ORIGINAL ARTICLE/ ÖZGÜN MAKALE

EVALUATION OF THE ASSOCIATION BETWEEN PROPER INHALER TECHNIQUE AND ANXIETY IN CHEST DISEASES OUTPATIENT CLINIC PATIENTS DURING COVID-19 PANDEMIC: A PROSPECTIVE CROSS-SECTIONAL STUDY

COVID-19 PANDEMİSİ DÖNEMİNDE GÖĞÜS HASTALIKLARI POLİKLİNİĞİ'NE BAŞVURAN HASTALARDA UYGUN İNHALER TEKNİĞİ VE ANKSİYETE İLİŞKİSİNİN DEĞERLENDİRİLMESİ: PROSPEKTİF KESİTSEL BİR ÇALIŞMA

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ABSTRACT

Objective: *In this study, we aimed to investigate the association between inhaler use skills and general anxiety or coronavirus anxiety scores in patients with respiratory diseases.*

Material and Method: *Inhaler techniques of 70 asthma and chronic obstructive pulmonary disease (COPD) patients were evaluated by three clinical pharmacists. A pulmonologist assessed the patients' anxiety scores using the Hamilton Anxiety Rating Scale (HAM-A) and Coronavirus Anxiety Scale (CAS). We used IBM SPSS 25.0 as a software program for related statistical analysis*

Result and Discussion: *Proper inhaler technique wasn't found to be associated with CAS score, age, comorbidity, inhaler type. HAM-A stage (p=0.096) and educational status (p=0.074) were not found as statistically significant in affecting the proper inhaler technique. A weak correlation was found between age and CAS score (r=-0.278, p=0.02). Asthma patients have a higher rate of coronavirus anxiety than COPD patients (p=0.036). Female patients had higher HAM-A (p=0,037) and CAS scores (p=0,002) than male patients. There was a moderate correlation between HAM-A and CAS scores (r=0.407, p<0.001). The correlation between HAM-A and inhaler use skills scores were not found in statistical significance (r=-0.208, p=0.083). In conclusion, increase of CAS score wasn't found to be associated with proper inhaler technique. HAM-A score was found to affect proper inhaler technique negatively, but these results are not significant.*

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Keywords: *Anxiety, asthma, COVID-19, COPD, inhaler technique*

ÖZ

Amaç: *Bu çalışmadaki amacımız respiratuvar hastalıkları olan hastaların inhaler kullanma becerileri ile koronovirüs anksiyete skorları ve genel anksiyete skorları arasındaki ilişkiyi belirlemektir.*

Gereç ve Yöntem: *Yetmiş astım ve kronik obstruktif akciğer hastalığı (KOAH) hastasının inhaler kullanma teknikleri üç klinik eczacı tarafından değerlendirildi. Göğüs Hastalıkları Uzmanı tarafından Hamilton Anksiyete Ölçeği (HAM-A) ve Koronavirüs Anksiyete Ölçeği (CAS) kullanılarak hastaların anksiyete skorları ölçüldü. IBM SPSS 25.0 programı kullanılarak ilgili istatistikler yapıldı.*

Sonuç ve Tartışma: *Doğru inhaler tekniği ile CAS skoru, yaş, komorbidite, veya inhaler tipi arasında ilişki bulunamamıştır. Doğru inhaler tekniği ile HAM-A seviyesi (p=0,096) ve eğitim durumu (p=0.074) arasında istatistiksel anlamlılık bulunamamıştır. Yaş ile CAS skoru arasında zayıf bir korelasyon bulunmuştur (r=-0.278, p=0.02). Astım hastalarının koronavirüs anksiyete oranı KOAH hastalarına göre anlamlı derecede yüksekti (p=0.036). Kadın hastaların HAM-A (p=0,037) ve CAS skorları (p=0,002) erkek hastalardan anlamlı derecede yüksekti. HAM-A ile CAS skorları arasında orta dereceli bir korelasyon bulunmuştur (r=0.407, p<0.001). HAM-A seviyesi ve inhaler kullanma beceri skorları arasındaki korelasyon anlamlı bulunmamıştır. (r=-0.208, p=0.083)Sonuç olarak, hastaların artmış CAS skorları inhaler kullanma becerilerini etkilememiştir. HAM-A skorları inhaler kullanma becerilerini negatif yönde etkilemiştir fakat sonuç anlamlı değildir.*

Anahtar Kelimeler: *Anksiyete, astım, COVID-19, inhaler tekniği, KOAH*

INTRODUCTION

The European Society for Patient Adherence, Compliance and Persistence (ESPACOMP) define medication nonadherence (MNA) in three categories as initiation, implementation, persistence. Implementation defined as taken prescribed dose correctly and this comprises patients' unintentional behaviour [1]. Although maintenance treatment of inhaled medication is vital for patients with asthma and chronic obstructive pulmonary disease (COPD), the majority of the patients do not adhere to therapy. The causes of MNA are complex and multifactorial. Improper inhaler technique is a component of unintentional MNA. Inhaler medications complicate drug adherence and patients have insufficient use skills of inhaler drugs because of various reasons [2]. Patients should be educated on how to use their inhaler devices, however many patients are unable to do so due to cognitive and physical limitations. [1]. Anxiety and depression have a negative impact on cognitive function and health behaviors. In a study which evaluated the association with different types of MNA and depressive and anxious symptoms has shown that these symptoms caused to unintentional and a greater extend of intentional MNA. They state that while depression has been identified as a risk factor for MNA in previous studies, research results on anxiety and comorbidity are confusing. They explained that anxiety symptoms are heterogeneous. An anxious patient could be more aware of his or her health and concerned about his or her physical ailment, which may reduce MNA, but even that adverse drug reactions may still cause MNA. [3]. Improvement in depressive symptoms had a positive effect on MNA in a study in cardiac patients, but there was no independent correlation between anxiety and MNA. They concluded that anxiety symptoms may have a lesser impact on the adherence outcomes measured. Besides, patients

with anxiety may be highly anxious about health concerns, leading to greater vigilance regarding recommendations about their health [4].

Coronavirus disease-2019 (COVID-19) has affected millions of people around the world. Clinicians estimate greater mortality rates among individuals with lung disease due to COVID-19's respiratory effects. Patients with COPD, on the other hand, have a decreased rate of COVID-19-induced hospitalizations. This lower rate could indicate that COVID-19 patients with COPD are taking effective COVID-19 preventative action [5]. But anyway respiratory effects of COVID-19 are worried among COPD patients [6].

There is evidence for an association between MNA and anxiety in asthma and COPD patients but there is no evidence of a correlation between anxiety and improper inhaler technique which is a key component of inhaler MNA according to our knowledge. As reported from the studies we could think that anxious patients endeavour to have more advanced knowledge and skills of their inhaler medication for getting rid of their symptoms [3, 4].

We aimed to investigate general anxiety and coronavirus anxiety scores in patients with COPD and asthma during COVID-19 pandemic and we wonder if moods of patients with COPD and asthma are influenced by COVID-19, there are any improve awareness of using their inhaler medication with proper technique due to increased anxiety about their health.

MATERIAL AND METHOD

This two-month cross-sectional study was conducted in the Chest Disease Outpatient Clinic at the İnönü University Turgut Özal Medical Center from December 2020 to February 2021.

Demographic data consist of patients' age, sex, diagnosis, educational level, smoking history, comorbidities, types of inhalers. Patients with asthma or COPD, who were 18 and over years old, applied to our hospital and taken at least one inhaler medication were included in the study. Patients over the age of 80 who could not self-administer their medication, patients who had difficulty speaking Turkish, patients with other respiratory diseases, acute organ failure, advanced stage cancer, and serious neurologic, mental or psychiatric diseases were excluded. During our research we conducted all face-to-face interviews within the scope of COVID-19 measures.

All the included patients' inhaler technique were assessed by three clinical pharmacists using either placebo inhalers or patients' own inhaler while providing the appropriate overdose warnings.

To assess patients' use skills, our pulmonologist first selected one inhaler medication. This inhaler medication was chosen to be used on a regular basis as a maintenance treatment, which was appropriate for their disease stage.

Inhaler techniques were evaluated in two ways; according to previous articles we evaluated use skills in nine main steps, which were given in supplementary data [7]. We scored one point for complete steps and zero points for those that were not performed. Each patient's total score was calculated and documented.

Based on published researchs and manufacturer instructions, we categorized inhaler types into four groups according to the following usage steps: metered dose inhaler (MDI), turbohaler, handihaler and diskus. We determined critical usage steps according to these literature and these steps were given in supplementary data [8, 9]. We documented the inhaler technique of patients who made one or more mistakes in critical steps as improper technique, and those who performed these steps correctly as proper technique, because inappropriate performance of critical steps would result in little or no medication reaching the lungs.

All the included patients were assessed by the same clinician using the Hamilton Anxiety Rating Scale (HAM-A). This is an asessment tool that measures anxiety in people according to 14 items. We did the rating as follows according to previous study; the score 6-14 indicated mild anxiety, 15-28 indicated moderate anxiety, 29-52 indicated severe anxiety [10]. Turkish validity and reliability of this scale has been made [11]. We divided the patients into three groups according to their scores and calculated total scores for each patient then documented them in these ways.

COPD Assesment Test (CAT) is an 8-items unidimensional measure of health status impairment in COPD. It was developed to be applicable worlwide and validated translations are available in a many languages [12]. Turkish validity and reliability of this scale has been made [13]. All COPD patients were assessed by the same clinician using CAT scale and calculated total scores then documented in this way.

Coronavirus Anxiety Scale (CAS) developed for identify COVID-19 related probable dysfunctional anxiety cases. Patients with score ≥9 are classified as having dysfunctional anxiety associated with COVID-19 crisis. Turkish validity and reliability of this scale has been made [14]. All patients were assessed by the same clinician. Then we divided patients into two group CAS-positive or negative according to their score and also, we calculated each patients' total score then documented in these ways. We evaluated patients who were diagnosed COPD and asthma by pulmonologists and we didn't assess the severity of the disease.

We used IBM SPSS 25.0 as a software program for statistical analysis. The analysis of qualitative data between the groups were done with the Pearson chi-square test or Fischer's exact test. Analysis of the quantitative data between the two groups were performed using the Independent Samples T test or the Mann-Whitney U test, depending on whether the data were normally distributed or not. Analysis of quantitative data between more than two groups were done by the Kruskal Wallis H test. Pearson (for normally distributed data) or Spearman's rho (for non-normally distributed data) correlation tests were used to determine the correlation of quantitative data.

RESULT AND DISCUSSION

Thirty-two asthma and 38 COPD patients, whose ability to use inhaler and anxiety scores were evaluated, were included in the study. The mean age of the patients was 54.33±14.44; 54.2% (38) of the patients were male and 45.7% (32) were female. The characteristics, anxiety scores, and the evaluation of inhaler techniques of the patients are summarized in Table 1. As expected, asthma patients were younger and had less comorbidities than COPD patients ($p<0.05$). While HAM-A scores of asthma and COPD patients were similar (p=0.953), CAS score was higher in asthma patients than in COPD patients (p=0.01).

Only 32.9% of the patients included in the study were using their inhalers properly. There were only 10 (14.3%) patients who had all steps correct.

Table 1. Characteristic features and other data of the patients

	Asthma (n=32)	COPD (n=38)	*p* value
Age (mean±SD)	43.7±12	63.3±9.4	<0.001*
Gender			<0.001**
Female	27 (84.4%)	5 (13.2%)	
Male	5 (15.6%)	33 (86.8%)	
Marital status			0.130**
Single	6 (18.8%)	2 (5.3%)	
Married	26 (81.2%)	36 (94.7%)	
Smoking			0.001**
Current smoker	3 (9.4%)	10 (26.3%)	
Former smoker	11 (34.4%)	23 (60.5%)	
Never smoker	18 (56.2%)	5 (13.2%)	
Level of education			
Illiterate	4 (12.5%)	4 (10.5%)	0.906**
Primary or secondary school graduate	19 (59.4%)	25 (65.8%)	0.306**
High school graduate	6 (18.8%)	8 (21.1%)	0.952**
University graduate	3 (9.3%)	1 (2.6%)	0.325**
Comorbidity			0.002**
Present	7 (21.9%)	22 (57.9%)	
Absent	25 (78.1%)	16 (42.1%)	
Inhaler type			
MDI	4 (12.5%)	3 (7.9%)	0.695**
Diskus	12 (37.5%)	19 (50%)	0.294**
Handihaler	14 (43.8%)	15 (39.5%)	0.717**
Turbuhaler	2 (6.2%)	1 (2.6%)	0.589**
HAM-A score (mean±SD)	23.1±8.6	23.1±10.5	0.953*
CAS score (median)	1.5 (0-18)	0 (0-16)	0.01***
CAS positivity			0.036**
Positive	8 (25%)	2 (5.3%)	
Negative	24 (75%)	36 (94.7%)	
The evaluation of inhaler technique			0.448**
Proper	12 (37.5%)	11 (29%)	
Improper	20 (62.5%)	27 (71%)	
Inhalation skills score (median)	6.5 (2-9)	5 (1-9)	0.142***

*:   Independent Samples t test
**:   Chi-square test
***: Mann Whitney U test

There are no differences in CAT score, CAS score, age, comorbidity and inhaler type between patients who use the inhaler properly or not properly (Table 2). Only the HAM-A stage and educational status have approached statistical significance in affecting the proper inhaler technique. According to the HAM-A score, the rate of using inhalers' properly in patients with mild anxiety (n=16) is 50%, while in those with moderate (n=31) and severe anxiety (n=23) this rate is 32.2% and 21.7% respectively (p=0.096). Whilst the rate of proper use of inhalers was 50% for high school and university graduates, it was 26.9% for illiterate and primary or secondary school graduates (p=0.072). In addition, it was found that the inhalation skills scores of different education level groups were different (p=0.037). Mean inhalation skills score was 5.9 ± 2.6 for illiterates and was 7.9 ± 1.9 for university graduates (p=0.231).

Coronavirus anxiety rate of our population was 14.2% (10/70). A negative weak correlation was found between age and CAS score (r=-0.278, p=0.02). Coronavirus anxiety rate (p=0.036) and median CAS score (p=0,01) were higher in asthma patients than COPD patients. While the rate of coronavirus anxiety in female patients was 25%, it was 5.2% in male patients (p=0.036).

According to HAM-A score, the anxiety rate of our patients was 77.1%. While the anxiety rate in asthma patients was 78.1%, the anxiety rate in COPD patients was 76.3%. Although no association was found between anxiety rates according to HAM-A score and gender (p=0.453), total HAM-A scores of female patients higher than male patients (p=0.037). Similarly, there was no association between anxiety and age (p=0.181). There was a strong correlation between HAM-A score and CAT score (r=0.774, p<0.001), and a moderate correlation between HAM-A score and CAS score (r=0.407, p<0.001). There was a moderate correlation between the CAS score and the HAM-A score in both groups, asthma patients (r=0.468, p=0.007) and COPD patients (r=0.469, p=0.003). In addition, the correlation between HAM-A score and inhalation skills score were not found as statistically significant (r=-0.208, p=0.083).

Patients with COPD may experience a high prevalence of anxiety and depression. Anxiety symptoms were reported as 6% to 74 % of COPD patients[15, 16].

In a more recent study, the best estimate of anxiety prevalence in COPD patients was 36% (31-41%). Because of the social isolation induced by the current pandemic, there are little data available to show whether COPD patients are more likely to engage in negative behaviours such as excessive drinking and active smoking compared to other chronic conditions. These negative social behaviours may have a detrimental effect on the emotional health status of COPD patients [17]. In the present study, the prevalence of anxiety symptoms was shown to be present in 76.3% of patients with COPD.

Anxiety was shown to be more frequent in our study than in previous studies. The high prevalence of anxiety among COPD patients in our study was thought to be linked to the present pandemic. There was a moderate correlation between HAM-A score and CAS score in patients with COPD (r=0.469, p=0.003).

Table 2. Comparison of patients who use their inhalers properly and those who use them improperly

	Proper (n=23)	Improper (n=47)	*p* value
Age (mean±SD)	54.0±15.32	54.5±14.2	0.74*
Gender			0.804**
Female	11 (47.8%)	21 (44.7%)	
Male	12 (52.2%)	26 (55.3%)	
Primary disease			0.448**
Asthma	12 (52.2%)	20 (42.6%)	
COPD	11 (47.8%)	27 (57.4%)	
Level of education			0.072**
Illiterate and primary or secondary school graduate	14 (60.9%)	38 (80.9%)	
High school and university graduate	9 (39.1%)	9 (19.1%)	
Comorbidity			0.202**
Present	12 (52.2%)	17 (36.2%)	
Absent	11 (47.8%)	30 (63.8%)	
Inhaler type			
MDI	3 (13.1%)	4 (8.5%)	0.676**
Diskus	7 (30.4%)	24 (51.1%)	0.102**
Handihaler	11 (47.8%)	18 (38.3%)	0.447**
Turbuhaler	2 (8.7%)	1 (2.1%)	0.249**
HAM-A stage			
Mild	8 (34.8%)	8 (17%)	0.096**
Moderate	10 (43.5%)	21 (44.7%)	0.924**
Severe	5 (21.7%)	18 (38.3%)	0.165**
CAT score (mean±SD)	21.8±10.1	21.2±10	0.784*
CAS score (median)	0 (0-18)	0 (0-18)	0.908***
CAS positivity			0.719**
Positive	4 (17.4%)	6 (12.8%)	
Negative	19 (82.6%)	41 (87.2%)	

*:   Independent Samples t test
**:   Chi-square test
***: Mann Whitney U test

In clinical studies, the prevalence of depression and anxiety in asthma patients varies. Psychological distress was found to be present in 7.5% to 80% [18, 19]. In the present study, anxiety symptoms were shown to be prevalent in 78.1% of asthma patients. People with chronic respiratory illness are disproportionately affected by COVID-19 and the measures taken to address it [20]. In our study the current pandemic might have been to cause for the high prevalence of anxiety in asthma patients. In asthma patients, there was a moderate correlation between HAM-score and the CAS score (r=0.468, p=0.007). Meanwhile, when compared to the COPD group, the asthma group had a higher CAS score positivity (p=0.036). In the trials, which had found relationship between higher CAT scores and anxiety and/or depression likely our study, several screening tools such as Beck Depression Inventory (BDI) [21], Hospital Anxiety and Depression Scale (HADS-A, HADS-D) [22], Hamilton Depression and Anxiety Rating Scale (HAM-A, HAM-D) [23], Patient Health Questionnaire-9 (PHQ-9) [24] were utilized to define depression and anxiety in patients with COPD. Patients with anxiety in the COPD group, according to a previous research, are mostly female patients [23]. Our findings support previous studies on anxiety-female gender association in asthma and COPD groups (p=0.037).

CAT is a dependable measure of COPD-specific health status [25]. It has been indicated in many trials that CAT correlates with anxiety symptoms. In the current study, this evidence was approved due to the strong correlation between the HAM-A and CAT scores (r=0.774, p<0.001).

The results demonstrated that 67.1% of the patient sample could not use their inhaler device as properly. Only 10 patients were successful in performing all the steps correctly. In previous studies, rates of inappropriate technique ranged from 4% to 97% depending on the patient sample and type of inhaler device [26, 27]. In one study, COPD patients with inappropriate inhaler device technique had a higher CAT score than patients with correct inhaler device technique (p=0.02) [28]. Meanwhile, one study showed that a remarkable association between CAT score and improper inhaler technique in patients with COPD [27]. However, in the present study, we could not indicate statistically significant assocation between CAT score and improper inhaler technique in COPD patients.

The type of inhaler device is a remarkable indicative of improper inhalation technique [9, 26-29]. Several studies have shown that MDI users had significantly more failures than users of other inhaler types [9, 27]. In contrast, a study indicated that patients using an MDI had a better inhalation technique [29]. Despite the two aspects, we were unable to discover the association between inhaler type and proper inhalation technique.

Previous studies evaluating the effects of age on inhaler technique have indicated that older patients make remarkably more mistakes in inhaler technique [26, 29]. However, two studies demonstrated that age was not significantly concerned to the patients' improper inhaler technique [26, 27]. Likewise, we could not show an association between patients age and proper inhalation technique.

The important factor that affected proper inhaler technique is level of education. One study demonstrated that patients with a higher educational level had significantly lower rate of mistakes [27]. However, it was found that there was no association between education level and proper inhaler technique in another study [26]. In the present study, while the rate of proper inhaler technique 39.1% for high school and university graduates and 60.9% for illiterate and primary or secondary school graduates (*p*=0.072) were not different, the total inhalation skills scores of different education level groups were found different (p=0.037). The mean inhalation skills score for illiterates was 5.9, while it was 7.9 for university graduates.

In this study in which both groups were included, the HAM-A scores weren't affect the proper inhaler technique. According to the HAM-A score, the rate of proper inhaler technique in patients with mild anxiety is 50%, while this rate is 27.7% in those with moderate and severe anxiety (p=0.096). In addition, the correlation between HAM-A and inhalation skills scores approached statistical significance (r=-0.208, *p*=0.083). In a study which was evaluated the association between inhaler MNA and anxiety in patients with asthma, it has reported that poor medication compliance in patients with asthma were

shown higher mean score for anxiety than good compliance group but these results were not significant [30]. In a parallel study involving patients with COPD, researchers could not determine a statistically significant difference between the inhaler MNA and anxiety [31]. Both studies [30, 31] included a single patient group (asthma or COPD), and only one inhaler device was evaluated for MNA (turbuhaler or diskus). Four inhaler device types were also included in our study, and we found patients with anxiety have more improper inhaler technique, but the results are not significant.

In a research study 84 COPD patients' treatment status, medication adherence and, and several factors that influence were evaluated over two months during COVID-19 pandemic. They discovered that 27.3% were predisposed to treatment reduction or discontinuation due to concerns about the COVID-19 pandemic, and that 31% of patients had possible depression, which was an independent risk factor for poor medication adherence. One of their study's limitations was that they couldn't meet with patients face to face [32]. Unlike this study, we had a face-to-face meeting with each patient. We didn't measure directly medication adherence, but our results showed that COVID-19 epidemic and mood disorders like as apprehensive status were not affect the inhaler technique.

This study has some limitations that may have reduced the generality of the results. If only we evaluated more patients, we'd be able to find a significant association between anxiety and inhaler technique. The number of patients admitted to chest diseases outpatient clinics is not at the expected level because to the social isolation experienced during the COVID-19 pandemic. So, the study's patient enrollment is not at the desired level. One of the limitations was assessing each patient's ability with a single inhaler type to keep the interviews short due to the pandemic.

The present study concludes that most COPD and asthma patients use their inhalers improperly. There wasn't any statistically significant correlation between proper inhaler technique and any parameter (CAT score, HAM-A score, CAS score, age, education level, comorbidity, inhaler device type) examined. However, patients with lower HAM-A stage and higher level of education used inhaler more properly, but it was not found statistically significant. Therefore, more attention should be paid to inhaler use skills training, especially in the low education level group and moderate-severe anxiety group.

In the present study, CAS score was not found to be associated with proper inhaler technique. HAM-A score was found to affect proper inhaler technique negatively, but these results are not significant. More studies are needed to shed light on the association between anxiety scores and proper inhaler technique.

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AUTHOR CONTRIBUTIONS

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

ETHICS COMMITTEE APPROVAL

The study was approved by the ethics committee of the Inonu University on 24.11.2020 (decision number: 2020/1231).

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