers. It was noteworthy that, about 20% of these current smokers had long-term oxygen treatment or noninvasive mechanical ventilation support at home.

One possible explanation for this was that, as we recruited the "routine control patients" from the outpatient department, therefore they might have been more symptomatic with a more severe clinical status than the patients with COPD in the general population. These findings might be also commented on as smoking cessation has improved the symptoms and the airflow limitation over time. It is hard to understand the reinforcers that make these patients keep smoking despite the deterioration of their respiratory function. The potential explanation for this issue might be the pertinent features of patients with COPD that they worry about in health status, but they deny their disease or since they commenced smoking at their very early ages, they may think the disease is self-inflicted through smoking.[17] As their COPD progresses, they suffer more dyspnea and get accustomed to the unpredicted symptoms and emergency room admissions. By the time they accept that their disease is advanced, and all these may influence their health-related behaviors.[17]

Patients with COPD experience an anxiety spiral with breathing difficulties and diminished physical activities, which leads them to smoke more, and in turn makes their

Table 4. Factors associated with smoking cessation based on sociodemographic characteristics of COPD patients in multivariable analysis

Variables	β	Wald	p
Age			
<65 years	Reference		
>65 years	28.787	<0.001	0.999
Sex			
Male	Reference		
Female	22.198	<0.001	0.992
Marital status			
Unmarried	Reference		
Married	12.965	<0.001	0.995
Education			
Primary school/High school	Reference		
University graduate	21.140	<0.001	0.994
Smokers among the households			
-	Reference		
+	-15.104	<0.001	0.996
Children <14 years at home			
-	Reference		
+	3.460	<0.001	0.999
Tobacco exposure at work place			
-	Reference		
+	-27.142	<0.001	0.994
Start age of smoking	-1.218	<0.001	0.996
Smoking duration	-5.282	0.001	0.982

Hosmer–Lemeshow test, Nagelkerke R^2 analysis. COPD: Chronic obstructive pulmonary disease

anxiety and quality of life worse.[18] Besides, symptoms of anxiety may overlap with dyspnea and chest tightness. The well-known specific features of smokers with COPD are that they have higher levels of tobacco dependence than healthy smokers which makes it more difficult to quit smoking for them.[19,20] The studies investigating quit attempts in COPD patients reported a negative association between the time spent smoking and quit attempts.[21]

Since COPD patients have been forced to remain at home due to their physical deconditioning and activity restrictions, feeling isolated and constant urges to smoke have been the direct consequences. All these factors have reduced the self-esteem of the patients for smoking cessation and have caused a fear of experiencing withdrawal symptoms. In this sense, healthcare professionals asking patients about their smoking status and recommendations to quit smoking become more precious than any other intervention in optimizing the management of COPD. Patients with COPD are in need of assistance for quitting and adequate information about smoking cessation methods.[19] Smoking cessation is a cornerstone in reducing the decline in lung function, decreasing the risk of exacerbations and frequent utilization of healthcare systems, and improving survival rates.[5]

Despite not being shown to be effective in multivariable analysis, in our cohort the current smokers were less likely to quit smoking because these patients were living unfortunately with smokers Inevitably, environmental factors such as exposure to tobacco use at home or work have caused these patients to continue smoking. It is noteworthy that despite the government tobacco control policies recommended by World Health Organization to decrease smoking rates and secondhand smoke exposure, tobacco use is still going on in workplaces in low-income countries.[22] Besides, smoking parents have been not good models for their children and have increased the likelihood of their tobacco use.

As shown in previous studies, a lower educational qualification has been associated with a lower probability of attempting to quit.[16] In our study, former smokers had been smoking for much less time than current smokers. There has been a negative correlation between smoking initiation and smoking duration, and having a motivation to quit smoking, which has pointed out the impact of nicotine dependence. Smoking cessation is indisputably more difficult among patients who smoke with higher intensity. Although the current smokers group had all these characteristics, none of the abovementioned features were found to have an apparent impact on smoking cessation in the multivariable analysis in our research.

Numerous epidemiologic and clinical research have shown that mood and anxiety disorders are highly comorbid with COPD which increases their symptom burden.[18] In our study, compared to the patients who quit smoking, current smokers displayed higher scores of BECK anxiety scores, and, much more patients had moderate to severe anxiety among these active smokers. Moreover, higher anxiety scores were found to lower the probability of smoking cessation. A high level of anxiety is the major risk factor in smoking initiation.[23] In previous reports, the association between anxiety disorders and COPD in the middle-aged population was attributed mostly to smoking and nicotine dependency as confounding factors.[24] In fact, rehospitalization may be more likely for COPD patients who have significant levels of anxiety, and, as shown in our study, 19% of the current smokers were hospitalized for acute exacerbation in the past year and 9.5% were admitted to the intensive care unit.

Available literature revealed that patients with anxiety may experience more intense tobacco withdrawal symptoms that make the situation more complicated.[23] The fear of worsening psychological problems may support continued smoking in these patients who tend to have less awareness of the health risks and benefits of quitting. Due to these factors, the

smoking rate among those with anxiety disorders has not decreased over time, in contrast to the overall population.[21] In the routine outpatient visits, taking into account that the socioeconomic factors have been a challenge in COPD, the current smokers should be evaluated for accompanying anxiety or depressive symptoms and should be referred to the related physicians for counseling and supported in their quit attempts more intensively. Even motivating patients by the health professionals, to believe their ability in accomplishing to quit is an important goal at that point. Patients need not only clear advice for quitting but also adequate information about the available smoking cessation methods.

Intriguingly, we found that having comorbidities like diabetes and cardiovascular disorders had a detrimental effect on quitting in current smokers who took part in our trial. This was an unexpected finding. Smoking is a major risk factor for atherosclerosis and cardiovascular disorders which are known to be smoking-related conditions.[25] Similarly, micro and macroangiopathic complications, development of coronary heart disease and adverse effects in lipid metabolism are highly associated with tobacco use in diabetic patients.[26] So, smoking cessation decreases the cardiovascular risks of mortality in diabetics but unfortunately, the studies reported disappointing rates of quitting.[27] The fear of weight gain and a history of chronic depressive symptoms constitute barriers to reducing daily tobacco consumption, so the diabetics continue smoking.[27] These patients mostly do not much care in the management of their diabetes and often feel unable to stop smoking which impairs the motivation to quit. As shown in the previous studies, denial of the medical conditions and fear of exacerbating symptoms of anxiety are the major drivers that reduce the self-efficacy of patients with multiple chronic diseases in smoking cessation.[21]

Parallel to earlier studies, we found white blood cell count and CRP in current smokers higher than the former smokers, which may in turn explain the underlying shared inflammatory mechanisms between COPD, smoking, comorbidities, and anxiety.[28] Several studies documented the increase in CRP levels in smokers compared to non-smokers and even a correlation between CRP levels and pack-years in COPD patients.[29] Moreover, in constantly smoking individuals a high level of CRP has been reported to be in relation with an annual decline in forced expiratory volume which has supported our findings.[29] Smokers also have increased numbers of white blood cells and hemostatic markers, which have reflected the response to lung inflammation and independent risk factors for coronary artery disease.[30] However, from a clinical perspective, physicians frequently encounter patients in the outpatient department who keep smoking even after surgical procedures for cardiovascular disease or a significant sudden cardiac event such as myocardial infarction. Despite the fact that patients state such medical conditions as life-changing experiences and being aware that smoking is associated with cardiac diseases, they keep smoking. Although the benefits of smoking cessation are clear, the frequently accompanying anxiety or depression in cardiovascular diseases motivate these patients to continue smoking under these circumstances.[31,32]

The most common extrapulmonary manifestations of COPD are heightened systemic inflammation, increased risk for cardiovascular diseases and thrombosis.[33] The activated platelets have a critical role in immune-mediated reactions and releasing cytokines related to inflammation in COPD.[34] Cigarette smoking induces platelet aggregation and pathophysiological functions of the platelets, in turn, contribute to the development of COPD and respiratory symptoms.[34] In line with the recent reports current smokers in our research had elevated platelet counts, besides, platelets had inversely correlated with the probability of smoking cessation in multivariable analysis.[33]

Our study has certain limitations because it was a cross-sectional study, and we were not able to monitor the levels of carbon monoxide in expired breath so the patient self-reports were the only source of information regarding smoking status. As a result, we were unable to generalize the findings or establish a reliable causal link. We could not evaluate these patients about their past quit attempts or question them regarding the phase of stopping smoking such as precontemplative or preparation which might help to identify their attitudes that make them continue smoking. This is an important point because accumulating data shows that these patients want to quit as much as their healthy peers in the general population.[19] It is clear that more efforts are needed to understand the interaction between smoking and multiple comorbid conditions, and also find a way to integrate the treatment of tobacco dependence and medical conditions in these patients at the same time.

Conclusion

Overall, COPD and tobacco use are major public health problems. In this study, almost two-thirds of the patients with COPD remained active smokers. We observed that the patients with more severe breathing difficulties and exhibiting more symptoms of anxiety continued smoking despite the harmful health effects of tobacco use. Additionally, the comorbid conditions also have promoted these patients to keep smoking. COPD and the most common comorbidities accompanying COPD such as cardiovascular diseases and anxiety are all inflammation-based disorders that are supported with biochemistrial markers and motivate these patients to continue to smoke.

Disclosures

Ethics Committee Approval: The study was approved by the University of Health Sciences Türkiye, Sisli Hamidiye Etfal Training and Research Hospital Ethics Committee (date: 15.08.2023, no: 2409).

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

Authorship Contributions: Concept – M.A.O.; Design – M.A.O.; Supervision – M.A.O., M.Y.; Data collection &/or processing – M.A.O., G.A.A., M.I.B.; Analysis and/or interpretation – M.A.O., M.Y.; Literature search – M.A.O., G.A.A., M.I.B.; Writing – M.A.O.; Critical review – M.A.O., G.A.A., M.I.B.

Use of AI for Writing Assistance: None declared.

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