İKÇÜ SBFD

2026 • CİLT 11 • SAYI 1 • 38-44
DOI: 10.61399/ikcusbfd.1670935

RESEARCH / ARAŞTIRMA

How Did the COVID-19 Pandemic Affect the Non-Motor Symptoms of Patients with Parkinson's Disease?

Aybüke Cansu KALKAN [1], Canseli TOSUN [2], Turhan KAHRAMAN [3], Arzu GENÇ [4], Berril DÖNMEZ ÇOLAKOĞLU [5]

[1] Izmir Katip Celebi University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Izmir, Türkiye. **ORCID:** 0000-0003-1329-7870
[2] Dokuz Eylul University, Institute of Health Sciences, Izmir, Türkiye. **ORCID:** 0000-0002-3484-5947
[3] Izmir Katip Celebi University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Izmir, Türkiye. **ORCID:** 0000-0002-8776-0664
[4] Dokuz Eylul University, Faculty of Physical Therapy and Rehabilitation, Izmir, Türkiye. **ORCID:** 0000-0001-9481-6083
[5] Dokuz Eylul University, Faculty of Medicine, Department of Neurology, Izmir, Türkiye. **ORCID:** 0000-0002-5143-236X

ABSTRACT

Objective: The study aimed to assess the effect of the COVID-19 pandemic on non-motor symptoms in patients with Parkinson's disease, compare these changes with healthy controls and investigate the relationship between coronaphobia and non-motor symptoms in patients with Parkinson's disease during the pandemic.
Material and Methods: The study included 53 patients with Parkinson's disease and 53 healthy controls. Participants' sleep quality (Pittsburgh Sleep Quality Index), fatigue severity (Fatigue Severity Scale), and depressive symptoms (Geriatric Depression Scale) were evaluated for two distinct time periods: the pre-pandemic period and the pandemic period. The COVID-19 Phobia Scale was administered to assess coronaphobia during the pandemic.
Results: Compared to the pre-pandemic period, non-motor symptoms significantly increased during the pandemic period ($p<0.05$). The change in these non-motor symptoms during the pandemic compared to the pre-pandemic period was similar between patients and the healthy control group ($p>0.05$). During the pandemic, a weak positive correlation was observed between the COVID-19 Phobia Scale and Geriatric Depression Scale scores in patients (rho=0.357, p=0.009).
Conclusion: During the COVID-19 pandemic, patients with Parkinson's disease experienced worsened sleep quality, increased fatigue severity and depressive symptoms. Increased coronaphobia levels in patients were associated with worsening depressive symptoms. Since non-motor symptoms in patients with Parkinson's disease may adversely be affected by such global health crises, developing preventive and supportive management strategies will be crucial.
Keywords: COVID-19, non-motor symptom, Parkinson's disease.

COVID-19 Pandemisi Parkinson Hastalarının Motor Olmayan Bulgularını Nasıl Etkiledi?

ÖZET

Amaç: Çalışmanın amacı COVID-19 pandemisinin Parkinson hastalarının motor olmayan bulguları üzerindeki değişimini incelemek, değişim miktarlarını sağlıklı bireylerle karşılaştırmak ve pandemi döneminde Parkinson hastalarının koronafobi ile motor olmayan bulguları arasındaki ilişkiyi incelemekti.
Gereç ve Yöntem: Çalışmaya 53 Parkinson hastası ve 53 sağlıklı birey dahil edildi. Katılımcıların uyku kalitesi (Pittsburgh Uyku Kalitesi İndeksi), yorgunluk şiddeti (Yorgunluk Şiddet Ölçeği) ve depresif bulguları (Geriatrik Depresyon Ölçeği) pandemi dönemi ve pandemi öncesi dönem olmak üzere iki ayrı dönem için değerlendirildi. Pandemi dönemindeki koronafobiyi değerlendirmek için Koronavirüs 19 Fobisi Ölçeği kullanıldı.
Bulgular: Pandemi öncesi dönemle karşılaştırıldığında pandemi döneminde hastaların motor olmayan semptomlarını değerlendiren ölçeklerin puanlarının istatistiksel olarak anlamlı derecede arttığı belirlendi ($p<0,05$). Sağlıklı bireylerle karşılaştırıldığında, hastaların Yorgunluk Şiddet Ölçeği puanındaki değişimin istatistiksel olarak anlamlı derecede daha yüksek olduğu bulundu (p=0,027). Pandemi sırasında hastaların Koronavirüs 19 Fobisi Ölçeği ile Geriatrik Depresyon Ölçeği puanları arasında pozitif yönde zayıf düzeyde bir korelasyon saptandı (rho=0,357, p=0,009).
Sonuç: COVID-19 pandemisi sırasında Parkinson hastalarının uyku kalitesi bozulmuş, yorgunluk şiddeti ve depresif bulguları artmıştır. Ayrıca pandemi döneminde yorgunluk şiddetindeki değişimin sağlıklı bireylere kıyasla daha belirgin olduğu görülmüştür. Hastaların artmış koronafobi düzeyi kötüleşen depresif bulgularla ilişkilidir. Parkinson hastalarının motor olmayan bulguları bu tür küresel sağlık krizlerinden olumsuz etkilenebileceğinden önleyici ve destekleyici yönetim stratejilerinin geliştirilmesi önemli olacaktır.
Anahtar Kelimeler: COVID-19, motor olmayan bulgu, Parkinson hastalığı.

1. Introduction

Numerous pandemics resulted in the deaths of millions of people, have been throughout human history. One of the existing pandemics is coronavirus disease 2019 (COVID-19) pandemic, caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (1,2). The COVID-19, emerging as an outbreak of pneumonia of unknown cause in December 2019 in Wuhan City, the capital of Hubei Province in China, rapidly spread to other countries due to its high contagiousness and was declared as a pandemic by the World Health Organization (WHO) on March 11, 2020 (3–5). The symptoms of the disease range from asymptomatic cases to severe conditions requiring intensive support (1).

Geliş Tarihi/Received: 07.04.2025, Kabul Tarihi/Accepted: 09.07.2025

Corresponding Author
Aybüke Cansu Kalkan, Izmir Katip Celebi University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Izmir, Türkiye.
E-mail: acansukalkan@hotmail.com ORCID: 0000-0003-1329-7870
The article has not been presented at any scientific event.

According to the latest data presented by the WHO on March 2, 2025, the disease has infected more than 777 million people worldwide, with over 6.5 million of these infections resulted in death (6). These numbers reveal the severity of the pandemic.

The COVID-19 pandemic had negative effects on healthcare systems and the global economy, particularly affecting the lives of people infected by the virus (7). Undoubtedly, one of the most significant effects of the pandemic has been on individuals with chronic diseases. Chronic diseases, which are the most important cause of disability worldwide, are associated with increased use of healthcare services and worsening health conditions. The management of chronic diseases is not only complex, but has also become more challenging due to the restrictions imposed during the pandemic (8). To control the COVID-19 pandemic, the healthcare workforce was redirected to manage the outbreak, limiting outpatient services. The restricted healthcare resources, along with reduced access to tests and routine examination, negatively affected clinical decision-making (8,9).

Individuals with neurological diseases such as Parkinson's disease (PD) also suffer from the challenges experienced by the chronic patients. Although the available evidence is still insufficient, the fact that most patients with PD are elderly and those in advanced stages have an increased risk of pneumonia suggests that they pose a risk for deteriorating health status after COVID-19 infection. Apart from the direct effects of the infection, the social restrictions implemented to control the pandemic have caused radical changes in patients' lives. A sudden and drastic disruption of daily routines requires flexible adaptation to changing conditions, which depends on a healthy dopaminergic system (7). In the pathogenesis of PD, the loss of dopaminergic neurons in the substantia nigra pars compacta plays a critical role (10). Dopamine depletion due to nigrostriatal neurodegeneration reduces cognitive and motor flexibility. It is though that this situation may increase psychological stress by causing a sense of loss of control. In this context, the pathophysiology of PD may pose a risk of chronic stress for patients. Additionally, the heightened stress levels during the COVID-19 pandemic may have had both short- and long-term negative effects on these patients (7).

According to prevalence estimates, it affects approximately 10 million people worldwide causing both motor and non-motor symptoms (10). Motor symptoms, which are among the initial complaints of most patients, play a crucial role in the diagnosis and assessment of the disease and generally respond well to pharmacological treatment (11). Non-motor symptoms usually begin to appear before motor symptoms emerge and frequently accompany the clinical picture from the early stages of the disease (12). In the early stages of the disease, including the period before initiating pharmacological treatment, non-motor symptoms have a greater impact on health-related quality of life than motor symptoms (13). Recently, the importance of non-motor symptoms in the diagnosis and management of the disease has been increasingly recognized (12).

Among the common non-motor symptoms of PD are sleep disorders, fatigue, and behavioral changes, including depression and anxiety (12). Studies examining these symptoms in patients during the COVID-19 pandemic are available, but the research results are heterogeneous. Additionally, these studies have certain limitations, such as the lack of disease duration and clinical data related to the disease, the absence of pre-pandemic data, or the lack of a control group in the research design. During the pandemic, it has been determined that patients' perception of stress and anxiety levels were high (14). However, no studies have been found in the literature examining the relationship between coronaphobia, defined as persistent and excessive fear of the coronavirus, and disease symptoms in PD.

Although the acute effects of the pandemic have subsided, the long-term psychosocial impacts of COVID-19, particularly on ulnerable groups, remain significant. In this context, understanding the changes in non-motor symptoms experienced by patients with PD during the pandemic and identifying the potential effects of coronaphobia on these symptoms are not only important for retrospectively assessing the situation but also for developing more effective support strategies for vulnerable patient groups in managing similar global crises in the future.

In the light of this information, the first objective of the study was to determine how the COVID-19 pandemic affected the non-motor symptoms of patients with PD by comparing sleep quality, fatigue severity, and depressive symptoms during the pandemic with pre-pandemic findings. The second objective was to compare the changes in sleep quality, fatigue severity, and depressive symptoms between patients and healthy individuals from the pre-pandemic to the pandemic period. The third objective was to investigate the relationship between coronaphobia and non-motor symptoms in patients with PD during the pandemic period.

2. Material and Method

2.1. Study Design

The study, designed as a cross-sectional research, was conducted at Dokuz Eylul University, Faculty of Physical Therapy and Rehabilitation, and Dokuz Eylul University, Faculty of Medicine, Department of Neurology. The research data were collected between February 2022 and April 2023.

2.2. Participants

The study sample consisted of patients diagnosed with PD who were in routine follow-up at the Movement Disorders Outpatient Clinic at Dokuz Eylül University Hospital and healthy controls selected from among their spouses or caregivers. Since no prior studies existed on this topic, a complete enumeration method was used to determine the sample size. In the selection of the sample of patients, 53 cases from 106 patient files were included in the study using a systematic sample selection method in which patient files were stacked on top of each other and the first file was excluded, the second file was included, and the third file was excluded, respectively. An equal number of healthy individuals were included in the study (n=53). In the post-data analysis, using the patients' Fatigue Severity Scale scores from pre-pandemic and pandemic periods as reference values, the effect size was calculated as 0.68. In the post hoc power analysis (two-tailed, effect size=0.68, α=0.05), statistical power was found to be 99%.

The inclusion criteria for patients with PD were: being 40 years or older, having received a diagnosis of idiopathic PD by a neurologist according to the UK Parkinson's Disease Society Brain Bank clinical diagnostic criteria (15), having < Modified Hoehn and Yahr stage 5 (16), and volunteering to participate in the study. Exclusion criteria for patients with PD were: being infected with COVID-19 during the assessment, having a neurological disease other than PD, presence of severe mental or cognitive dysfunction that could affect verbal communication skills, and having medical problems that could affect physical activity levels (such as pulmonary diseases, cardiac diseases, or musculoskeletal problems).

The inclusion criteria for healthy individuals were: being aged 40 years or older and volunteering to participate in the study. The exclusion criteria for healthy individuals were: being infected with COVID-19 during the assessment, having an additional neurological disease (e.g., cerebrovascular diseases, demyelinating disorders, movement disorders, dementia, or neuromuscular diseases), using medications for insomnia, anxiety, or depression a year before the pandemic, having

medical problems that could affect physical activity levels (such as pulmonary diseases, cardiac diseases, or musculoskeletal problems) and being a healthcare worker.

2.3. Data Collection

The clinical data of patients with PD were assessed by a neurologist during the 'on' period, approximately 1-1.5 hours after medication intake. Other evaluations were conducted face-to-face by a physiotherapist during interviews. To determine changes during the COVID-19 pandemic, participants were asked to complete questionnaires for two separate time periods: (1) at the time of the assessment and (2) retrospectively for one month before the first COVID-19 case was reported in Turkey (February 2020). Data were recorded separately for the pre-pandemic and pandemic periods.

2.3.1. Assessment of Sociodemographic and Clinical Characteristics

Sex, age, height, and body weight of all participants were recorded, and the body mass index was calculated. Additionally, education level, marital status, and occupation were questioned. In addition, patients' the date of PD diagnosis was recorded to determine disease duration, and the total levodopa equivalent daily dose (LEDD) was calculated (17).

The modified Hoehn & Yahr Scale (mHYS) was used to assess disease severity. The mHYS consists of seven stages ranging from stage 1.0 (unilateral involvement only) to stage 5.0 (wheelchair- or bed-bound without assistance) (16).

Disease-related disability was evaluated using the Unified Parkinson's Disease Rating Scale (UPDRS). This scale consists of a total of 42 questions, divided into four sections: Part I assesses mentation, behavior, and mood; Part II evaluates activities of daily living; Part III measures motor examination and Part IV assesses disease complications. Higher total scores indicate greater disease-related disability (18).

2.3.2. Assessment of Non-Motor Symptoms

The sleep quality of the participants was assessed using the Pittsburgh Sleep Quality Index (PSQI). The PSQI was developed by Buysse et al. (19), and was showed the validity and reliability of Turkish version of the scale by Ağargün et al. (20). It consists of a total of 24 questions: 19 self-rated items that comprehensively evaluate sleep duration, sleep latency, and the severity and frequency of specific sleep-related problems, as well as 5 additional questions to be answered by the participant's bed partner or roommate, which are not included in the scoring but provide clinical insight. The 19 scored questions are categorized into seven components included subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. Each component is scored on a scale of 0–3, and the total PSQI score ranges from 0 to 21. A higher total score indicates poorer sleep quality (20).

The Fatigue Severity Scale (FSS), developed by Krupp et al., (21) was used to assess the severity of fatigue in participants. Öztürk et al. (22) demonstrated the validity and reliability of the Turkish version of the FSS for patients with PD. It is a self-assessment scale consisting of nine items, each rated on a 7-point Likert scale ranging from "1: completely disagree " to "7: completely agree." The total FSS score, calculated by dividing the sum of all item scores by the number of items, ranges from 1 to 7. A higher total score indicates more severe fatigue (22).

The depressive symptoms of participants were assessed using the Geriatric Depression Scale (GDS). The GDS was developed by Yesavage and Brink (23), and was showed the validity and reliability of Turkish version of the scale for patients with PD by Ertan et al. (24). The GDS is a self-report scale consisting of 30 items answered as "Yes/No." The total score ranges from 0 to 30. A higher total score indicates more severe depressive symptoms (24).

2.3.3. Assessment of Coronaphobia

COVID-19 Phobia Scale (C19P-S) was used to assess coronaphobia. The C19P-S was developed and demonstrated the validity and reliability by Arpacı et al. (25). The C19P-S is a self-report scale consisting of four subscales: psychological, psychosomatic, economic, and social. It includes 20 items, each rated on a 5-point Likert scale ranging from "1: strongly disagree" to "5: strongly agree". The total C19P-S score ranges from 20 to 100, with higher scores indicating greater coronaphobia (25).

2.4. Statistical Analysis

The data were analyzed using IBM SPSS software (version 26.0, IBM Corp.). The normality of data distribution was assessed using the Kolmogorov-Smirnov test and histogram plots. The variables were found to be non-normally distributed. Sociodemographic and clinical characteristics were presented as median and interquartile range (IQR) for continuous variables and as percentages and frequencies for categorical variables. Sociodemographic characteristics of patients with PD and healthy controls before the COVID-19 pandemic were compared using the Mann-Whitney U test for ordinal variables and the chi-square test for nominal variables. Non-motor symptoms of patients with PD were compared during COVID-19 period with pre-pandemic period using the Wilcoxon signed-rank test. Due to significant differences between patients with PD and the healthy control group in terms of age and sex, the Quade test (a nonparametric equivalent of analysis of covariance, ANCOVA) was used for the between-group comparison of changes in sleep quality, fatigue severity, and depressive symptoms between the pre-pandemic and pandemic periods, as the parametric assumptions and homogeneity of variance were not met. In the Quade test, the changes in sleep quality, fatigue severity, and depressive symptoms were entered as dependent variables, while age and sex were included as independent variables to control for their potential confounding effects, and linear regression analysis was performed. The relationship between coronaphobia and non-motor symptoms was investigated using Spearman's correlation analysis. Correlation coefficients were interpreted as follows: <0.10 as "negligible," 0.10-0.39 as "weak," 0.40-0.69 as "moderate," 0.70-0.89 as "strong," and ≥0.90 as "very strong" (26).

2.5. Ethical Aspects of the Research

This research was conducted in accordance with the principles of the Declaration of Helsinki. The study was approved by the Non-Invasive Research Ethics Board of Dokuz Eylul University on October 13, 2021 (Protocol No: 6637-GOA, Decision No: 2021/28-12). Additionally, as this was a study planned during the COVID-19 pandemic, the necessary permission for conducting the research was approved by the Scientific Research Commission on COVID-19 of the Turkish Ministry of Health on August 21, 2021.

3. Results

Fifty-three patients with PD and fifty-three healthy individuals were included in the study. The sociodemographic and clinical characteristics of the participants were presented in Table 1. Compared to healthy individuals, the median age of patients with PD was found to be higher ($p<0.001$). While the majority of the patient group were male (62.3%), the majority of the healthy group were female (64.2%) ($p=0.007$). The employment rate of patients with PD was found to be lower compared to healthy individuals ($p=0.002$).

The comparison of patients' non-motor symptoms during COVID-19 period with pre-pandemic period was presented in Table 2. Compared to the pre-pandemic period, PSQI, FSS, and GDS scores were determined to have increased significantly during the pandemic period ($p<0.05$).

After controlling for age and sex as covariates using the Quade test, no statistically significant differences were found between patients with PD and healthy controls in the changes in sleep quality ($\chi^2 = 0.01$, df = 1, $p = 0.912$), fatigue severity ($\chi^2 = 3.08$, df = 1, $p = 0.079$), and depressive symptoms ($\chi^2 = 0.15$, df = 1, $p = 0.698$) between the pre-pandemic and pandemic periods.

The relationships between coronaphobia and sleep quality, fatigue severity, and depressive symptoms were presented in Figures 1, 2, and 3, respectively. A weak positive correlation was found between the C19P-S and GDS (rho=0.357, p=0.009). No statistically significant correlation was detected between coronaphobia and the other variables ($p>0.05$).

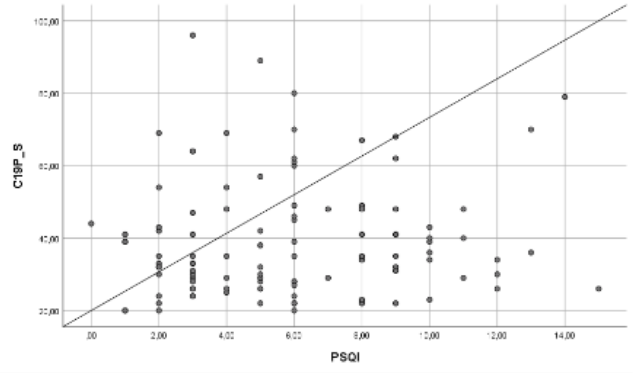

Figure 1. The relationship between coronaphobia and sleep quality in patients with PD (n=53)

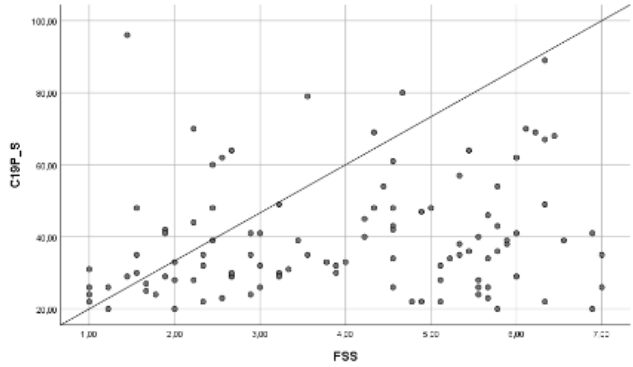

Figure 2. The relationship between coronaphobia and fatigue severity in patients with PD (n=53)

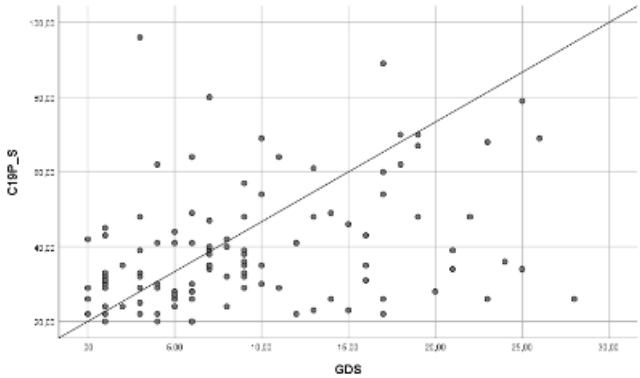

Figure 3. The relationship between coronaphobia and depressive symptoms in patients with PD (n=53)

Table 1. Sociodemographic and clinical characteristics of participants

	Patients with PD (n=53)	Healthy Individuals (n=53)	
Variables	**Median (IQR) n (%)**	**Median (IQR) n (%)**	**p**
Age (years)	69.0 (60.0-76.0)	53.0 (49.5-62.0)	<0.001[a*]
Sex			
Female	20 (37.7)	34 (64.2)	0.007[b*]
Male	33 (62.3)	19 (35.8)	
BMI (kg/m^2)	26.71 (24.99-29.55)	27.05 (24.39-29.78)	0.752[a]
Education Level			
No formal education	1 (1.9)	1 (1.9)	
Primary school graduate	19 (35.8)	12 (22.6)	
Middle school graduate	4 (7.5)	5 (9.4)	0.688[b]
High school graduate	11 (20.8)	13 (24.5)	
University graduate	18 (34.0)	22 (41.5)	
Marital Status			
Single	11 (20.8)	9 (17.0)	0.620[b]
Married	42 (79.2)	44 (83.0)	
Occupation			
Employed	9 (17.0)	29 (54.7)	0.002[b*]
Unemployed	44 (83.0)	24 (45.3)	
Disease Duration (years)	7.0 (5.0-12.0)	-	-
Total LEDD (mg)	675.00 (475.00-909.62)	-	-
mHYS			
Stage 1.0	2 (3.8)		
Stage 1.5	11 (20.8)		
Stage 2.0	16 (30.2)	-	-
Stage 2.5	8 (15.1)		
Stage 3.0	15 (28.3)		
Stage 4	1 (1.9)		
UPDRS			
Part I	2.00 (1.00-4.00)		
Part II	13.00 (9.0017.50)		
Part III	31.00 (25.00-43.00)	-	-
Part IV	3.00 (1.00-5.00)		
Total	50.00 (38.50-61.00)		

*p<0.05, **a:** Mann-Whitney U test, **b:** Chi-square test, **IQR**: Interquartile range, **n:** frequency, **%:** percentage, **kg:** kilogram, **m:** meter, **mg:** miligram, **mHYS:** modified Hoehn & Yahr Scale, **UPDRS:** Unified Parkinson's Disease Rating Scale.

4. Discussion

In our study, the changes in non-motor symptoms of patients with PD during the COVID-19 pandemic compared to the pre-pandemic period were examined, and these changes was compared with healthy individuals. Additionally, the relationship between coronaphobia and patients' non-motor symptoms in during the pandemic was investigated. The results revealed that compared to the pre-pandemic period, patients with PD have experienced worsened sleep quality, increased fatigue severity, and more pronounced depressive symptoms during the pandemic. The change in fatigue severity from the pre-pandemic to the pandemic period has been found to be greater in patients with PD than in healthy individuals. Furthermore, a relationship between coronaphobia and depressive symptoms has been identified during the COVID-19 pandemic.

Table 2. Comparison of non-motor symptoms in patients with PD during pandemic and pre-pandemic periods (n=53)

	Pre-Pandemic Period	Pandemic Period	
Non-Motor Symptoms	**Median (IQR)**	**Median (IQR)**	**p[a]**
PSQI	5.00 (3.00-8.00)	6.00 (3.00-9.00)	0.024*
FSS	2.89 (2.00-4.55)	4.55 (2.78-5.89)	<0.001*
GDS	4.00 (2.00-9.00)	7.00 (4.50-13.50)	<0.001*

***p<0.05, **a:** Wilcoxon signed-rank test, **IQR:** Interquartile range, **PSQI:** Pittsburgh Sleep Quality Index, **FSS:** Fatigue Severity Scale, **GDS:** Geriatric Depression Scale.

Current evidence supports the view that non-motor symptoms have a determining effect on the diagnosis and management process of PD (12). One of the most common non-motor symptoms is sleep disturbance. While sleep disorders may appear negligible compared to more severe motor symptoms, recent estimates indicate that approximately 98% of patients exhibit sleep-related symptoms (27). Given sleep's crucial role in regulating both physical and psychological functions, sleep disturbances can negatively impact health by impairing existing functions. In addition to the uncertainty and fear brought by the COVID-19 pandemic, isolation measures have further exacerbated sleep disorders, adversely affecting mental health (28). Kumar et al. (29) reported that 35.4% of patients with PD under home isolation due to the pandemic experienced sleep disturbances, while 23.9% developed new or worsening sleep disorders. Their study indicated that sleep disturbances were more common among patients lacking adequate family support, those isolated for over 60 days, and those with disease durations exceeding 7 years. Xia et al. (30) reported that 68.9% of patients with Parkinson's disease had sleep disturbances during the pandemic, which was significantly higher than the 44.4% observed in healthy controls. Additionally, the study highlighted associations between sleep disorders and symptom exacerbation as well as anxiety in patients. Desai et al. (31) found sleep disorder prevalence rates of 28% in healthy individuals versus 88% in patients with PD during the pandemic, with a significant correlation between depressive symptoms and sleep disturbances. Our research reported that while sleep quality significantly deteriorated during the pandemic compared to the pre-pandemic period, he changes in sleep quality were similar between patients and healthy controls. The restriction of routine medical services may trigger concerns about the disease progression, leading to negative effects on their mood. These factors may account for the observed deterioration in patients' sleep quality. The current uncertainty, the fear of infection, and adverse conditions such as prolonged isolation affect not only patients but also healthy individuals may have caused to similar changes in sleep quality for both groups. Furthermore, our study found no correlation between coronaphobia and sleep quality in patients. The survey questions used to assess coronaphobia largely focused on the fear of infection and uncertainty during the pandemic. However, patients' concerns about disease progression due to restricted healthcare services may have been more prominent than these factors. Additionally, in our study, the PSQI, which was used to assess sleep quality and evaluates the behavioral aspects of sleep over the past month, may not be highly sensitive to acute emotional states or specific psychological constructs such as fear and anxiety. Although it is known that fear and anxiety can affect sleep, the impact may vary depending on the intensity and duration of the emotional response, as well as individual coping mechanisms.

Fatigue is one of the most common non-motor symptoms in PD that significantly affects daily living activities. It can appear at any stage of the disease, it typically persists and worsens over time, impacting patients' quality of life (32). In a pilot study by Falla et al. (33), no significant change in fatigue severity was detected among patients with PD during the lockdown measures implemented due to the COVID-19 pandemic. On the contrary, Song et al. (34) reported that 27% of patients experienced worsening non-motor symptoms including fatigue, stress, depressive symptoms, pain, and sleep disturbances during the pandemic. A multicenter study by Kumar et al. (35) found that 25.1% of patients reported increased fatigue during the pandemic. Van Der Heide et al. (36) observed that, compared to the pre-pandemic period, patients experienced a deterioration in subjectively perceived disease-related symptoms during COVID-19, with fatigue being one of the deteriorating symptoms. In this study, patients with higher pandemic-related stress levels exhibited more severe disease symptoms. In our study, it was determined that the severity of fatigue increased in patients with PD during the pandemic period. The increase in fatigue severity may have resulted from the worsening of motor symptoms during the pandemic. We found that the change in fatigue severity between the pre-pandemic and pandemic periods was similar in both patients and healthy individuals. This result may be attributed to the fact that the healthy control group consisted of the patients' spouses or caregivers. These individuals may also have been affected by increased caregiving responsibilities, isolation, and stress during the pandemic. Additionally, considering that the pandemic widely increased fatigue across the general population, the lack of a statistically significant difference between the two groups is understandable. Interestingly, our study found no correlation between coronaphobia and fatigue severity. Although fatigue has been reported to be largely independent of self-reported depressive symptoms (21), increased fear and stress have been shown to be more closely associated with mental fatigue rather than physical fatigue (37). Since the FSS used in our study primarily assesses physical fatigue, this may explain the observed result.

Depression, a common psychiatric comorbidity in PD, adversely affects both motor and social functioning, leading to decreased quality of life and increased caregiver burden (38). Montanaro et al. (39) assessed advanced-stage patients with PD and their caregivers during and after the pandemic-imposed isolation period. During the isolation period, depression was observed in 35% of patients and anxiety in 39%, while a decrease in anxiety was detected after the isolation. In this study, depression was reported in 21.7% of caregivers and anxiety in 40%. Shalash et al. (40) found that patients experienced greater worsening of depression, anxiety and stress symptoms compared to healthy individuals during the COVID-19 pandemic period. Contrary to these findings, Balcı et al. (41) reported not detect depression or anxiety symptoms both patients with PD and healthy individuals during the pandemic period. Suzuki et al. (42) determined that during the pandemic, patients' presence of anxiety and depression was similar to that of their caregivers. Haas et al. (43) observed that, compared to the pre-pandemic period, patients with PD experienced an increase in anxiety, fear, and thoughts of death during the pandemic, but there was no change in depressive symptoms. Research findings examining depressive symptoms during the COVID-19 period are heterogeneous. In our study, we found that the severity of depressive symptoms in patients increased during the pandemic compared to the pre-pandemic period. However, no significant difference was observed between patients and healthy individuals in terms of changes in depressive symptoms relative to the pre-pandemic baseline. The pandemic brought numerous challenges, including infection risk, disruptions in healthcare services, and consequent worsening of disease symptoms. We believe these pandemic-related difficulties contributed to the exacerbation of depressive symptoms in patients compared to the pre-pandemic period. A greater increase in depressive symptoms might have been expected in individuals with PD during the pandemic due to their vulnerability; however, our findings did not reveal a statistically significant difference compared to healthy controls. One possible explanation for this could be the composition of the control group, which included patients' spouses or caregivers.

These individuals may have shared similar stressors during the pandemic, such as increased caregiving responsibilities, social isolation, and uncertainty. Additionally, the current finding may be explained by the possibility that patients and healthy individuals had similar levels of depressive symptoms before the pandemic. Our finding of a positive correlation between coronaphobia levels and depressive symptoms in patients with PD during the pandemic was not surprising given these contextual factors. Although coronaphobia represents a specific and situational fear, depression reflects a broader and more persistent emotional state. The weak strength of the correlation between these two variables suggests that while coronaphobia may contribute to emotional distress, it does not necessarily lead to clinical depression in every case. Additionally, individual differences such as resilience, coping strategies, and social support may have influenced the observed relationship.

Our study is particularly valuable as it provides both face-to-face, detailed evaluations of non-motor symptoms in patients during the pandemic and presents comprehensive clinical data. Additionally, it contributes to the literature as the first study to examine the relationship between coronaphobia and non-motor symptoms in patients with PD. However, our study has some limitations. The first limitation is that the healthy individuals compared with patients did not have similar age and sex characteristics. Although age and sex differences were controlled for in the analyses, residual confounding effects related to these variables cannot be entirely excluded. The second limitation is that, despite achieving a sample size appropriate for power analysis, the study was conducted in a single center, which restricts the generalizability of the results. The final limitation is that the questionnaires were answered retrospectively to assess the pre-pandemic period, which may have led to recall bias, potentially affecting the objectivity of the results.

5. Conclusion and Recommendations

During the COVID-19 pandemic, patients with PD experienced a decline in sleep quality, increased fatigue severity, and worsened depressive symptoms. Additionally, the changes in these non-motor symptoms during the pandemic were similar between patients and healthy individuals. Increased coronaphobia was also associated with aggravated depressive symptoms in patients. This study provides crucial insights into the impact of the COVID-19 pandemic on patients with PD and highlights potential risks during similar health crises in the future.

Although the COVID-19 pandemic has ended, it should be remembered that patients' non-motor symptoms may be negatively affected by future global health crises, such as potential pandemics. In particular, situations that increase stress levels, fear and anxiety such as pandemics, should be considered as factors that may worsen depressive symptoms.

Therefore, it is crucial to develop preventive and supportive management strategies to minimize the impact of pandemics on vulnerable populations like patients with PD. It is recommended that the strategies include strengthening psychosocial support services, ensuring uninterrupted regular follow-ups, and implementing interventions to manage patients' pandemic-related fears and anxieties should be implemented.

6. Contribution to the Field

This study provides critical insights into the impact of the COVID-19 pandemic on patients with PD and increases awareness about potential risks that may emerge during similar future health crises.

Acknowledgements

The authors sincerely thank all participating patients with PD and healthy controls for their contribution to this study.

Conflict of Interest

There is no conflict of interest with any person and/or institution.

Authorship Contribution

Concept: ACK, CT, TK, AG, BDÇ; Design: ACK, CT, TK, AG, BDÇ; Supervision: TK, AG, BDÇ; Funding: ACK, CT, TK, AG, BDÇ; Materials: AG, BDÇ; Data Collection/Processing: CT, BDÇ; Analysis/Interpretation: ACK, CT; Literature Review: ACK, CT; Manuscript Writing: ACK, TK, AG; Critical Review: TK, AG, BDÇ.

Funding

No budget support was received for the research.

References

1. Struyf T, Deeks JJ, Dinnes J, Takwoingi Y, Davenport C, Leeflang MM, et al. Signs and symptoms to determine if a patient presenting in primary care or hospital outpatient settings has COVID-19 disease. Cochrane Database Syst Rev. 2020;7(7):CD013665. DOI: 10.1002/14651858.CD013665.
2. Akin L, Gözel MG. Understanding dynamics of pandemics. Turk J Med Sci. 2020;50(SI-1):515-9. DOI: 10.3906/sag-2004-133.
3. Ciotti M, Ciccozzi M, Terrinoni A, Jiang WC, Wang CB, Bernardini S. The COVID-19 pandemic. Crit Rev Clin Lab Sci. 2020;57(6):365-88. DOI: 10.1080/10408363.2020.1783198.
4. Liu M, Choo WC, Lee CC. The Response of the Stock Market to the Announcement of Global Pandemic. Emerg Mark Financ Tr. 2020;56(15):3562-77. DOI: 10.1080/1540496X.2020.1850441.
5. Cucinotta D, Vanelli M. WHO Declares COVID-19 a Pandemic. Acta Biomed. 2020;91(1):157-60. DOI: 10.23750/abm.v91i1.9397.
6. who.int [Internet]. Geneva: World Health Organization; 2025 [cited 2025 Mar 2]. Available from: https://data.who.int/dashboards/covid19/cases.
7. Helmich RC, Bloem BR. The Impact of the COVID-19 Pandemic on Parkinson's Disease: Hidden Sorrows and Emerging Opportunities. J Parkinsons Dis. 2020;10(2):351-4. DOI: 10.3233/JPD-202038.
8. Kendzerska T, Zhu DT, Gershon AS, Edwards JD, Peixoto C, Robillard R, et al. The effects of the health system response to the COVID-19 pandemic on chronic disease management: A narrative review. Risk Manag Healthc Policy. 2021;14:575–84. DOI: 10.2147/RMHP.S295376.
9. Poonja S, Chaudhuri KR, Miyasaki JM. Movement disorders in COVID-19 times: Impact on care in movement disorders and Parkinson disease. Curr Opin Neurol. 2022;35(4):494-501. DOI: 10.1097/WCO.0000000000001075.
10. Church FC. Review treatment options for motor and non-motor symptoms of Parkinson's Disease. Biomolecules. 2021;11(4):612. DOI: 10.3390/biom11040612.
11. Ruiz PJG, Catalán MJ, Carril JMF. Initial motor symptoms of Parkinson disease. Neurologist. 2011;17:18-20. DOI: 10.1097/NRL.0b013e31823966b4.
12. Pfeiffer RF. Non-motor symptoms in Parkinson's disease. Parkinsonism Relat Disord. 2016;22:119–22. DOI: 10.1016/j.parkreldis.2015.09.004.
13. Müller B, Assmus J, Herlofson K, Larsen JP, Tysnes OB. Importance of motor vs. non-motor symptoms for health-related quality of life in early Parkinson's disease. Parkinsonism Relat Disord. 2013;19:1027–32. DOI: 10.1016/j.parkreldis.2013.07.010.
14. Mameli F, Zirone E, Capetti B, Mellace D, Ferrucci R, Franco G, et al. Changes in non-motor symptoms in patients with Parkinson's disease following COVID-19 pandemic restrictions: A systematic review. Front Psychol. 2022;13:939520. DOI: 10.3389/fpsyg.2022.939520.
15. Hughes AJ, Daniel SE, Kilford L, Lees AJ. Accuracy of clinical diagnosis of idiopathic Parkinson's disease: A clinico-pathological study of 100 cases. J Neurol Neurosurg Psychiatry. 1992;55(3):181–4. DOI: 10.1136/jnnp.55.3.181.

16. Goetz CG, Poewe W, Rascol O, Sampaio C, Stebbins GT, Counsell C, et al. Movement Disorder Society Task Force report on the Hoehn and Yahr staging scale: Status and recommendations. Mov Disord. 2004;19(9):1020–8. DOI: 10.1002/mds.20213.

17. Schade S, Mollenhauer B, Trenkwalder C. Levodopa Equivalent Dose Conversion Factors: An Updated Proposal Including Opicapone and Safinamide. Mov Disord Clin Pract. 2020;7(3):343-5. DOI: 10.1002/mdc3.12921.

18. Schrag A, Sampaio C, Counsell N, Poewe W. Minimal clinically important change on the Unified Parkinson's Disease Rating Scale. Mov Disord. 2006;21(8):1200-7. DOI: 10.1002/mds.20914.

19. Buysse D, Reynolds III C, Monk T, Berman S, Kupfer D. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. Psychiatry Res. 1989;28(2): 193-213. DOI: 10.1016/0165-1781(89)90047-4.

20. Ağargün M, Kara H, Anlar Ö. The Validity and Reliability of the Pittsburgh Sleep Quality Index. Türk Psikiyatr Derg. 1996;7:107–15.

21. Krupp L, LaRocca N, Muir-Nash J, Steinberg A. The Fatigue Severity Scale: application to patients with multiple sclerosis and systemic lupus erythematosus. Arch Neurol. 1989;46(10):1121-3. DOI: 10.1001/archneur.1989.00520460115022.

22. Ozturk EA, Kocer BG, Gundogdu I, Umay E, Cakci FA. Reliability and validity study of a Turkish version of the fatigue severity scale in Parkinson's disease patients. Int J Rehabil Res. 2017;40(2):185-90. DOI: 10.1097/MRR.0000000000000224.

23. Yesavage JA, Brink TL, Rose TL, Lum O, Huang V, Adey M, et al. Development and validation of a geriatric depression screening scale: a preliminary report. J Psychiatr Res. 1982;17(1):37-49. DOI: 10.1016/0022-3956(82)90033-4.

24. Ertan FS, Ertan T, Kiziltan G, Uyguçgil H. Reliability and validity of the Geriatric Depression Scale in depression in Parkinson's disease. J Neurol Neurosurg Psychiatry. 2005;76(10):1445-7. DOI: 10.1136/jnnp.2004.057984.

25. Arpaci I, Karataş K, Baloğlu M. The development and initial tests for the psychometric properties of the COVID-19 Phobia Scale (C19P-S). Pers Individ Dif. 2020;164:110108. DOI: 10.1016/j.paid.2020.110108.

26. Schober P, Boer C, Schwarte LA. Correlation Coefficients: Appropriate Use and Interpretation. Anesth Analg. 2018 May;126(5):1763-8. DOI: 10.1213/ANE.0000000000002864.

27. Albers JA, Chand P, Anch AM. Multifactorial sleep disturbance in Parkinson's disease. Sleep Med. 2017;35:41-8. DOI: 10.1016/j.sleep.2017.03.026.

28. Lin YN, Liu ZR, Li SQ, Li CX, Zhang L, Li N, et al. Burden of Sleep Disturbance During COVID-19 Pandemic: A Systematic Review. Nat Sci Sleep. 2021;13:933-66. DOI: 10.2147/NSS.S312037.

29. Kumar N, Gupta R, Kumar H, Mehta S, Rajan R, Kumar D, et al. Impact of home confinement during COVID-19 pandemic on sleep parameters in Parkinson's disease. Sleep Med. 2021;77:15–22. DOI: 10.1016/j.sleep.2020.11.021.

30. Xia Y, Kou L, Zhang G, Han C, Hu J, Wan F, et al. Investigation on sleep and mental health of patients with Parkinson's disease during the Coronavirus disease 2019 pandemic. Sleep Med. 2020;75:428–33. DOI: 10.1016/j.sleep.2020.09.011.

31. Desai I, Gupta R, Kumar M, Tiwari A, Kumar N. Sleep Disorders in Patients with Parkinson's Disease during COVID-19 Pandemic: A Case–Control Study. Ann Indian Acad Neurol. 2022;25(3):394-400. DOI: 10.4103/aian.aian_255_22.

32. Herlofson K, Kluger BM. Fatigue in Parkinson's disease. J Neurol Sci. 2017;374:38-41. DOI: 10.1016/j.jns.2016.12.061.

33. Falla M, Dodich A, Papagno C, Gober A, Narduzzi P, Pierotti E, et al. Lockdown effects on Parkinson's disease during COVID-19 pandemic: a pilot study. Acta Neurol Belg. 2021;121:1191–8. DOI: 10.1007/s13760-021-01732-z.

34. Song J, Ahn JH, Choi I, Mun JK, Cho JW, Youn J. The changes of exercise pattern and clinical symptoms in patients with Parkinson's disease in the era of COVID-19 pandemic. Parkinsonism Relat Disord. 2020;80:148–51. DOI: 10.1016/j.parkreldis.2020.09.034.

35. Kumar N, Gupta R, Kumar H, Mehta S, Rajan R, Kumar D, et al. Impact of home confinement during COVID-19 pandemic on Parkinson's disease. Parkinsonism Relat Disord. 2020;80:32-4. DOI: 10.1016/j.parkreldis.2020.09.003.

36. Van Der Heide A, Meinders MJ, Bloem BR, Helmich RC. The Impact of the COVID-19 Pandemic on Psychological Distress, Physical Activity, and Symptom Severity in Parkinson's Disease. J Parkinsons Dis. 2020;10(4):1355-64. DOI: 10.3233/JPD-202251.

37. Li SH, Lloyd AR, Graham BM. Physical and mental fatigue across the menstrual cycle in women with and without generalised anxiety disorder. Horm Behav. 2020;118:104667. DOI: 10.1016/j.yhbeh.2019.104667.

38. Ray S, Agarwal P. Depression and Anxiety in Parkinson Disease. Clin Geriatr Med. 2020;36(1):93-104. DOI: 10.1016/j.cger.2019.09.012.

39. Montanaro E, Artusi CA, Rosano C, Boschetto C, Imbalzano G, Romagnolo A, et al. Anxiety, depression, and worries in advanced Parkinson disease during COVID-19 pandemic. Neurol Sci. 2022;43(1):341-8. DOI: 10.1007/s10072-021-05286-z.

40. Shalash A, Roushdy T, Essam M, Fathy M, Dawood NL, Abushady EM, et al. Mental Health, Physical Activity, and Quality of Life in Parkinson's Disease During COVID-19 Pandemic. Mov Disord. 2020;35(7):1097–9. DOI: 10.1002/mds.28134.

41. Balci B, Aktar B, Buran S, Tas M, Donmez Colakoglu B. Impact of the COVID-19 pandemic on physical activity, anxiety, and depression in patients with Parkinson's disease. Int J Rehabil Res. 2021;44(2):173–6. DOI: 10.1097/MRR.0000000000000460.

42. Suzuki K, Numao A, Komagamine T, Haruyama Y, Kawasaki A, Funakoshi K, et al. Impact of the COVID-19 Pandemic on the Quality of Life of Patients with Parkinson's Disease and Their Caregivers: A Single-Center Survey in Tochigi Prefecture. J Parkinsons Dis. 2021;11(3):1047-56. DOI: 10.3233/JPD-212560.

43. Haas AN, Passos-Monteiro E, Delabary MDS, Moratelli J, Schuch FB, Corrêa CL, et al. Association between mental health and physical activity levels in people with Parkinson's disease during the COVID-19 pandemic: an observational cross-sectional survey in Brazil. Sport Sci Health. 2022;18:871–7. DOI: 10.1007/s11332-021-00868-y.