NEU PRESS

SELCUK MEDICAL JOURNAL
SELÇUK TIP DERGİSİ

DOI:http:/dx.doi.org/10.30733/std.2026.01911
Selcuk Med J 2026;42(2): 144-150

OPEN

RESEARCH ARTICLE

Association Between Sleep Problems and Quality of Life in Idiopathic Parkinson's Disease: Findings from Multiple Centers in Türkiye

İdiyopatik Parkinson Hastalığında Uyku Sorunları ve Yaşam Kalitesi Arasındaki İlişki: Türkiye'deki Çeşitli Merkezlerden Elde Edilen Bulgular

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ABSTRACT

Objective: This study investigated the prevalence of sleep disturbances and their association with sleep quality and overall well-being in Turkish patients diagnosed with idiopathic Parkinson's disease.

Materials and Methods: This collaborative cross-sectional study included a total of 451 patients with idiopathic Parkinson's disease across Türkiye. Demographic characteristics and relevant clinical information were systematically recorded. Sleep quality, health-related quality of life, and depressive symptoms were assessed using the Parkinson's Disease Sleep Scale, Parkinson's Disease Questionnaire 39, and Beck Depression Inventory, respectively.

Results: The mean age of the participants was 69.13 ± 11.27 years. According to the modified Hoehn and Yahr staging, most patients were categorized as stage 1 (24.8%), while very few had stage 5 disease (1.3%). Depressive symptoms were moderate in 30.6%, minimal in 29.9%, mild in 24.6%, and severe in 14.9% of the participants. Older age was associated with a significant decline in both sleep onset and sleep benefit scores. Longer disease duration and higher disease stage were associated with decreases in all domains of sleep quality. Depression scores were directly correlated with quality-of-life scores ($p<0.001$), indicating a strong association between increased depressive symptoms and poorer quality of life in all domains.

Conclusion: Sleep disturbances are prevalent in individuals with Parkinson's disease and have a marked adverse impact on their emotional state and daily functioning. Addressing these sleep problems may contribute to better emotional well-being and enhanced quality of life in this population.

Keywords: Parkinson's disease; sleep-wake cycle disorders; quality of life

ÖZET

Amaç: Bu çalışmada, Türkiye'de İdiyopatik Parkinson Hastalığı (İPH) olan hastalarda uyku bozukluklarının yaygınlığının araştırılması ve bu bozuklukların hastaların uyku ve yaşam kalitesini nasıl etkilediğinin belirlenmesi amaçlanmıştır.

Gereç ve Yöntemler: Türkiye'de yürütülen bu çok merkezli çalışmada, 451 IPH hastası değerlendirildi. Hastaların demografik ve klinik verileri kaydedildi. Değerlendirmeler Parkinson Hastalığı Uyku Ölçeği, Parkinson Hastalığı Anketi ve Beck Depresyon Envanteri kullanılarak yapıldı.

Bulgular: IPH tanısı olan 451 hastanın ortalama yaşı 69,13±11,27 yıldı. Modifiye Hoehn Yahr Ölçeği'ne göre en sık görülen hastalık evresi %24,8 ile evre 1 iken, en az görülen evre ise %1,3 ile evre 5 idi. Hastaların %30,6'sında orta şiddette depresyon, %29,9'unda minimal depresyon, %24,6'sında hafif depresyon, %14,9'unda ise ağır depresyon saptandı. Hasta yaşı arttıkça uyku başlangıcı ve uyku faydası puanları anlamlı derecede azaldı. Hastalık süresi ve evresi arttıkça uyku kalitesinin tüm alt parametrelerinde azalma görüldü. Yaşam kalitesi alt parametreleri ve toplam puanları arttıkça depresyon puanı da artmaktaydı. Yaşam kalitesi alt parametrelerinin tümü ile depresyon arasında güçlü pozitif korelasyon vardı ($p<0,001$).

Sonuç: Uyku bozuklukları IPH hastalarında yaygındır ve depresyon ve yaşam kalitesini büyük ölçüde olumsuz etkiler. Parkinson hastalarında uyku bozukluklarının kontrol altına alınmasıyla yaşam kalitesi artırılabilir.

Anahtar Kelimeler: Parkinson hastalığı; uyku-uyanıklık bozuklukları; yaşam kalitesi

Received: 14 November 2025 **Accepted:** 1 March 2026 **Published Online:** 17 June 2026

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Cite this article as: Akkoyun Arikan F, Canbaz Kabay S, Kisabay Ak A, Santas AS, Ergin Bakar E, Karsidag S, Cinar N, Kendirli Aslan S, Tosun Kaya H, Florentina Ates M, Cokal BG, Eren F, Apaydin H, Tulek Z, Kilicaslan K, Batum M, Surmeli R, Sahin S, Ergin N, Akdag G, Cetiner M, Cihan E, Sahbaz Pirincci C. Association Between Sleep Problems and Quality of Life in Idiopathic Parkinson's Disease: Findings from Multiple Centers in Türkiye. Selcuk Med J 2026;42(2): 144-150

Disclosure: *Author has not a financial interest in any of the products, devices, or drugs mentioned in this article. The research was not sponsored by an outside organization. Author has agreed to allow full access to the primary data and to allow the journal to review the data if requested.*

INTRODUCTION

Idiopathic Parkinson's disease (IPD) presents with the cardinal motor findings of rigidity, bradykinesia, involuntary shaking at rest (resting tremor), and impaired balance (postural instability). It ranks as the second most common neurodegenerative condition globally, after Alzheimer's disease. Pathologically, the disorder is marked by the gradual degeneration of dopaminergic neurons in the nigrostriatal pathway and the intracellular accumulation of abnormally folded protein aggregates known as Lewy bodies. Disease progression causes gradual deterioration of motor function (1). The relationship between Parkinson's disease and sleep disorders is strong and closely linked to the natural course of the disease. Aside from the hallmark motor symptoms of Parkinson's disease, early neurodegeneration affecting the brainstem, hypothalamus, and networks regulating circadian rhythm leads to sleep–wake cycle disruption. Conditions such as insomnia, rapid eye movement (REM) sleep behavior disorder, excessive daytime sleepiness, restless legs syndrome, and circadian rhythm disturbances are significantly more prevalent in this population compared to the general population. In particular, REM sleep behavior disorder (RBD) reflects early brainstem involvement of α-synuclein pathology and is therefore considered a prodromal marker of Parkinson's disease. Sleep disorders are associated with greater motor symptom severity, cognitive impairment, autonomic dysfunction, and depression, exerting an independent negative impact on patient quality of life (2).

Impaired circadian rhythm and decreased REM transition time are expected outcomes in Parkinson's disease. The decline in sleep efficiency and total sleep duration is related to an increase in respiratory and motor events. In Parkinson's disease, dystonic movements of the limbs tend to occur more frequently during nighttime sleep. Due to bradykinesia, these individuals have a limited ability to alter their sleeping posture, resulting in greater discomfort and involuntary dystonic activity that may exacerbate motor symptoms (3,4). Sleep patterns are further disturbed by alterations in dopaminergic, serotonergic, and noradrenergic transmission. It is believed that this condition may lead to an increase in cataplexy-like attacks due to heightened daytime sleepiness, potentially exacerbated by high doses of non-ergot dopamine agonists, although evidence remains insufficient. The use of dopamine agonists such as L-Dopa/carbidopa may cause the sudden onset of sleep during the day (4). Given the chronic and progressive course of Parkinson's disease, which often extends beyond 15 years, sustaining an optimal quality of life in affected individuals is essential (5). This requires effective management of motor symptoms as well as non-motor symptoms such as sleep disturbances, autonomic dysfunction, anxiety, depression, and fatigue (6).

Although there are no definitive data concerning the prevalence of IPD in Türkiye, the global prevalence is reported to be approximately 14.2/100,000 individuals. In addition, IPD is more common in men and its incidence increases with age (7). Given its prevalence in the general population, recognizing the characteristic symptoms and defining disease-related parameters are essential for guiding appropriate treatment and rehabilitation strategies. In this cross-sectional multicenter analysis conducted in Türkiye, we examined the prevalence of sleep disturbances among individuals diagnosed with idiopathic Parkinson's disease and explored their influence on both sleep quality and overall well-being.

MATERIALS AND METHODS

Participants

Recruitment and setting

This multicenter study included 451 individuals diagnosed with IPD who were under follow-up either in tertiary-level neurology outpatient clinics or in the movement disorder units of education and research hospitals across Türkiye. All participants enrolled voluntarily and provided informed consent. Demographic and clinical data, including sex, age, disease duration, Hoehn and Yahr (H&Y) stage, current medications, and relevant personal and family medical history were documented using a structured data form. Clinical outcomes were assessed using the Parkinson's Disease Sleep Scale to evaluate nocturnal sleep disturbances, the Parkinson's Disease Questionnaire (PDQ-39) to measure health-related quality of life, and the Beck Depression Inventory (BDI) to assess the severity of depressive symptoms.

Inclusion criteria

1. Age ≥ 18 years
2. Currently under follow-up for IPD at one of the participating centers
3. Provision of voluntary informed consent

Exclusion criteria

1. Diagnosis of atypical parkinsonism (Parkinson-plus syndromes) or secondary parkinsonism
2. Known diagnosis of sleep disorder
3. Engaged in shift work
4. Current use of pharmacological agents known to affect sleep regulation (e.g., tricyclic antidepressants, selective serotonin reuptake inhibitors)
5. Moderate or severe dementia according to the Clincial Dementia Rating Scale
6. Adjustments to antiparkinsonian therapy (medication or dosage) within the month preceding enrollment

Study Design

This multicenter, cross-sectional study was conducted through the collaboration of Turkish Neurological Society (TNS) Movement Disorders Working Group members employed in participating centers, under the leadership of the Turkish Neurological Society Quality of Life Working Group. Ethical approval for the study was granted by the Institutional Review Board of Kütahya University of Health Sciences (2021-04/05).

Outcome Measures

Descriptive Data Form: A structured data form was developed by the research team to document each participant's age, sex, disease duration, H&Y stage, current treatment regimen, and relevant personal or family medical history. Modified Hoehn and Yahr Scale: The H&Y scale is widely

employed to evaluate symptom severity and monitor disease progression in IPD (8). The stages are defined as follows:

- ***Stage 1:*** Cardinal symptoms (tremor, rigidity, or bradykinesia) present unilaterally
- ***Stage 1.5:*** Unilateral symptoms and axial involvement
- ***Stage 2:*** Bilateral symptoms with preserved balance; possible speech abnormalities, impaired posture, and gait abnormality
- ***Stage 2.5:*** Mild bilateral involvement with a normal pull test response
- ***Stage 3:*** More severe bilateral symptoms with impaired balance; independent in physical functioning
- ***Stage 4:*** Advanced disease; able to stand but requires assistance to function
- ***Stage 5:*** Confined to a wheelchair or bedridden

Parkinson's Disease Sleep Scale: The scale comprises 15 items designed to evaluate various aspects of sleep: overall quality of nocturnal sleep (item 1), difficulty initiating and maintaining sleep (items 2 and 3), nocturnal restlessness (items 4 and 5), nocturnal psychotic symptoms (items 6 and 7), frequency of nocturnal urination (items 8 and 9), nocturnal motor problems (items 10–13), perceived benefit from sleep and morning well-being (item 14), and daytime sleepiness (item 15). Each item is scored on a scale from 0 (very severe complaints) to 10 (no complaints), yielding a maximum total score of 150. A higher score reflects a lower frequency of sleep-related complaints and better sleep quality (9).

Parkinson's Disease Questionnaire 39: The PDQ-39 questionnaire, originally developed by Peto and colleagues in 1995, has been validated for use in Turkish populations, with its reliability well established in earlier studies (10). It is regarded as the primary instrument for measuring health-related quality of life among individuals with Parkinson's disease.

Beck Depression Inventory: The Turkish adaptation of the BDI was validated and shown to be reliable by Hisli and colleagues (11). The inventory comprises 21 multiple-choice items designed to assess the intensity of depressive symptoms. Total scores range from 0 to 63, with higher values indicating greater symptom severity.

Statistical analysis

Data analysis was performed using IBM SPSS Statistics version 20.0 (IBM Corp., Armonk, NY, USA). The normality of the data distribution was assessed through visual inspection and statistical tests. Continuous variables were expressed as mean

Table 1. Demographic and clinical data of the participants

		Mean ± SD	Median (range)
	Age (years)	69.13 ± 11.27	71 (22-93)
	Height (cm)	167.28 ± 8.68	168 (140-190)
	Weight (kg)	75.78 ± 11.58	75 (50-130)
	Disease duration (years)	5.60 ± 4.69	5 (1-35)
		n	**%**
Gender	Female	202	44.8
	Male	249	55.2
Marital status	Married	377	83.6
	Single	74	16.4
Educational level	Illiterate	40	8.9
	Literate	37	8.2
	Primary school	179	39.7
	Middle school	73	16.2
	High school	85	18.8
	University and above	37	8.2
Family history of PD	Present	451	100
	Absent	361	80
Disease stage (according to the Modified Hoehn and Yahr Scale)	Stage 1	112	24.8
	Stage 1.5	89	19.7
	Stage 2	101	22.4
	Stage 2.5	61	13.5
	Stage 3	49	10.9
	Stage 4	33	7.3
	Stage 5	6	1.3
Medication/Treatment	Apomorphine pump	1	0.2
	Deep brain stimulation	1	0.2
	Dopamine agonist	83	18
	Levodopa	393	87
	MAO-B inhibitor	23	5.1

n: number of participants, SD: standard deviation

± standard deviation or as median values with corresponding ranges. Categorical variables were presented as frequencies and percentages. Correlation analyses employed Pearson's correlation coefficient for normally distributed data and Spearman's rank correlation for non-normally distributed data. Statistical significance was defined as $p < 0.05$.

RESULTS

The study included 451 IPD patients with a mean age of 69.13 ± 11.27 years and mean disease duration of 5.60 ± 4.69 years. Only 20% of the participants reported a family history of Parkinson's disease. Based on the H&Y, the most common stage was stage 1 (24.8%), while the least common was stage 5 (1.3%). Most of the patients were primary school graduates. Pharmacological management included levodopa in 87% of patients and dopamine agonists in 18% (Table 1).

The participants' mean total sleep score was 87.22 ± 36.30, and their mean total health-related quality of life score was 16.78 ± 11.61. Depressive symptoms were classified as moderate in 30.6%, minimal in 29.9%, mild in 24.6%, and severe in 14.9% of the patients (Table 2). Older age was correlated with a decline in sleep onset and sleep benefit scores. Longer disease duration was associated with reductions in all sleep domain scores, indicating a decline in sleep quality. Higher disease stage according to the H&Y scale was also correlated with lower scores for all sleep domains (Table 3).

Patient age demonstrated a significant positive correlation with mobility, activities of daily living, and cognitive function scores ($p < 0.001$). As expected, longer disease duration and higher H&Y stage were associated with a decline in all domains of health-related quality of life ($p < 0.001$). In addition, both disease duration and H&Y disease stage were positively associated with the severity of depressive symptoms ($p < 0.001$) (Table 4). Negative correlations were observed between sleep and depression scores ($p < 0.001$), indicating that depressive symptoms tended to increase in association with reduced sleep quality (Table 5). Similarly, depression score was directly correlated with health-related quality-of-life scores (p

Table 2. Mean sleep and quality-of-life scores and classification of depressive symptom severity

		Mean ± SD	Median (range)
Sleep	Overall quality of nighttime sleep	5.91±2.71	6 (0-10)
	Onset of asleep	11.32±5.76	12 (0-20)
	Nocturnal restlessness	11.30±6.66	12 (0-20)
	Nocturnal psychosis	12.67±6.93	15 (0-20)
	Nocturia	11.98±5.73	13 (0-20)
	Motor symptoms at night	22.94±11.99	24 (0-40)
	Benefitting from sleep	5.16±3.17	5 (0-10)
	Daytime sleepiness	5.75±2.92	6 (0-10)
	Total score	87.22±36.30	89 (9-149)
Quality of life	Mobility	18.51±11.54	18 (0-40)
	Activities of daily living	10.31±6.92	11 (0-24)
	Emotional well-being	10.17±6.21	10 (0-24)
	Stigma	4.40±4.24	4 (0-16)
	Social support	2.68±2.86	2 (0-11)
	Cognition	6.21±3.61	6 (0-15)
	Communication	2.88±2.69	2 (0-11)
	Bodily discomfort	4.90±3.07	5 (0-12)
	Total score	16.78±11.61	15 (0-60)
Depression		**n**	**%**
	Minimal	135	29.9
	Mild	111	24.6
	Moderate	138	30.6
	Severe	67	14.9

n: number of participants, SD: standard deviation

Table 3. Correlation of sleep-related variables with age and clinical characteristics

		Overall quality of nocturnal sleep	Sleep onset	Nocturnal restlessness	Nocturnal psychosis	Nocturia	Motor symptoms at night	Sleep benefit	Daytime sleepiness	Total score
Age	r	-0.142**	-0.149**	-0.109*	-0.064	-0.026	-0.087	-0.147**	-0.094*	-0.107*
	p	0.002	0.002	0.021	0.174	0.586	0.064	0.002	0.046	0.023
Disease duration	r	-0.205**	-0.154**	-0.124**	-0.102*	-0.128**	-0.097*	-0.113*	-0.165**	-0.151**
	p	<0.001	0.001	0.008	0.03	0.006	0.039	0.017	<0.001	0.001
Disease stage†	r	-0.283**	-0.223**	-0.182**	-0.137**	-0.174**	-0.186**	-0.157**	-0.174**	-0.222**
	p	<0.001	<0.001	<0.001	0.004	<0.001	<0.001	0.001	<0.001	<0.001

†According to the modified Hoehn and Yahr Scale; r: correlation coefficient; *p < 0.05, **p < 0.01

Table 4. Correlation of quality-of-life variables and depression with age and clinical characteristics

		Mobility	ADL	Emotional well-being	Stigma	Social support	Cognition	Communication	Bodily discomfort	Depression
Age	r	0.245**	0.165**	0.095*	-0.038	0.017	0.198**	0.053	0.089	0.110*
	p	<0.001	<0.001	0.043	0.424	0.712	<0.001	0.263	0.059	0.019
Disease duration	r	0.355**	0.395**	0.318**	0.303**	0.185**	0.337**	0.359**	0.330**	0.328**
	p	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Disease stage*	r	0.660**	0.586**	0.403**	0.335**	0.149**	0.421**	0.444**	0.405**	0.459**
	p	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001

ADL: activities of daily living, r: correlation coefficient; *p < 0.05, **p < 0.01

Table 5. Correlation between sleep-related variables and depression

		Sleep onset	Nocturnal restlessness	Nocturnal psychosis	Nocturia	Motor symptoms at night	Sleep benefit	Daytime sleepiness	Total sleep score	Depression
Overall sleep quality	r	0.618**	0.474**	0.406**	0.340**	0.493**	0.473**	0.353**	0.614**	-0.490**
	p	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Sleep onset	r	-	0.629**	0.542**	0.504**	0.616**	0.624**	0.447**	0.782**	-0.370**
	p	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nocturnal restlessness	r	0.629**	-	0.575**	0.536**	0.758**	0.561**	0.488**	0.845**	-0.230**
	p	<0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nocturnal psychosis	r	0.542**	0.575**	-	0.606**	0.682**	0.452**	0.425**	0.794**	-0.235**
	p	<0.001	<0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nocturia	r	0.504**	0.536**	0.606**	-	0.606**	0.407**	0.392**	0.736**	-0.206**
	p	<0.001	<0.001	<0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001
Motor symptoms at night	r	0.616**	0.758**	0.682**	0.606**	-	0.597**	0.512**	0.917**	-0.225**
	p	<0.001	<0.001	<0.001	<0.001	-	<0.001	<0.001	<0.001	<0.001
Sleep benefit	r	0.624**	0.561**	0.452**	0.407**	0.597**	-	0.489**	0.698**	-0.282**
	p	<0.001	<0.001	<0.001	<0.001	<0.001	-	<0.001	<0.001	<0.001
Daytime sleepiness	r	0.447**	0.488**	0.425**	0.392**	0.512**	0.489**	-	0.608**	-0.319**
	p	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	<0.001	<0.001
Total sleep score	r	0.782**	0.845**	0.794**	0.736**	0.917**	0.698**	0.608**	-	-0.326**
	p	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	<0.001
Depression	r	-0.370**	-0.230**	-0.235**	-0.206**	-0.225**	-0.282**	-0.319**	-0.326**	-
	p	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-

r: correlation coefficient, p < 0.05

Table 6. Correlation between quality-of-life variables and depression

		Mobility	ADL	Emotional well-being	Stigma	Social support	Cognition	Communication discomfort	Bodily
Depression	r	0.667**	0.659**	0.787**	0.598**	0.391**	0.694**	0.675**	0.556**
	p	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Mobility	r	-	0.794**	0.618**	0.428**	0.254**	0.522**	0.591**	0.526**
	p	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
ADL	r	0.794**	-	0.604**	0.491**	0.253**	0.531**	0.596**	0.449**
	p	<0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Emotional well-beingr		0.618**	0.604**	-	0.606**	0.453**	0.606**	0.572**	0.538**
	p	<0.001	<0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001
Stigma	r	0.428**	0.491**	0 .606**	-	0.380**	0.492**	0.593**	0.409**
	p	<0.001	<0.001	<0.001	-	<0.001	<0.001	<0.001	<0.001
Social support	r	0.254**	0.253**	0.453**	0.380**	-	0.417**	0.351**	0.305**
	p	<0.001	<0.001	<0.001	<0.001	-	<0.001	<0.001	<0.001
Cognition	r	0.522**	0.531**	0.606**	0.492**	0.417**	-	0.619**	0.565**
	p	<0.001	<0.001	<0.001	<0.001	<0.001	-	<0.001	<0.001
Communication	r	0.591**	0.596**	0.572**	0.593**	0.351**	0.619**	-	0.446**
	p	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	<0.001
Bodily discomfort	r	0.526**	0.449**	0.538**	0.409**	0.305**	0.565**	0.446**	-
	p	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-

ADL: activities of daily living, r: correlation coefficient, p < 0.05

< 0.001), indicating that increased depressive symptoms were associated with poorer quality of life in all domains (Table 6).

DISCUSSION

This cross-sectional research evaluated sleep quality and depressive symptoms in 451 individuals with IPD from multiple clinics in Türkiye. The findings demonstrated a significant relationship between sleep-related disturbances, depressive symptoms, and health-related quality of life. We observed that most of the patients were prone to depression. Higher disease stage and longer disease duration were also associated with an increase in sleep disturbances. Additionally, the education level was generally low in our sample. Menza et al. categorized sleep disorders in Parkinson's disease under the following

headings: Insomnia, RBD, sleep apnea, vivid dreaming, excessive daytime sleepiness, and sleep attacks (12). RBD is a parasomnia common in Parkinson's disease and characterized by loss of muscle atonia during REM sleep. Multicenter studies have shown that RBD is a prodromal marker that can precede the development of overt motor symptoms in Parkinson's disease. Clinical data indicate that individuals with RBD exhibit non-motor symptoms similar to those in Parkinson's disease, leading to a lower quality of life and accelerated cognitive decline (2).

The management of sleep disorders in patients with Parkinson's disease is individualized according to symptomatology and generally requires a combination of non-pharmacological interventions and targeted pharmacotherapy. These non-pharmacological approaches include sleep hygiene training, regular exercise, scheduling of activity and light exposure, and cognitive behavioral therapy, particularly for insomnia (2). Continuous positive airway pressure is recommended for patients with sleep apnea. Regarding pharmacotherapy, melatonin or clonazepam have been suggested to reduce the risk of injury in RBD. In patients with excessive daytime sleepiness, initial management involves addressing the sedative burden and any comorbid conditions disrupting nighttime sleep (e.g., sleep apnea, restless legs syndrome, nocturnal akinesia), and wakefulness-promoting agents may be used in refractory cases. For insomnia, sedatives/hypnotics should be used cautiously and as briefly as possible due to the risk of confusion and falls in IPD (13). Periodic limb movements during sleep or restless legs syndrome associated with motor involvement of the disease cause awakenings and impair the quality of sleep (14). Evidence from the present study demonstrates strong correlations among various sleep-related parameters, as well as correlation between these parameters and external factors. A decreased ability to fall asleep increases daytime sleepiness, and increased motor symptoms at night trigger nocturnal psychosis. In addition to multidisciplinary treatment, sleep disorders should be considered a separate pathology, and disease-related effects on sleep subparameters should also be mitigated. Improving sleep patterns can lead to more restorative rest, thereby enhancing overall quality of life for these patients.

Quality of life is a subjective yet crucial construct that serves to evaluate therapeutic interventions and reflect an individual's psychological, physical, and social functioning. In a multifaceted disorder such as Parkinson's disease, which is characterized by progressive disability, the continuous evaluation of quality of life becomes indispensable (15). In the present study, depressive symptoms were associated with reduced mobility, lower emotional well-being, and diminished cognitive and communicative performance. Increased physical strain and limitations in activities of daily living were also related to poorer overall quality of life. In a study including 158 patients with Parkinson's disease, Karlsen et al. (16) reported that despite receiving the most modern care available, there was still a decline in quality of life. Social isolation and emotional reactivity exacerbated stress and anxiety in patients with advanced disease stage according to the H&Y scale. Based on these findings, the authors concluded that decreased quality of life might increase the public health burden (16). Considering the long life expectancy of individuals diagnosed with Parkinson's disease, maintaining their well-being is essential. A key result emerging from the current study is that with longer disease duration and higher disease stage, patients exhibited deterioration in both emotional well-being and cognitive function. Parkinson's disease is primarily managed pharmacologically. Levodopa is effective in alleviating the cardinal motor symptoms of the disease. Medication use is important for controlling motor fluctuations. The disease is typically managed by adjusting the dose of levodopa or adding MAO-B inhibitors or dopamine agonists to the treatment regimen. The use of dopaminergic drugs, especially dopamine agonists, is often reduced to manage emergent impulse control disorders. Although Parkinson's disease is incurable, pharmacological and non-pharmacological treatments are utilized for the purpose of enhancing patient quality of life (17). The present analysis revealed that pharmacotherapy in this cohort was largely based on levodopa and dopamine agonists. This is an indication that evidence-based pharmacological guidelines are generally adopted in the management of IPD. Deep brain stimulation was utilized less frequently as a treatment option in this Turkish cohort.

Sleep problems, disease-related decline in quality of life, and pharmacological burden collectively contribute to the development of psychopathological clinical conditions in patients with IPD over time. Depression and anxiety have emerged as the most prevalent psychiatric comorbidities reported in this population (18,19). Approximately one-third of patients with IPD exhibit depressive symptoms which may persist at mild levels and progressively worsen to moderate or severe intensity over time (20). Therefore, recognition and optimal treatment of depression are essential. The pathophysiological basis of depression linked to IPD has yet to be fully elucidated, although it may precede motor symptoms. The disease presents with structural alterations and reductions in dopamine, serotonin, and norepinephrine levels, which contribute to the depressive phenotype. Several studies have proposed that deep brain stimulation may be considered as a potential treatment for depression. Evidence suggests that subthalamic nucleus stimulation may provoke suicidal behavior in some cases, in contrast to pallidal stimulation, which has been associated with improvements in mood and depressive symptoms (20). Consistent with this, our findings revealed a positive correlation between depression and the progression and duration of IPD.

Study Limitations

A primary limitation of this research was the lack of objective measures to confirm sleep disturbances. Additionally, the majority of participants were in the early to moderate stages of Parkinson's disease, which may influence the generalizability of the findings. Furthermore, the participants had a wide age range. In future studies, the confounding effects of age-related factors can be mitigated with age-stratified analyses. Lastly, the

considerable variance in disease duration among participants can be considered another limitation.

CONCLUSION

The present analysis underscores the interrelation between sleep disturbances, depressive symptoms, and health-related quality of life in individuals with IPD, a common neurodegenerative disorder. This multicenter study contributes valuable clinical insights to the literature by comprehensively evaluating these multifaceted parameters within a large Turkish cohort.

DECLARATIONS

Conflict of Interest: *The authors declare that they have no conflict of interest.*

Financial Disclosure: *The authors declare that there is no financial conflict of interest related to this study.*

Acknowledgements: *Not applicable.*

Funding: *No financial support was received for this study.*

Author Contributions: *Concept: FAA, SCK; Design: FAA, SCK, GA, MÇ; Data Collection or Processing: AKA, AŞS, EEB, SK, NÇ, SKA, HTK, MFA, BGÇ, FE, HA, ZT, KK, MB, RS, SS, NE; Analysis or Interpretation: FAA, MÇ, EC, CŞP; Literature Search: FAA, GA, EC, CŞP; Writing: FAA, EC, CŞP*

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