

# Comparative Analysis of Clinical Features in Former Versus Current Smoker Patients with Chronic Obstructive Pulmonary Disease: A Cross-Sectional Study

## Sigara İçen ve Sigarayı Bırakmış Kronik Obstrüktif Akciğer Hastalığı Olan Hastalarda Klinik Özelliklerin Karşılaştırmalı Analizi: Kesitsel Çalışma

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**ABSTRACT Objective:** In this study, we aimed to determine the clinical differences between former and current smoker chronic obstructive pulmonary disease (COPD) patients. **Material and Methods:** Demographic characteristics, smoking history, emergency admissions and hospitalizations in the last year were questioned in patients with COPD admitted to the chest diseases outpatient clinic. The assistive devices they used such as oxygen concentrators and bi-level positive airway pressure (BIPAP) were recorded. Exercise capacity was assessed by 6-minute walk test, dyspnea perception by Modified Medical Research Council dyspnea scale, quality of life by St. George Respiratory Questionnaire, psychological symptoms by Hospital Anxiety Depression Questionnaire, comorbidity severity by Charlson Comorbidity Index (CCI). Mann-Whitney U test and the chi-square test were used to compare group data. **Results:** Of the 447 COPD patients, 111 (24.83%) continued to smoke. Former smokers were significantly older than current smokers ( $p=0.014$ ). Current smokers exhibited significantly lower body mass index values ( $p=0.002$ ). The amount of cigarette consumption (pack/year), the number of emergency admissions and hospitalizations in the last year was higher in current smokers ( $p=0.002$ ,  $p<0.001$ ,  $p=0.001$ ). BIPAP and oxygen concentrator use, presence of cardiovascular disease and CCI score were higher in former smokers than in current smokers ( $p<0.05$ ). **Conclusion:** The number of emergency visits and hospitalizations is higher in COPD patients who continue to smoke.

**ÖZET Amaç:** Bu çalışmada, sigara içen ve sigara içmeyi bırakmış olan kronik obstrüktif akciğer hastalığı (KOAH) hastalarının klinik farklılıklarını belirlemeyi amaçladık. **Gereç ve Yöntemler:** Göğüs hastalıkları polikliniğine sevk edilen KOAH'lı hastalarda demografik özellikler, sigara içme öyküsü, son bir yıldaki acil başvurusu ve hastane yatışları sorgulandı. Oksijen konsantratörleri ve iki seviyeli pozitif hava yolu basıncı (BIPAP) gibi kullandıkları yardımcı cihazlar kaydedildi. Egzersiz kapasitesi 6 dakikalık yürüme testi, dispne algısı Değiştirilmiş Tıbbi Araştırma Konseyi dispne skalası, yaşam kalitesi St. George Solunum Hastalıkları Anketi, psikolojik semptomlar Hastane Anksiyete Depresyon Anketi, komorbidite şiddeti Charlson Komorbidite İndeksi [Charlson Comorbidity Index (CCI)] ile değerlendirildi. Grup verilerini karşılaştırmak için Mann-Whitney U testi ve ki-kare testi kullanıldı. **Bulgular:** 447 KOAH hastasından 111'i (%24,83) sigara içmeye devam etmekteydi. Sigarayı bırakanlar, sigara içenlerden önemli ölçüde daha yaşlıydı ( $p=0,014$ ). Sigara içenlerde önemli ölçüde daha düşük beden kitle indeksi değerleri saptandı ( $p=0,002$ ). Sigara tüketim miktarı (paket/yıl), son bir yıldaki acil başvurusu ve hastane yatış sayısı sigara içenlerde daha yüksekti ( $p=0,002$ ,  $p<0,001$ ,  $p=0,001$ ). BIPAP, oksijen konsantratörü kullanımı, kardiyovasküler hastalık varlığı ve CCI skoru eski sigara içicilerinde mevcut sigara içicilerinden daha yüksekti ( $p<0,05$ ). **Sonuç:** Sigara içmeye devam eden KOAH hastalarında acil başvurusu ve yatış sayısı daha yüksek seyretmektedir.

**Keywords:** COPD; comorbidity; smoking

**Anahtar Kelimeler:** KOAH; komorbidite; sigara

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Smoking is a serious public health concern and the leading avoidable cause of morbidity and death globally.<sup>1,2</sup> It is the biggest risk factor for the development of chronic obstructive pulmonary disease (COPD) and is responsible for 90% of COPD-related deaths. Continuous smoking adversely impacts symptom control, lung function maintenance, exacerbation frequency, and mortality in patients with COPD.<sup>1</sup>

Patients with COPD benefit enormously from smoking cessation.<sup>3</sup> Within one year of quitting smoking, patients' complaints of chronic cough, sputum production, shortness of breath, and wheezing decrease. After a few years, the pace of lung function deterioration resembles that of nonsmokers.<sup>4</sup> Smoking cessation is the simplest and most effective method to slow or stop the progression of COPD.<sup>1</sup> It also reduces bronchial bacterial colonization, improves the body's natural defense system, and reduces the risk of exacerbation of COPD, significantly reducing the mortality rate. It increases the effectiveness of medical treatment, especially corticoids.<sup>4</sup> For all patients with COPD who still smoke, quitting is an essential strategy. Healthcare professionals should always urge patients to stop smoking and play a crucial role in providing smoking cessation strategies and communications.<sup>5</sup>

Due to psychological and physiological addiction, quitting smoking is extremely difficult, and patients often succeed permanently after their 5<sup>th</sup> try.<sup>5,6</sup> There is a significant unmet need in the care of individuals with advanced COPD, as at least one-third of them still smoke.<sup>1</sup> To stop smoking, the complex of habit and addiction must be broken. Rehabilitation programs including behavioral support, counseling, and pharmacological drugs should be combined for long-term results.<sup>7</sup>

Few research have been published in the literature investigated the clinical characteristics of current and former smoker COPD patients.<sup>8-10</sup> And there is not enough information about how patients who quit smoking differ from those who continue to smoke. Therefore the aim of this study was to compare the clinical characteristics of patients who continued to smoke and who stopped smoking and to answer the question of which patients with COPD quit smoking.

## MATERIAL AND METHODS

The study was conducted as a cross sectional design between February 2020 and July 2022. Our hospital's ethics committee gave its approval to our study (date: June 12, 2020, no: E-49109414-604.02). Written informed consent was acquired from each participant after they had been informed of its goals and evaluation techniques. The Declaration of Helsinki principles was followed in the conduct of the research.

The study included patients with stable COPD who visited the outpatient clinic for chest disorders and agreed to participate.<sup>5</sup> Patients who had intrapulmonary comorbidities (lung cancer, bronchiectasis, interstitial lung disease, pulmonary embolism, etc.) and did not want to fill out the questionnaire were excluded. Patients with COPD who quit smoking at least one year ago were included in the former smoker group, and those who continued to smoke were included in the current smoker group.<sup>11</sup>

Demographic characteristics, smoking history, comorbidities, emergency admissions, and hospitalizations in the last year were questioned. Comorbidities were classified as cardiovascular disease (hypertension, coronary artery disease, etc.), metabolic disease (diabetes mellitus, obesity, dyslipidemia, etc.), musculoskeletal system disease (osteoporosis, rheumatological diseases), and endocrine disease (Cushing's disease, hypothyroidism, etc.).

Charlson Comorbidity Index (CCI) of patients with comorbidity was calculated.<sup>12</sup> The assistive devices they used such as oxygen concentrators and bi-level positive airway pressure (BIPAP) were recorded. Arterial blood gas was taken by a pulmonologist.

## RESPIRATORY FUNCTIONS

The patients underwent respiratory function test (Zan 500, Germany) and diffusion capacity of carbon monoxide (DLCO, Zan 300, Germany) following the standardization criteria defined by the ATS and ERS.<sup>13</sup> In our study, the forced expiratory volume in one second (FEV<sub>1</sub>), forced vital capacity (FVC), FEV<sub>1</sub>/FVC, DLCO values that adjusted for age, gender, weight, and height were recorded.

## EXERCISE CAPACITY

The 6-minute walk test (6MWT), a measure of functional ability, was used to make the determination. Patients were instructed to go as quickly as they could for 6 minutes down a straight 30-meter hallway. During assessment, standardized instructions and positive reinforcement were offered. The test was given at least twice because of the learning impact. After the 2<sup>nd</sup> test, the distance was recorded in meters.<sup>14</sup>

## DYSPNEA ASSESSMENT

The severity of dyspnea was assessed using the “Modified Medical Research Council” dyspnea scale. “0” stands for the best level and “4” for the worst level in the scoring.<sup>15</sup>

## QUALITY OF LIFE

The Turkish version St. George’s Respiratory Questionnaire (SGRQ) was used to determine disease related quality of life. In this questionnaire, which has four sub domains: symptom, activity, impact and total, high scores indicate worsening of the disease and increased symptoms.<sup>16</sup>

## PSYCHOLOGICAL SYMPTOMS

The 14-question Hospital Anxiety and Depression scale was used to assess the patients’ psychological well-being. 0-7: normal, 8-11: borderline, and >11: implies anxiety or depression.<sup>17</sup>

## STATISTICAL ANALYSES

Statistical evaluations were performed utilizing IBM SPSS 21.0 (Armonk, NY, ABD). For each variable, descriptive statistics were computed. Using histogram graphics and the Kolmogorov-Smirnov test, the normality of the distribution was examined. Continuous data were represented as median (interquartile range) as the distribution is not normal. The frequency (n) and percentage (%) of the categorical variables are shown. The Mann-Whitney U test and the chi-square test were used for group comparisons. If the p-value was less than 0.05, it was deemed statistically significant.

## RESULTS

Of the 447 COPD patients included in the study, 111 (24.83%) continued to smoke. Former smokers were

significantly older ( $p=0.014$ ). Current smokers had significantly lower body mass index (BMI) values ( $p=0.002$ ).

The amount of cigarette consumption (pack/year) was higher in active smokers ( $p=0.002$ ). The usage of BIPAP and oxygen concentrator were more than the current smoker group ( $p<0.001$ ,  $p<0.001$ ). FEV1, FEV1/FVC, TLCO of SFT values and partial oxygen pressure ( $pO_2$ ), partial carbon dioxide pressure ( $pCO_2$ ) and  $O_2$  saturation values of arterial blood gas values were similar in both groups ( $p>0.005$ ). The presence of comorbidities and CCI were higher in former smokers compared to the other group ( $p<0.001$ ,  $p=0.003$ ). While cardiovascular, metabolic, musculoskeletal and endocrine system diseases were distributed at similar rates in both groups ( $p=0.636$ ,  $p=0.566$ ,  $p=0.588$ , respectively), it was concluded that the presence of cardiovascular disease was significantly higher in the former smoker group ( $p=0.020$ ). The number of emergency admissions and hospitalizations in the last 1 year were higher in former smokers ( $p<0.001$ ,  $p=0.001$ ) (Table 1). Comorbidity distributions of the groups are shown in Figure 1.

Walking distance was lower in former smokers, although not statistically significant ( $p=0.271$ ). Dyspnea perceptions were similar in both groups ( $p=0.560$ ). There was no significant difference in all SGRQ parameters in both groups ( $p>0.05$ ). Anxiety and depression scores were similar in both groups ( $p>0.05$ ) (Table 2).

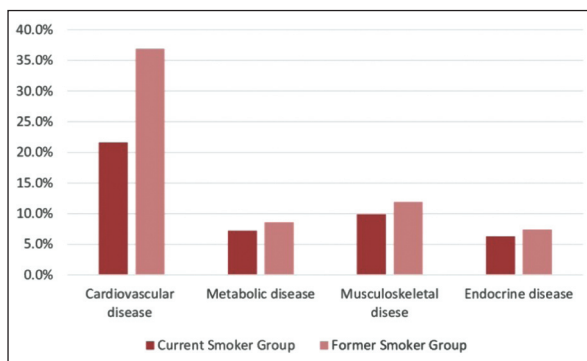
## DISCUSSION

In this study, where we compared the clinical characteristics of former smokers and current smokers, the smoking cessation rate was higher in COPD patients with comorbidities, high comorbidity index, cardiovascular disease, and those using BIPAP and oxygen concentrators. The presence of cardiovascular disease increases the rate of smoking cessation in patients with COPD. It has been observed that COPD patients quit smoking when their disease progresses and they need to use assistive devices. Current smoker COPD patients had lower BMI, higher cigarette consumption, more emergency admissions

**TABLE 1:** Comparison of sociodemographic and clinical characteristics of the groups.

| Variables                      | Current smoker Former smoker |            | p value*         |
|--------------------------------|------------------------------|------------|------------------|
|                                | (n=111)                      | (n=336)    |                  |
| Age (years)                    | 63 (58/67)                   | 64 (60/70) | <b>0.014</b>     |
| Male gender n (%)              | 90 (89.1)                    | 300 (89.4) | 0.964            |
| BMI (kg/m <sup>2</sup> )       | 23 (21/28)                   | 26 (23/30) | <b>0.002</b>     |
| Smoking (p/years)              | 60 (40/100)                  | 50 (36/80) | <b>0.002</b>     |
| Emergency admission            | 1 (0/3)                      | 0 (0/1)    | <b>&lt;0.001</b> |
| Hospitalization                | 0 (0/1)                      | 0 (0/0)    | <b>0.001</b>     |
| Presence of comorbidity n (%)  | 50 (45.0)                    | 233 (69.3) | <b>&lt;0.001</b> |
| Charlson comorbidity index     | 2 (1/2)                      | 2 (2/3)    | <b>0.003</b>     |
| Comorbidities n(%)             |                              |            |                  |
| Cardiovascular disease         | 24 (21.6)                    | 124 (36.9) | <b>0.020</b>     |
| Metabolic disease              | 8 (7.2)                      | 29 (8.6)   | 0.566            |
| Musculoskeletal system disease | 11 (9.9)                     | 40 (11.9)  | 0.636            |
| Endocrine disease              | 7 (6.3)                      | 25 (7.4)   | 0.588            |
| Oxygen concentrator n (%)      | 3 (2.7)                      | 68 (20.2)  | <b>&lt;0.001</b> |
| BIPAP n (%)                    | 2 (1.8)                      | 21 (6.2)   | <b>&lt;0.001</b> |
| Pulmonary function test        |                              |            |                  |
| FEV <sub>1</sub> (%)           | 42 (34/61)                   | 43 (32/61) | 0.946            |
| FEV <sub>1</sub> /FVC          | 59 (51/67)                   | 61 (49/70) | 0.241            |
| DLCO (%)                       | 41 (25/57)                   | 40 (26/55) | 0.825            |
| Arterial blood gas             |                              |            |                  |
| PaO <sub>2</sub> (mmHg)        | 73 (65/82)                   | 74 (63/82) | 0.792            |
| PaCO <sub>2</sub> (mmHg)       | 41 (38/45)                   | 40 (37/44) | 0.117            |
| SaTO <sub>2</sub> (%)          | 95 (94/96)                   | 95 (93/97) | 0.743            |

\*Mann-Whitney U test or chi-square test, p<0.05. Data expressed as median (25/75 interquartile range) or n (%). Bold indicates significant values. BMI: Body mass index; BIPAP: Bi-level positive airway pressure; FEV<sub>1</sub>: Forced expiratory volume in 1 second; FVC: Forced vital capacity; DLCO: Diffusion capacity of carbon monoxide; PaO<sub>2</sub>: Partial arterial oxygen pressure; PaCO<sub>2</sub>: Partial arterial carbon dioxide pressure; SaTO<sub>2</sub>: Oxygen saturation.



**FIGURE 1:** Distribution of the comorbid conditions of the groups.

and more hospitalizations. Walking distance, dyspnea perception, quality of life and psychological symptoms were similar in both groups.

**TABLE 2:** Comparison of the six-minute walk distance, dyspnea, quality of life, anxiety and depression of the groups.

| Variables                      | Current smoker Former smoker |               | p value* |
|--------------------------------|------------------------------|---------------|----------|
|                                | (n=111)                      | (n=336)       |          |
| 6 minute walk distance (meter) | 380 (290/440)                | 360 (280/420) | 0.271    |
| MMRC                           | 3 (2/4)                      | 3 (2/4)       | 0.560    |
|                                | 3.20±1.11                    | 3.28±1.13     |          |
| SGRQ                           |                              |               |          |
| Symptom                        | 53 (40/69)                   | 52 (37/66)    | 0.734    |
| Activity                       | 66 (48/79)                   | 67 (54/80)    | 0.194    |
| Impact                         | 44 (32/60)                   | 46 (30/62)    | 0.939    |
| Total                          | 50 (41/69)                   | 55 (41/67)    | 0.599    |
| HAD                            |                              |               |          |
| Anxiety                        | 7 (4/10)                     | 7 (4/10)      | 0.633    |
| Depression                     | 6 (3/9)                      | 6 (4/9)       | 0.678    |

\*Mann-Whitney U test, p<0.05. Data expressed as median (25/75 interquartile range). MMRC: Modified Medical Research Council; SGRQ: St. George's Respiratory Questionnaire; HAD: Hospital anxiety and depression.

Although smoking is the main cause of the development and progression of COPD, a large proportion of smokers, one in three or more, continue to smoke after being diagnosed with COPD.<sup>1,18</sup> Nicotine dependence in smoker COPD patients was found to be higher than in healthy smokers.<sup>19</sup> As in 2 studies comparing former smokers and current smokers with COPD, former smokers were older in our study.<sup>18,20</sup> The amount of cigarette consumption was found to be higher in current smokers in our study, as in the other study.<sup>20</sup> Smoking has an inverse association with body weight or BMI and quitting smoking has been associated with weight gain.<sup>21</sup> In a study comparing the characteristics of smoking and non-smoking COPD patients, the BMI of non-smoking patients was found to be higher.<sup>22</sup> In our study, BMI was found to be higher in ex-smokers.

Although the use of LTOT and the number of comorbidities were found to be higher in former smokers, it was not statistically significant.<sup>20</sup> In our study, the number of patients using oxygen concentrators and BIPAP was significantly higher in former smokers. In addition, the number of patients with comorbidities, high comorbidity index, and cardiovascular disease is higher in smokers. Patients with COPD quit smoking when they need assistive devices and have cardiovascular comorbidities.

The diversity of cigarette smoke constituents and the complexity of individuals' medical conditions either exacerbate pathological immune responses or weaken the normal defense function of the immune system.<sup>22</sup> Quitting smoking reduces bronchial bacterial colonization in patients with COPD, improves the body's natural defense system and reduces the risk of exacerbation of COPD.<sup>4</sup> In a study similar to our study, the number of emergency admissions and hospitalizations were found to be higher in current smokers.<sup>18</sup>

And, in contrast to that study indicating that current smokers had a higher 6-minute walking distance, our study found similar walking distances in both groups. In one study, the severity of dyspnea was found to be higher in former smokers than in current smokers, whereas no difference was found between the two groups in our study and the other study.<sup>17,20</sup> As in the study where pulmonary rehabilitation was applied to patients with COPD, no difference was found in terms of quality of life and psychological symptoms in former smokers and current smokers in this study.<sup>23</sup>

In the literature, most of the studies in this direction have made comparisons between never smokers and smokers with COPD. As in our study, there are very few studies on patients with current smokers and former smokers. This is the superior aspect of our study. The fact that the educational and socio-economic level of the patients was not questioned may be considered as a limitation of this study. However, the aim of this study was to compare patients with current

smokers and former smokers clinically rather than demographically.

## CONCLUSION

Just as smoking is the main cause of the development and progression of COPD, quitting smoking is the only proven way to slow or stop the progression of the disease. However, due to physiological and psychological dependence, some patients with COPD continue to smoke. This study showed that the number of emergency visits and hospitalizations is higher in COPD patients who continue to smoke.

### Source of Finance

*During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.*

### Conflict of Interest

*No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.*

### Authorship Contributions

**Idea/Concept:** Hülya Şahin; **Design:** Hülya Şahin, İlknur Naz; **Control/Supervision:** Hülya Şahin, İlknur Naz; **Data Collection and/or Processing:** Hülya Şahin; **Analysis and/or Interpretation:** İlknur Naz; **Literature Review:** Hülya Şahin; **Writing the Article:** Hülya Şahin, İlknur Naz; **Critical Review:** Hülya Şahin, İlknur Naz; **References and Fundings:** Hülya Şahin, İlknur Naz; **Materials:** Hülya Şahin, İlknur Naz.

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