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Sleep Quality in Patients with Parkinson's Disease

by

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Dedication

We dedicate this research to Allah; may this work be a means for benefiting humanity and earning His mercifulness.

This study is also genuinely dedicated to our parents, who continually supported, inspired, and encouraged us throughout our life; we will forever wholeheartedly appreciate what they did for us.

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Abstract

Background: Parkinson's disease is a prevalent neurodegenerative disorder that is associated with several motor and non-motor symptoms, including sleep disturbances. These disturbances have a significant impact on the quality of life of Parkinson's disease patients and are often underdiagnosed and undertreated by healthcare providers.

Objectives: To assess the sleep disturbances of Parkinson's disease patients, evaluate their impacts on daytime activities, and emphasize addressing sleep problems in clinical care.

Material and methods: This is a case-control study that was conducted in Baghdad, Iraq. Parkinson's disease patients and the control participants were recruited from several hospitals and clinics. A questionnaire comprised the standard PSQI instrument, and several inquiries related to participants' demographics was administered to all participants. Spearman's correlation and t-test statistical methods were used to analyze the variables.

Results: 44 Parkinson's disease patients and 80 control participants were enrolled in this study. Parkinson's disease patients showed significantly poorer sleep quality than the control group, as evidenced by PSQI scores. No significant difference was recorded between the two genders of Parkinson's disease patients regarding sleep quality and its related variables. There were also no significant correlations between age and other sleep-related variables. Most Parkinson's disease patients (86.4%) suffered from varying degrees of daytime dysfunction, compared to (61.25%) in the control group.

Conclusion: Parkinson's disease patients had significantly poorer sleep quality than the control group. Age and gender were not found to be strong predictors of sleep quality in Parkinson's disease patients. There were also higher daytime dysfunction rates in Parkinson's disease patients.

Introduction:

Parkinson's disease (PD) is the fastest-growing neurological disorder globally⁽¹⁾, it is also the second most common neurodegenerative disease in the world, around 6.1 million people were documented to have PD in 2016⁽²⁾. It is characterized by the gradual loss of both motor and non-motor functions, making it a progressive and disabling disease, the exact etiology of PD is still unknown, but some studies suggest that genetics and environmental factors may play a role in its development⁽³⁻⁵⁾. Motor symptoms which consist mainly of rigidity, bradykinesia, and resting tremor were the core of studies in the past, however, non-motor symptoms (NMS) have gained increasing attention from researchers in recent years⁽⁶⁾, many studies suggest that these NMS have a direct effect on the quality of life of the patients⁽⁷⁾. NMS include depression, mood changes, cognitive decline, pain, fatigue, constipation, hallucinations and sleep problems^(7,8). NMS may not be due to dopaminergic dysfunction in extrastriatal areas only, even the serotonergic system may play a significant role in the development of NMS as some studies suggest⁽⁹⁾.

Sleep is considered a non-motor feature, and it is part of people's natural routines. It is fundamental to promoting their health and well-being. An important term in our study regarding this subject is sleep quality, which is defined as the person's complacency with the entire aspects of sleep: sleep efficiency, sleep latency, sleep duration, and wake after sleep onset⁽¹⁰⁾. Low sleep quality might lead to a lack of concentration, cognitive impairment, and mood changes⁽¹¹⁾. It is also associated with an increased incidence of hypertension, diabetes mellitus, metabolic syndromes, depression, and car accidents ⁽¹²⁻¹⁴⁾. Low sleep quality is even associated with low quality of life ⁽¹⁵⁾. Sleep disturbances that the PD patients struggle with were observed by James Parkinson himself ⁽¹⁶⁾, and they have been frequently reported since the past century, even though, clinicians pay little attention when it comes to

this subject. There are many subjective measures and tools used to evaluate and assess the sleep quality of the patients: Parkinson's Disease Sleep Scale, Epworth Sleepiness Scale, Stanford Sleepiness Scale, and Pittsburgh Sleep Quality Index (PSQI). We chose to use the PSQI as it shows validity and reliability ⁽¹⁷⁾, it is also the recommended tool to measure the severity of sleep disturbances and to rate the overall sleep problems in PD patients⁽¹⁸⁾.

The main objective of this study is to comprehensively evaluate the sleep quality among a sample of individuals with PD. We also aim to determine the severity of sleep disturbances and assess their impact on daytime activities. We hope to enhance awareness and emphasize the significance of this crucial aspect of clinical care.

Methodology

This is a case-control study that was conducted between November 2022 and January 2023 in Baghdad, Iraq. The patients with PD were recruited from Saad Al-Witry Neuroscience Teaching Hospital, Neurosurgery Teaching Hospital, Baghdad Teaching Hospital, and in addition to various private clinics. The patients were diagnosed clinically by specialist neurologists with at least five-year experience.

The control group participants were recruited from relatives and companions of outpatients attending certain Baghdad hospitals and clinics, they are defined as those who were not proven to have any neurological deficits or mental issues. Exclusion criteria for both groups were individuals with a history of substance abuse, taking medications that influence sleep such as sedatives, hypnotics, antidepressants, and opioids within one year of recruitment. A specific questionnaire was administered to both groups, the data were collected through direct interviews with the patients. In some cases, a relative of the patient assisted in the interview process.

Before the commencement of the interviews, written consent was obtained from all the participants after they were fully informed about the objectives of the research.

The questionnaire comprised the standard PSQI instrument in addition to several inquiries related to the participants' demographics, including age, gender, substance abuse, and the use of sedative or hypnotic medications. Additional questions were included for PD patients regarding the onset of motor symptoms related to the disease, and whether they were taking medication for the PD.

The Arabic version of the PSQI, which is a widely accepted and validated tool for evaluating sleep quality⁽¹⁹⁾, was utilized for the assessment of the sleep quality of PD patients, it includes seven components: i) subjective sleep quality, ii) sleep latency, iii) sleep duration, iv) sleep efficiency, v) sleep disturbance, vi) use of sleep

medication and vii) daytime dysfunction. Each component has a score range from 0 to 3, and by summation of all components' scores, the global PSQI score can be obtained. The global PSQI score ranges from 0 to 21, the higher the global PSQI score is, the poorer sleep quality. Global PSQI scores equal or less than 5 are indicative of “good” sleep quality, while scores greater than 5 indicate “poor” sleep quality⁽²⁰⁾.

Data were analyzed using IBM SPSS version 27.0 software for Windows. The Shapiro-Wilk normality test was used to assess the normality of data distribution.

The mean values between different groups were compared using Independent samples t-test. Correlation analyses were done using Spearman’s correlation analysis. A p-value less than 0.05 was considered statistically significant in all the statistical tests.

The approval for this study was obtained from the ethical and scientific unit in AL-Kindy College of Medicine, University of Baghdad.

Results

The study population included 44 patients who had been diagnosed with PD, of which, 26 were males and 18 were females. The control group consisted of 80 participants, including 47 males and 33 females. The mean age in PD patients was 62.7 ± 10.246 years, while the mean age in the control group was 59.01 ± 8.47 years (Table.1).

As seen in Table.1, the mean of the global PSQI score of PD patients was 11.55 ± 4.412 , while it was 5.73 ± 3.22 for the control group, with a significant p-value of <0.001 when comparing means using independent samples t-test. Sleep latency onset was 75.57 minutes for PD patients and 22.81 minutes for the control group, with a significant p-value of <0.001 .

Table 1: Comparison between PD patients and the control group

	PD patients (n:44)	Control group (n:80)	p-value	Test value	df	Method
Age	62.75 $\pm$ 10.246	59.01 $\pm$ 8.47				
Male (%)	26 (59.1)	47 (58.75)				
Female (%)	18 (40.9)	33 (41.3)				
Sleep duration in hours	5.829 $\pm$ 2.274	6.55 $\pm$ 1.42	0.031	-2.18 t-value	122	t-test
Sleep onset latency in minutes	75.57 $\pm$ 67.093	22.81 $\pm$ 20.498	<0.001	6.52 t-value	122	t-test
Sleep efficiency %	66.73 $\pm$ 25.098	91.12 $\pm$ 10.971	<0.001	-7.5 t-value	122	t-test
Global PSQI score	11.55 $\pm$ 4.412	5.73 $\pm$ 3.222	<0.001	8.415 t-value	122	t-test

A comparison between the two genders of PD patients using independent samples' t-test is shown in Table 2. The mean age of the PD male group was 60.96 ± 10.246 , while the mean age of the PD female group was 65.33 ± 8.47 . There is no significant difference between the two genders in terms of sleep duration, sleep latency, sleep efficiency, and global PSQI score.

Table 2: Comparison between the two genders of PD patients

	Male (n:26)	Female (n:18)	p-value	Test value	df	Method
Age (SD)	60.96 ± 10.246	65.33 ± 8.47				
Sleep duration in hours	5.89 ± 2.338	5.75 ± 2.244	0.85	-0.191 t-value	42	t-test
Sleep onset latency in minutes	74.42 ± 74.099	77.22 ± 57.502	0.894	0.135 t-value	42	t-test
Sleep efficiency %	68.363	64.383	0.611	0.513 t-value	42	t-test
Global PSQI score	11.23 ± 4.16	12 ± 4.839	0.576	0.564 t-value	42	t-test

A Spearman's correlation analysis was used to determine the association between certain sleep variables (independent variables) with the age (dependent variable) in PD patients. There was a weak positive correlation between the global PSQI score with the age of the patients (0.046), indicating that when age increases, the global PSQI score also increases, however, the p-value was not significant (0.768). The other variables had weak negative correlations with age, with non-significant p-values, as listed in Table 3.

Table 3: Correlations between certain sleep variables with the age in PD patients

	Spearman's correlation	p-value
Global PSQI score	0.046	0.768
Sleep duration	-0.13	0.401
Sleep onset latency	-0.067	0.665
Sleep efficiency	-0.103	0.507

The PSQI global score ranged from 3 to 18 in PD patients, with 41 patients (93.18%) reporting poor sleep quality. Only 3 patients (6.81%) reported good sleep quality. Whereas the PSQI global score of the control group ranged from 1 to 16, with 34 participants (42.5%) reporting poor sleep quality, and 46 participants (57.5%) reporting good sleep quality, as seen in Table 4.

Table 4: Distribution of Good and Poor Sleepers by PSQI Global Score, Stratified by Patient Group and Gender

	No. (%) Global PSQI score = or < 5	No. (%) Global PSQI score >5
PD patients	3 (6.81)	41 (93.18)
Male	3 (6.818)	23 (52.272)
Female	0 (0)	18 (40.9)
Control group	46 (57.5)	34 (42.5)
Male	26 (32.5)	21 (26.25)
Female	20 (25)	13 (16.25)

Table 5 shows that there were only 6 PD patients (13.6%) who did not exhibit any daytime dysfunction (had a subscore of 0 on the daytime dysfunction component), compared to 31 participants in the control group (38.75%). Among the 44 PD patients, 28 (63.6%) had a subscore of 1 on the daytime dysfunction component, 7 (15.91%) had a subscore of 2, and 3 (6.82%) had a subscore of 3. In comparison, out

of 80 participants in the control group, 43 (53.75%) had a subscore of 1, 6 (7.5%) had a subscore of 2, and none of the control group participants had a subscore of 3.

Table5: Distribution of participants of both groups according to each subscore in the daytime dysfunction component

Daytime dysfunction component subscores	No. (%)	
	Control group	PD patients
0	31 (38.75)	6 (13.6)
1	43 (53.75)	28 (63.6)
2	6 (7.5)	7 (15.91)
3	0 (0)	3 (6.82)

Discussion

Based on the findings of our study, it has been determined that there is a significant difference between PD patients and the control group in terms of PSQI score, sleep duration, sleep latency, and sleep efficiency. The percentage of participants with a global PSQI score higher than 5 in PD patients was (93.18%), whereas the percentage was (42.5%) in the control group.

Poor sleep quality in PD patients is believed to be linked with chemical changes in the brain involving GABAergic, glutamatergic, and cholinergic systems, due to the impairment of brainstem structures in the laterodorsal pontine tegmentum ⁽²¹⁾. Furthermore, vitamin D deficiency is highly prevalent in PD patients⁽²²⁾, and vitamin D deficiency is associated with sleep disturbances according to a meta-analysis conducted in 2018⁽²³⁾.

The sleep quality of PD patients in our study is much worse than the sleep quality of PD patients in studies conducted in other countries⁽²⁴⁾. A possible cause is the decline of infrastructure and public health services in Iraq⁽²⁵⁾. A recent study conducted in 2023, stated that the healthcare services that are implicated for PD patients in the Middle East and North Africa region (MENA) are inadequate ⁽²⁶⁾. It is also important to note that even the sleep quality of the control group in our study appeared to be worse than the control groups of other studies, however, we could not find any studies that explicitly assess the sleep quality of the Iraqi general population, nevertheless, the different lifestyles and cultures may play a role.

Our results also showed that the male-to-female ratio in PD patients is 1.44. This is consistent with a meta-analysis done in 2016⁽²⁾, which reported that the ratio is 1.40 times higher in men. Despite this difference in gender ratio, our study showed no significant differences in terms of sleep-related variables. This is consistent with a study by Liu et al ⁽²⁷⁾, which found that both genders had similar global PSQI scores

(6.0). It stated that there is no difference between the two genders in night-time sleep quality. It is important to note that the differences between the two gender groups in terms of sleep-related variables (even though are not significant), may be due to the differences in age between males and females.

The results of our study showed that there are no significant correlations between age and other sleep-related variables, meaning that age cannot be considered a predictor of sleep quality in PD patients, however, a study with a much larger sample size by Ylikoski et al.⁽²⁸⁾, found that older age is negatively associated with sleep deprivation. The differences in the results between our study and Ylikoski's study can be explained by several factors, including sample characteristics, methodological differences, the presence of PD-specific factors, and PD-related medications in addition to the cultural differences between Arabic and Scandinavian populations.

Regarding the daytime dysfunction component, our results showed that PD patients had a greater frequency of daytime dysfunction than the control group, as evidenced by higher subscores on the daytime dysfunction component of the PSQI. Specifically, a higher proportion of participants in the PD patients (63.6%) had a subscore of 1 compared to the control group (53.75%). Additionally, a higher proportion of participants in the PD group (15.91%) had a subscore of 2 compared to the control group (7.5%), and a higher proportion of participants in the PD group (6.82%) had a subscore of 3 compared to the control group (0%). In contrast, the control group had a higher proportion of participants with a subscore of 0 compared to the PD group (38.75% vs. 13.6%). These findings suggest that individuals with PD are more likely to experience daytime dysfunction, as measured by the PSQI, compared to individuals without the disease. These results are consistent with previous studies by Gallagher et al. (2010)⁽²⁹⁾ and Suzuki et al. (2012)⁽²⁴⁾, which also

found that PD patients had worse daytime dysfunction and sleep quality compared to the control group. Some possible causes include motor symptoms, medication side effects, sleep disturbances, and depression. This can have a negative significant impact on quality of life, including physical and psychological aspects. Effective management of PD should consider the potential for daytime dysfunction and address its underlying causes.

We have several limitations in our study. Firstly, our PD sample size is 44 patients, and this is considered a small sample. Secondly, due to the unavailability of well-equipped sleep laboratories, we relied only on subjective self-reported surveys, which are vulnerable to bias. Also, the unavailability of PD medication regimen data is another limitation, as these medications may affect the sleep quality of PD patients.

Conclusion

The study demonstrated that PD patients had significantly poorer sleep quality than the control group in terms of PSQI global score, sleep duration, sleep onset latency, and sleep efficiency. Our findings also revealed that age and gender are not strong predictors of sleep quality in PD patients. Moreover, our study highlights the higher daytime dysfunction rates in PD patients compared to the control group.

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Appendix A: Parkinson's Disease Patients' Questionnaire

(استبيان لمرضى الباركنسون)

جامعة بغداد/كلية طب الكندي

بين يديك استبيان لبحث حول اضطرابات النوم عند مرضى الشلل الرعاشي (الباركنسون)

شكرا لك عزيزي المشارك على وقتك من أجل ملء هذا الاستبيان، نؤكد لك أن جميع المعلومات سوف تستخدم لأغراض البحث العلمي، وخصوصياتك محفوظة

القسم الأول: معلومات خاصة بالمريض

الاسم:

الجنس:

بدأت اعراض الشلل الرعاشي منذ (وقت):

تم تشخيص المرض من قبل: د.

القسم الثاني: مؤشر جودة النوم (PSQI)

العمر:

تأريخ ملء الاستبيان:

هل تأخذ أدوية لمرض الشلل الرعاشي؟

رقم هاتف المشارك:

تعليمات: الاسئلة التالية تتعلق بعادات نومك خلال الشهر الماضي، نرجو ان تكون اجوبتك دقيقة وتتعلق بمعظم الأيام أو الليالي خلال الشهر الماضي، اجب عن جميع الاسئلة من فضلك.

١- خلال الشهر الماضي هل تستطيع تحديد وقت ذهابك للنوم؟ وقت النوم المعتاد

٢- خلال الشهر الماضي، ما الوقت (بالدقائق/بالساعات) الذي تحتاجه قبل ان تخذ تماما الى النوم؟

٣- خلال الشهر الماضي، متى كنت تنهض من الفراش في الصباح؟ وقت النهوض من الفراش المعتاد:

٤- خلال الشهر الماضي كم ساعة كنت تنام فعلياً كل ليلة؟ (هذا قد يختلف عن عدد الساعات التي تقضيها في الفراش) عدد ساعات النوم كل ليلة

٥- خلال الشهر الماضي، كم مرة حصلت لك احدى هذه المشاكل خلال نومك؟	ليس خلال الشهر الماضي	اقل من مرة واحدة بالاسبوع	مرة او مرتين في الاسبوع	ثلاث مرات او اكثر في الاسبوع
أ- لا تستطيع النوم في غضون ثلاثين (٣٠) دقيقة				
ب- تستيقظ في منتصف الليل او في الصباح الباكر				
ج- تضطر ان تستيقظ من اجل الذهاب للحمام				
د- لا تستطيع التنفس بارتياح				
هـ - تعاني من السعال او الشخير				
و- تشعر بالبرد الشديد				
ز- تشعر بالحر الشديد				
ح- تحلم بأحلام مزعجة				
ط- تشعر بالآلام				

				٦- خلال الشهر الماضي، كم مرة اخذت ادوية لتساعدك على النوم؟ (سواء كانت بوصفة طبيب او غير موصوفة)
				٧- خلال الشهر الماضي، كم مرة واجهت مشكلة بالبقاء مستيقظا اثناء القيادة او اثناء تناول وجبات الطعام او خلال الانخراط في الانشطة الاجتماعية؟
مشكلة كبيرة جدا	توجد مشكلة الى حد ما	فقط مشكلة بسيطة جدا	لا مشكلة على الاطلاق	
				٨- خلال الشهر الماضي، هل كنت تعاني من أن يكون لديك المزاج الكافي او الطاقة النفسية الكافية التي تساعدك في انجاز امورك المختلفة؟
سيئة جدا	سيئة	جيدة	جيدة جدا	
				٩- خلال الشهر الماضي، كيف تقيم جودة نومك بشكل عام؟
لا يوجد شخص ينام بالقرب مني	يوجد شخص ينام في نفس غرفتي لكن ليس على فراشي	يوجد شخص ينام في غرفة اخرى	لدي شريك ينام على فراشي	
				١٠- هل هناك شخص ينام بالقرب منك ؟
ليس خلال الشهر الماضي	اقل من مرة واحدة بالاسبوع	مرة او مرتين في الاسبوع	ثلاث مرات او اكثر في الاسبوع	اذا كان هناك شخص ينام في غرفتك او على فراشك، اسأله كم مرة حصل معك:
				أ-شخير بصوت عال
				ب- فترات توقف طويلة بين الأنفاس خلال النوم
				ج- أي اهتزاز او حركة في الأرجل اثناء النوم
				د- القيام بالمشي او الكلام او امور لا يفعلها النائم عادةً

شكرا جزيلا لك على وقتك، نتمنى لك دوام الصحة والعافية..

Appendix B: Control Participants' Questionnaire

(استبيان لقياس جودة النوم) جامعة بغداد/كلية طب الكندي

بين يديك استبيان لبحث حول قياس جودة النوم

شكرا لك عزيزي المشارك على وقتك من أجل ملء هذا الاستبيان، نؤكد لك أن جميع المعلومات سوف تستخدم لأغراض البحث العلمي، وخصوصياتك محفوظة

القسم الأول: معلومات خاصة بالمريض

العمر: _____ الجنس: _____
هل تأخذ ادوية مهدئة او منومة؟ _____
هل لديك اي ادمان على شرب المشروبات الكحولية؟ _____
القسم الثاني: مؤشر جودة النوم (PSQI)

تعليمات: الاسئلة التالية تتعلق بعادات نومك خلال الشهر الماضي، نرجو ان تكون اجوبتك دقيقة وتتعلق بمعظم الأيام أو الليالي خلال الشهر الماضي، اجب عن جميع الاسئلة من فضلك.

- ١- خلال الشهر الماضي، هل تستطيع تحديد وقت ذهابك للنوم؟ وقت النوم المعتاد _____ (مثال: الساعة ١٠:٠٠ مساء)
- ٢- خلال الشهر الماضي، ما الوقت (بالدقائق/بالساعات) الذي تحتاجه قبل ان تخلد تماما الى النوم؟ _____ (مثال: نصف ساعة)
- ٣- خلال الشهر الماضي، متى كنت تنهض من الفراش في الصباح؟ وقت النهوض من الفراش المعتاد: _____ (مثال: الساعة ٨:٠٠ صباحا)
- ٤- خلال الشهر الماضي كم ساعة كنت تنام فعليًا كل ليلة؟ (هذا قد يختلف عن عدد الساعات التي تقضيها في الفراش) عدد ساعات النوم كل ليلة _____ (مثال: ٨ ساعات)

٥- خلال الشهر الماضي، كم مرة حصلت لك احدى هذه المشاكل خلال نومك ؟	ليس خلال الشهر الماضي	اقل من مرة واحدة بالاسبوع	مرة او مرتين في الاسبوع	ثلاث مرات او اكثر في الاسبوع
أ- لا تستطيع النوم في غضون ثلاثين (٣٠) دقيقة				
ب- تستيقظ في منتصف الليل او في الصباح الباكر				
ج- تضطر ان تستيقظ من اجل الذهاب للحمام				
د- لا تستطيع التنفس بارتياح				
هـ - تعاني من السعال او الشخير				
و- تشعر بالبرد الشديد				
ز- تشعر بالحر الشديد				
ح- تحلم بأحلام مزعجة				
ط- تشعر بالام				
٦- خلال الشهر الماضي، كم مرة اخذت ادوية لتساعدك على النوم؟ (سواء كانت بوصفة طبيب او غير موصوفة)				

				٧- خلال الشهر الماضي، كم مرة واجهت مشكلة بالبقاء مستيقظا اثناء القيادة او اثناء تناول وجبات الطعام او خلال الانخراط في الانشطة الاجتماعية؟
مشكلة كبيرة جدا	توجد مشكلة الى حد ما	فقط مشكلة بسيطة جدا	لا مشكلة على الاطلاق	
				٨- خلال الشهر الماضي، هل كنت تعاني من أن يكون لديك المزاج الكافي او الطاقة النفسية الكافية التي تساعدك في انجاز امورك المختلفة؟
سيئة جدا	سيئة	جيدة	جيدة جدا	
				٩- خلال الشهر الماضي، كيف تقيم جودة نومك بشكل عام؟
لا يوجد شخص ينام بالقرب مني	يوجد شخص ينام في نفس غرفتي لكن ليس على فراشي	يوجد شخص ينام في غرفة اخرى	لدي شريك ينام على فراشي	
				١٠- هل هناك شخص ينام بالقرب منك ؟
ليس خلال الشهر الماضي	اقل من مرة واحدة بالاسبوع	مرة او مرتين في الاسبوع	ثلاث مرات او اكثر في الاسبوع	اذا كان هناك شخص ينام في غرفتك او على فراشك، اسأله كم مرة حصل معك:
				أ-شخير بصوت عال
				ب- فترات توقف طويلة بين الأنفاس خلال النوم
				ج- أي اهتزاز او حركة في الأرجل اثناء النوم
				د- القيام بالمشي او الكلام او امور لا يفعلها النائم عادةً

شكرا جزيلا لك على وقتك، نتمنى لك دوام الصحة والعافية..