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ORIGINAL RESEARCH

The Prevalence of Depression Among Parkinson's Disease Patients in Saudi Arabia: A Cross-Sectional Study

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Background and Aim: Depression is thought to affect up to half of Parkinson's patients at some point during their illness, while anxiety is reported by about 40% of PD patients. The study aimed to assess the prevalence of depression and anxiety among patients with Parkinson's disease (PD) in Saudi Arabia.

Methods: The study involved Saudi Arabian citizens and residents aged 40 or older with PD, who completed internet-survey (including online and email-based data collection) or telephone-survey by trained interviewers. We used the Parkinson's Disease Questionnaire for quality-of-Life assessment questionnaire (PDQ-39), Patient Health Questionnaire-9 for depression (PHQ-9), and General Anxiety Disorder-7 anxiety questionnaire (GAD-7).

Results: The study included 46 participants, of whom 37% were aged 60–69 years, 67% were male, 46% had completed a university education, and 87% were married. Depression symptoms were present in 84.8% of participants, while 73.9% experienced anxiety. PD patients lacking social support were 8 times more likely to develop major depression [OR = 8.27, 95% CI (1.47–46.31), p = 0.016] and 5 times more likely to experience anxiety symptoms [OR = 5.36, 95% CI (1.14–25.26), p = 0.034]. Those unable to perform daily living activities or who faced stigma had a 16.5 times higher likelihood of anxiety symptoms [OR = 16.5, 95% CI (1.62–168.48), p = 0.018]. Furthermore, cognitive impairment increased the likelihood of anxiety by 11 times [OR = 11.43, 95% CI (1.83–71.42), p = 0.009].

Conclusion: The study reveals a high prevalence of depression and anxiety among Parkinson's disease patients, linked to physical impairments and social isolation. Many patients report no mental health improvement despite treatment, highlighting the need for routine mental health assessments, social support, and tailored interventions to enhance their quality of life. The small sample size may limit the statistical power, precision, and generalizability of the study's findings.

Keywords: Parkinson disease, depression, anxiety, Saudi Arabia

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Introduction

Parkinson's disease (PD) is widely recognized for its characteristic motor symptoms, including tremors, bradykinesia (slowed movements), and postural instability.[1] However, it is increasingly evident that PD encompasses a spectrum of non-motor symptoms that profoundly impact patients' overall well-being.[2] Among these non-motor symptoms, depression and anxiety are particularly prevalent and debilitating, often overshadowing the motor aspects of the disease.[3]

Depression in PD is estimated to affect up to 50% of patients at some point during the course of their illness, while anxiety is reported in approximately 40% of individuals with PD.[4] These psychological manifestations not only impair

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emotional health but also have significant implications for physical health and functional abilities.[5] For instance, depression in PD is associated with increased disability, higher healthcare utilization, and greater caregiver burden.[6] Similarly, anxiety in PD can exacerbate motor symptoms, impair cognition, and reduce quality of life.[7] Depression in PD can impair quality of life and may precede motor symptoms.[8]

The etiology of depression and anxiety in PD is multifactorial and likely involves a complex interplay of biological, psychological, and social factors.[9] Neurochemical changes in the brain, particularly alterations in dopamine and serotonin neurotransmitter systems, are thought to contribute to mood disturbances in PD.[10] Additionally, neurodegeneration in regions of the brain associated with emotional processing and regulation, such as the limbic system and prefrontal cortex, may play a role in the development of depression and anxiety.[11,12] Psychosocial factors also influence the prevalence and severity of depression and anxiety in PD.[6] Chronic stress, social isolation, caregiver strain, and perceived stigma associated with PD can exacerbate psychological symptoms.[13] Moreover, the progressive nature of PD and the uncertainty surrounding its prognosis can lead to feelings of hopelessness and despair in affected individuals.

Recognizing and addressing depression and anxiety in PD requires a comprehensive approach that integrates pharmacological interventions, such as antidepressant medications and anxiolytics, with psychosocial therapies, including cognitive-behavioral therapy and support groups.[14,15] Additionally, optimizing PD management through medication adjustments, physical activity, and social engagement can help alleviate psychological symptoms and improve overall well-being.[16]

Despite growing recognition of the psychological manifestations of PD, depression, and anxiety remain underdiagnosed and undertreated in this population. Consequently, there is a critical need for research that elucidates the epidemiology and determinants of these comorbidities in PD patients to inform clinical practice and optimize patient outcomes. Assessing both depression and anxiety in Parkinson's disease (PD) patients is crucial due to their significant impact on quality of life and disease management. Research in this region remains limited, making it challenging to compare with global trends or design culturally tailored interventions. While depression, anxiety, and cognitive impairment have been extensively studied, this study stands out for its emphasis on a specific location. This study aimed to determine the prevalence of depression and anxiety among Parkinson's disease patients in Saudi Arabia, and to assess their quality of life providing critical insights into the mental health challenges faced by this specific patient population.

Materials and Methods

Study Design

An analytical cross-sectional study was conducted among a sample of adult PD patients from various regions of Saudi Arabia from 20 November to 20 January 2024.

Study Participants and Sampling Methods

The study's eligibility requirements included being citizens and residents of Saudi Arabia, aged 40 years or older, and having PD. Patients with Parkinson disease completed internet-survey (including online and email-based data collection) or telephone-survey by trained interviewers.

Sample Size

The sample size was calculated using Open-epi; an open-source software for epidemiological statistics. The prevalence of PD in Saudi Arabia has been estimated to be 27 per 100,000 population.[5] With 95% confidence limits, the minimum calculated sample size to achieve study objectives was 46 patients.

Data Collection

Web-based or telephone-based questionnaires were utilized to collect data. For web-based questionnaire, the link being disseminated via social media and email. For telephone-based questionnaire, the data was collected from eligible patients who agreed to participate in our study by trained interviewers. Detailed information regarding the study's objectives, potential risks and benefits, as well as the confidentiality of participants' data, was provided in the consent form. Access to the questionnaires was granted to participants only upon reading and endorsing the consent form. Web-Based Consent: Participants reviewed study details on a consent page and confirmed their agreement via a checkbox or digital signature before proceeding with the questionnaire. Telephone-Based Consent: The interviewer explains the study verbally, and participants gave verbal consent, which was recorded. A follow-up Email or letter was also sent for confirmation. Participants were assured that their information would solely be accessible to the research team and that their responses were analyzed for reporting purposes, with all individual data being securely disposed of upon the study's publication. We implemented informed consent procedures and secure data deletion protocols to protect participant data throughout the study.

The data collection tool comprised four sections: demographic information, The Parkinson's Disease Questionnaire for Quality-of-Life assessment questionnaire (PDQ-39), Patient Health Questionnaire-9 for depression (PHQ-9), and General Anxiety Disorder-7 anxiety questionnaire (GAD-7). The demographic section gathered basic information about participants, encompassing age, gender, educational level, marital status, employment status, and number of children.

For this study, a subset of questions from the validated PDQ-39 questionnaire[17] was translated into Arabic and utilized. Specifically, 36 questions covering seven dimensions—mobility, activities of daily living, stigma, social support, cognitive impairment, communication, and bodily discomfort—were chosen for research purposes. Participants answered each question affirmatively or negatively. Affirmed answers indicated impairment in these quality-of-life dimensions.

The Arabic-validated PHQ-9,[18] a nine-question tool administered to patients used to assess the presence and severity of depression. Its outcomes were utilized to diagnose depression by the DSM-IV (Diagnostic and Statistical Manual of Mental Disorders–Fourth Edition) criteria. It gauged the frequency of depressive symptoms experienced by patients over two weeks, with responses categorized as follows: 0 points for "never", 1 point for "a few days", 2 points for "more than half of the days", and 3 points for "almost every day". Each item was scored on a scale of 0 to 3, yielding a total score ranging from 0 to 27. These scores can then classify depressive symptoms of "none or minimum" (0–4), "mild" (5–9), "moderate" (10–14), "moderately severe" (15–19), and "severe" (20–27). A score $\geq$10 indicated a major depression.

The validated Arabic version of the GAD-7 questionnaire was utilized,[19] comprising seven items aimed at screening for anxiety disorders in the general population. Scores were assigned based on responses, with values of 0, 1, 2, and 3 corresponding to "not at all", "several days", "more than half the days", and "almost every day", respectively. Reference points for mild, moderate, and severe anxiety were established at total scores of 5, 10, and 15, respectively.

Before beginning data collecting, the research team carried out a pilot study to confirm the web tool's viability and accessibility before starting to gather data. The pilot study validated the web tool's usability, cultural relevance, and technical functionality. Based on participant feedback, modifications were made to improve clarity, navigation, and accessibility, ensuring the tool effectively collected reliable data. To ensure consistency between web-based and telephone surveys, we standardized the questionnaires, trained the interviewers, conducted pilot tests, and applied quality control and statistical adjustments. We also implemented informed consent procedures and secure data deletion protocols to protect participant data throughout the study.

We minimized response biases by ensuring anonymity, and providing clear instructions. We employed validated scales and cross-checked responses in both survey formats.

All the questionnaires were sent to 10 participants.

Ethical Considerations

Approval from the research ethics committee at King Khaled University (ECM#2023-3234) was secured before commencing the study. Participation was entirely voluntary, and participants were assured of their right to withdraw from the study at any point without facing any repercussions. Contact details for both the institutional review board and the authors were made available to participants. The study was performed by the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

Statistical Analyses

Stata 17.0 was utilized for data management and analysis. Numerical variables were characterized by the mean and standard deviation (SD), whereas nominal and categorical variables were described by frequency and percentage. The chi-square test was applied to compare between qualitative variables. To determine factors that influenced depression and anxiety status in PD patients, logistic regression was performed. The predictors impacting the chance of getting depression or anxiety were evaluated using odds ratios (OR) and 95% confidence intervals (CI). The variables that showed significance (P<0.05) in the univariate analyses were kept.

Results

Demographics and Quality of Life Dimensions of Participants Based on Depression Status

A total of 46 patients participated in our study. Approximately, two-fourths of the participants (37%) aged 60–69 years old, with 31 (67%) being male, 46% completing university education, 40 (87%) were married, 39% of the participants were retired and 30% were unemployed. Of the surveyed participants, 39 (84.8%) had depression symptoms, while only 7 (15.2%) did not suffer from depression symptoms. Among the PD participants, 96% had impaired mobility, 89% were unable of daily activities, 89% suffered from stigma, 80% lacked social support, 83% had problems in communication, 85% had cognition impairments, and 96% suffered from bodily discomfort. Although they took Parkinson's medications, 22% reported that they did not feel better.

The prevalence was for; mild depression 23.9%, moderate depression 19.6%, moderately severe depression 23.9%, and severe depression 17.4% among our PD participants. Participants who could not do daily activities were more likely to have depression symptoms compared to those who were able to do daily activities (80.4% vs 4.3%, p-value= 0.022). Also, participants who lacked social support had a higher prevalence of depression compared to those who had social support (73.9% vs 10.8%, p-value= 0.044). Participants with communication difficulties were more likely to experience depression than those with good communication skills (71.7% vs 13%, p-value = 0.002). Depression was more prevalent in participants with cognition impairments compared to those who did not suffer from cognition impairments (78.3% vs 6.5%, p-value= 0.003) (Table 1).

Table 1 Participants Demographics and Quality of Life Dimensions by Depression Status

Variables	**Total**	**Depression Status**					
		No	**Mild**	**Moderate**	**Moderately Severe**	**Severe**	**p-value**
N	46	7	11	9	11	8	
Age (years)							0.16
<50	10 (22%)	1 (14%)	4 (36%)	1 (11%)	1 (9%)	3 (38%)	
50–59	11 (24%)	1 (14%)	2 (18%)	4 (44%)	1 (9%)	3 (38%)	
60–69	17 (37%)	5 (71%)	3 (27%)	4 (44%)	4 (36%)	1 (13%)	
70–79	6 (13%)	0 (0%)	2 (18%)	0 (0%)	3 (27%)	1 (13%)	
80–89	2 (4%)	0 (0%)	0 (0%)	0 (0%)	2 (18%)	0 (0%)	
Gender							0.19
Male	31 (67%)	6 (86%)	9 (82%)	7 (78%)	5 (45%)	4 (50%)	
Female	15 (33%)	1 (14%)	2 (18%)	2 (22%)	6 (55%)	4 (50%)	

(*Continued*)

Table 1 (Continued).

Variables	**Total**	**Depression Status**					
		No	**Mild**	**Moderate**	**Moderately Severe**	**Severe**	**p-value**
Education level							0.16
Uneducated	1 (2%)	0 (0%)	0 (0%)	0 (0%)	1 (9%)	0 (0%)	
Primary education	6 (13%)	0 (0%)	0 (0%)	0 (0%)	3 (27%)	3 (38%)	
Intermediate education	3 (7%)	0 (0%)	1 (9%)	0 (0%)	2 (18%)	0 (0%)	
High school education	15 (33%)	2 (29%)	5 (45%)	5 (56%)	1 (9%)	2 (25%)	
University	21 (46%)	5 (71%)	5 (45%)	4 (44%)	4 (36%)	3 (38%)	
Employment status							0.19
Unemployed	14 (30%)	0 (0%)	3 (27%)	3 (33%)	6 (55%)	2 (25%)	
Employee	14 (30%)	2 (29%)	4 (36%)	3 (33%)	4 (36%)	1 (13%)	
Retired	18 (39%)	5 (71%)	4 (36%)	3 (33%)	1 (9%)	5 (63%)	
Marital Status							0.91
Not married	6 (13%)	1 (14%)	1 (9%)	2 (22%)	1 (9%)	1 (13%)	
Married	40 (87%)	6 (86%)	10 (91%)	7 (78%)	10 (91%)	7 (88%)	
Number of Childs, mean (SD)	5.0 (3.1)	4.7 (3.0)	5.0 (3.4)	4.0 (3.2)	6.3 (3.2)	4.6 (2.5)	0.58
Impaired Mobility							0.47
No	2 (4%)	1 (14%)	0 (0%)	0 (0%)	1 (9%)	0 (0%)	
Yes	44 (96%)	6 (86%)	11 (100%)	9 (100%)	10 (91%)	8 (100%)	
Inability of Daily Living Activities							0.022
No	5 (11%)	3 (43%)	2 (18%)	0 (0%)	0 (0%)	0 (0%)	
Yes	41 (89%)	4 (57%)	9 (82%)	9 (100%)	11 (100%)	8 (100%)	
Stigma							0.27
No	5 (11%)	2 (29%)	2 (18%)	1 (11%)	0 (0%)	0 (0%)	
Yes	41 (89%)	5 (71%)	9 (82%)	8 (89%)	11 (100%)	8 (100%)	
Lack social support							0.044
No	9 (20%)	4 (57%)	3 (27%)	1 (11%)	1 (9%)	0 (0%)	
Yes	37 (80%)	3 (43%)	8 (73%)	8 (89%)	10 (91%)	8 (100%)	
Communication problem							0.002
No	8 (17%)	2 (29%)	6 (55%)	0 (0%)	0 (0%)	0 (0%)	
Yes	38 (83%)	5 (71%)	5 (45%)	9 (100%)	11 (100%)	8 (100%)	

(*Continued*)

Table 1 (Continued).

Variables	Total	Depression Status					
		No	Mild	Moderate	Moderately Severe	Severe	p-value
Cognitions impairment							0.003
No	7 (15%)	4 (57%)	3 (27%)	0 (0%)	0 (0%)	0 (0%)	
Yes	39 (85%)	3 (43%)	8 (73%)	9 (100%)	11 (100%)	8 (100%)	
Bodily Discomfort							0.47
No	2 (4%)	1 (14%)	1 (9%)	0 (0%)	0 (0%)	0 (0%)	
Yes	44 (96%)	6 (86%)	10 (91%)	9 (100%)	11 (100%)	8 (100%)	
If you take. Parkinson medication, do you feel better?							0.16
No	10 (22%)	0 (0%)	2 (18%)	1 (11%)	3 (27%)	4 (50%)	
Yes	36 (78%)	7 (100%)	9 (82%)	8 (89%)	8 (73%)	4 (50%)	

Demographics and Quality of Life Dimensions of Participants Based on Anxiety Status

Table 2 shows that 34 (73.9%) of our participants had anxiety. Eleven participants (39.7%) had mild anxiety, 8 (17.4%) had moderate anxiety, and 15 (32.6%) had severe anxiety. Participants who had minimal anxiety were more likely to be with university education (67%), retired (50%), and married (92%).

Table 2 Participants Demographics and Quality of Life Dimensions by Anxiety Status

Variables	Anxiety Status				
	Minimal	Mild	Moderate	Severe	p-value
N	12	11	8	15	
Age (year)					0.53
<50	2 (17%)	3 (27%)	2 (25%)	3 (20%)	
50–59	4 (33%)	2 (18%)	2 (25%)	3 (20%)	
60–69	6 (50%)	3 (27%)	2 (25%)	6 (40%)	
70–79	0 (0%)	3 (27%)	2 (25%)	1 (7%)	
80–89	0 (0%)	0 (0%)	0 (0%)	2 (13%)	
Gender					0.14
Male	10 (83%)	9 (82%)	5 (63%)	7 (47%)	
Female	2 (17%)	2 (18%)	3 (38%)	8 (53%)	
Education level					0.031
Uneducated	0 (0%)	1 (9%)	0 (0%)	0 (0%)	
Primary education	0 (0%)	0 (0%)	2 (25%)	4 (27%)	

(*Continued*)

Table 2 (Continued).

Variables	Anxiety Status				
	Minimal	**Mild**	**Moderate**	**Severe**	**p-value**
Intermediate education	0 (0%)	1 (9%)	0 (0%)	2 (13%)	
High school education	4 (33%)	7 (64%)	0 (0%)	4 (27%)	
University	8 (67%)	2 (18%)	6 (75%)	5 (33%)	
Employment status					0.60
Unemployed	1 (8%)	5 (45%)	3 (38%)	5 (33%)	
Employee	5 (42%)	2 (18%)	2 (25%)	5 (33%)	
Retired	6 (50%)	4 (36%)	3 (38%)	5 (33%)	
Marital Status					0.71
Not married	1 (8%)	1 (9%)	2 (25%)	2 (13%)	
Married	11 (92%)	10 (91%)	6 (75%)	13 (87%)	
Number of Childs, mean (SD)	5.1 (2.5)	5.0 (3.7)	4.3 (2.9)	5.3 (3.4)	0.89
Impaired Mobility					0.40
No	1 (8%)	0 (0%)	1 (13%)	0 (0%)	
Yes	11 (92%)	11 (100%)	7 (88%)	15 (100%)	
Inability of Daily Living Activities					0.028
No	4 (33%)	1 (9%)	0 (0%)	0 (0%)	
Yes	8 (67%)	10 (91%)	8 (100%)	15 (100%)	
Stigma					0.028
No	4 (33%)	1 (9%)	0 (0%)	0 (0%)	
Yes	8 (67%)	10 (91%)	8 (100%)	15 (100%)	
Lack social support					0.053
No	5 (42%)	3 (27%)	0 (0%)	1 (7%)	
Yes	7 (58%)	8 (73%)	8 (100%)	14 (93%)	
Communication problem					0.021
No	4 (33%)	4 (36%)	0 (0%)	0 (0%)	
Yes	8 (67%)	7 (64%)	8 (100%)	15 (100%)	
Cognitions impairment					0.013
No	5 (42%)	2 (18%)	0 (0%)	0 (0%)	
Yes	7 (58%)	9 (82%)	8 (100%)	15 (100%)	
Bodily Discomfort					0.55
No	1 (8%)	1 (9%)	0 (0%)	0 (0%)	
Yes	11 (92%)	10 (91%)	8 (100%)	15 (100%)	

(*Continued*)

Table 2 (Continued).

Variables	Anxiety Status				
	Minimal	Mild	Moderate	Severe	p-value
If you take Parkinson medication, do you feel better?					0.037
No	0 (0%)	1 (9%)	3 (38%)	6 (40%)	
Yes	12 (100%)	10 (91%)	5 (63%)	9 (60%)	

Participants who could not do daily activities were more likely to have anxiety symptoms compared to those who were able to do daily activities (71.7% vs 9%, p-value= 0.028). Also, anxiety was more prevalent in participants who had problems in communication compared to those who could be well-communicated (65.2% vs 36%, p-value= 0.021). Participants with cognitive impairments had higher rates of anxiety than participants without cognitive impairments (69.5% vs 18%, p-value = 0.013)). When taking Parkinson's medicine, all individuals with mild anxiety reported feeling better, compared to just 60% of those with severe anxiety who felt better (Table 2).

Depression and Anxiety Medication and Quality of Life in Parkinson's Patients

Among the study participants, 18 (39.1%) took medications to treat depression symptoms while 8 (17.4%) took medications for anxiety symptoms. Of participants who had an inability of daily activity, 18 (41%) took antidepressant medications compared to 26 (59%) who did not take antidepressants. Of those who suffered from stigma, 17 (41.5%) reported taking antidepressants. Furthermore, among participants who reported taking antidepressants, 94% lacked social support, had communication problems, and had cognition impairments. All participants who took antidepressants had reported bodily discomfort. Of those who reported feeling better after taking Parkinson's medication, 14 (61.8%) used antidepressants and 22 (61.1%) did not (Table 3).

Table 3 Association Between Taking Depression/Anxiety Medication and Quality of Life in Parkinson's Patients

Factor	Take Medications to Treat Depression Symptoms			Take Medications to Treat Anxiety Symptoms		
	No	Yes	p-value	No	Yes	p-value
N (%)	28 (60.9%)	18 (39.1%)		38 (82.6%)	8 (17.4%)	
Impaired Mobility			0.25			0.51
No	2 (7%)	0 (0%)		2 (5%)	0 (0%)	
Yes	26 (93%)	18 (100%)		36 (95%)	8 (100%)	
Inability of Daily Living Activities			0.058			0.87
No	5 (18%)	0 (0%)		4 (11%)	1 (13%)	
Yes	23 (82%)	18 (100%)		34 (89%)	7 (88%)	
Stigma			0.35			0.28
No	4 (14%)	1 (6%)		5 (13%)	0 (0%)	
Yes	24 (86%)	17 (94%)		33 (87%)	8 (100%)	
Lack social support			0.055			0.58
No	8 (29%)	1 (6%)		8 (21%)	1 (13%)	
Yes	20 (71%)	17 (94%)		30 (79%)	7 (88%)	

(*Continued*)

Table 3 (Continued).

Factor	Take Medications to Treat Depression Symptoms			Take Medications to Treat Anxiety Symptoms		
	No	Yes	p-value	No	Yes	p-value
Communication problem			0.089			0.69
No	7 (25%)	1 (6%)		7 (18%)	1 (13%)	
Yes	21 (75%)	17 (94%)		31 (82%)	7 (88%)	
Cognitions impairment			0.14			0.19
No	6 (21%)	1 (6%)		7 (18%)	0 (0%)	
Yes	22 (79%)	17 (94%)		31 (82%)	8 (100%)	
Bodily Discomfort			0.25			0.21
No	2 (7%)	0 (0%)		1 (3%)	1 (13%)	
Yes	26 (93%)	18 (100%)		37 (97%)	7 (88%)	
If you take Parkinson medication, do you feel better?			0.95			0.23
No	6 (21%)	4 (22%)		7 (18%)	3 (38%)	
Yes	22 (79%)	14 (78%)		31 (82%)	5 (63%)	

Of participants who had an inability of daily activity, 8 (18.1%) took medications to treat anxiety compared to 36 (81.8%) who did not take anti-anxiety medications. Of those who suffered from stigma, 8 (19.5%) reported taking medications for anxiety. Furthermore, among participants who reported taking medications to treat anxiety, 88% lacked social support and had problems in communication, and bodily discomfort. All participants of them reported cognition impairments. Of those who reported feeling better after taking Parkinson's medication, 5 (13.8%) used medications for anxiety and 31 (86.1%) did not (Table 3).

Logistic Regression Analysis of Depression and Anxiety Risk Factors

In Table 4 logistic regression measured the significant associations between risk factors and depression or anxiety. Among the participants, PD patients who lacked social support had 8 more chance of major depression [OR= 8.27, 95%

Table 4 Logistic Regression for Depression and Anxiety Risk Factors

Risk Factor	Major Depression	
	OR (95% CI)	P-value
Lack Social support	8.27 (1.47–46.31)	0.016
Risk factor(s)	Anxiety	
Inability of Daily Living Activities	16.5 (1.62–168.48)	0.018
Stigma	16.5 (1.62–168.48)	0.018
Lack Social support	5.36 (1.14–25.26)	0.034
Cognitions impairment	11.43 (1.83–71.42)	0.009

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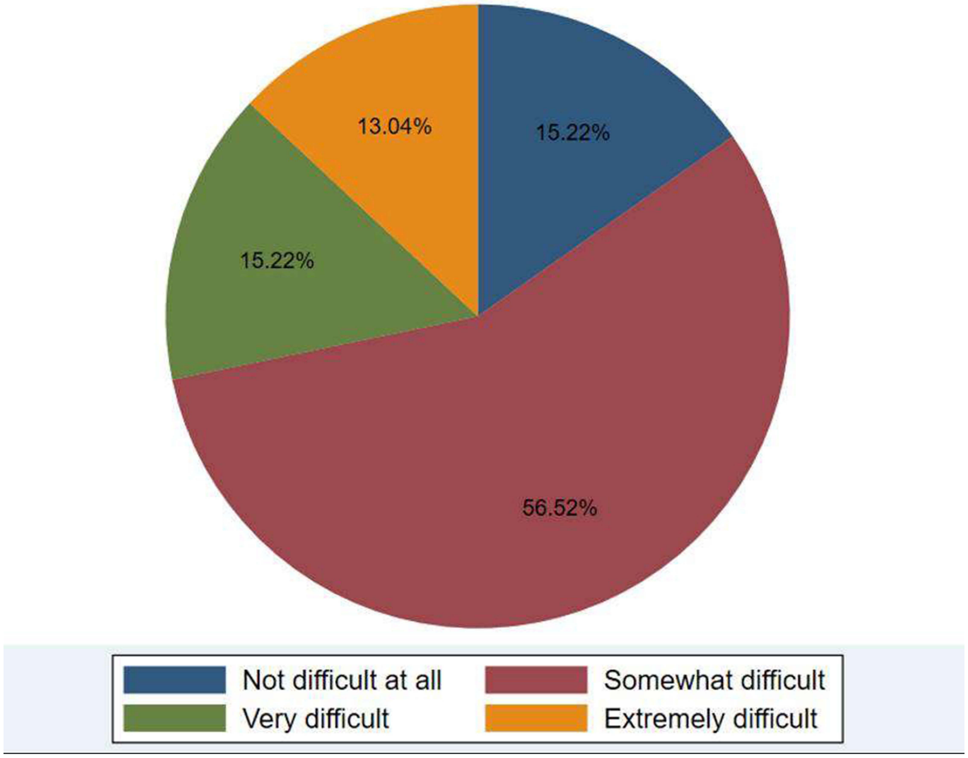

Figure 1 How difficult the depression problems make it for you to do your work, take care of things at home, or get along with other people?.

CI (1.47–46.31), p-value= 0.016] and 5 chance of anxiety symptoms [OR= 5.36, 95% CI (1.14–25.26), p-value= 0.034] compared to those who had social support. Also, PD patients who were unable to do daily living activities or suffered from stigma had 16.5 more likelihood of anxiety symptoms compared to those doing daily activity and did not suffer from stigma [OR=16.5, 95% CI (1.62–168.48), p-value= 0.018]. Furthermore, cognition impairment increased the likelihood of anxiety 11 times [OR= 11.43, 95% CI (1.83–71.42), p-value= 0.009].

For doing work, taking care of things at home, or getting along with other people, more than half of the participants (56.5%) reported that they had somewhat difficulty due to depression problems. While only 15.22% reported not being difficult at all. Moreover, 13.04% suffered from extreme difficulty due to depression problems (Figure 1).

Discussion

The study of 46 patients with PD found strikingly high rates of depression and anxiety symptoms, with 84.8% experiencing depression and 73.9% reporting anxiety. A significant link was discovered between a lack of social support and an increased risk of major depressive and anxiety symptoms. Furthermore, difficulties with daily living activities and stigma were identified as major contributors to anxiety symptoms. Notably, cognitive impairment emerged as a strong predictor of anxiety, highlighting the complex relationship between cognitive health and mental well-being in PD patients. Cognitive impairments and anxiety/depression in Parkinson's disease are closely linked through changes in brain regions like the prefrontal cortex and limbic system, along with dopamine and serotonin imbalances.[20–22] Cognitive conditions and psychiatric symptoms in Parkinson's disease are closely interconnected, with each worsening the other. Cognitive impairments can lead to depression and anxiety, while untreated psychiatric symptoms can accelerate cognitive decline. This highlights the importance of integrated treatment strategies that address both aspects to improve patient well-being, quality of life, and functional independence, reducing the burden on both patients and caregivers.[23] The study on Parkinson's Disease patients reveals a high prevalence of depression and anxiety, emphasizing the importance of mental health screening and intervention in PD care. Impairments like mobility issues and communication difficulties significantly correlate with these mental health symptoms, highlighting the intricate relationship between physical and mental health in PD. Lack of social support compounds these issues, indicating the need for robust support networks in PD management. Despite medication, many patients reported persistent symptoms, suggesting a need for alternative treatment strategies. Overall, the study underscores the necessity of holistic care approaches that address both physical and mental health aspects, integrating screening, support networks, and innovative interventions to improve the well-being of PD patients.

Prevalence of Depression Among Patients with PD

Depression is one of the most common and severe non-motor symptoms of PD. In this study, the prevalence of depression was 84.8% regardless of the severity of depression (mild, moderately severe, and severe). A systematic review conducted by Reijnders et al, revealed that depression prevalence rates range widely, from 2.7% to 90%, depending on assessment methods, diagnostic criteria, patient characteristics, comorbidities, and disease stage.[24] Clinically significant depression affects approximately 20% to 35% of Parkinson's disease patients,[25,26] with rates as high as 40.4% for outpatients and 54.3% for inpatients, albeit with varying severity[27,28] Major depressive disorder affects about 20% of PD cases. Furthermore, the risk of depression is four times higher in PD patients than in age-, gender-, and comorbidity-matched individuals in the general population.[26] A systematic review and meta-analysis of 129 studies, involving 38,304 participants across 28 countries, revealed an overall depression prevalence of 38% among Parkinson's disease patients.[29] Cultural, social, and healthcare system differences may contribute to this variation. These findings highlight the critical need for effective screening, assessment, and management strategies to address depression, a significant non-motor symptom in Parkinson's disease management, with the goal of improving affected individuals' overall quality of life and well-being. In our study, depression was more prevalent among males, whereas studies conducted in Egypt and Pakistan reported higher depression rates in females.[3,30] This variability in findings could be attributed to differences in methodologies, sample sizes, and the genetic diversity of study populations. Diagnostic differences may explain higher depression and anxiety rates in Parkinson's patients in Saudi Arabia.

Prevalence of Anxiety Among Patients with PD

Anxiety is a common non-motor symptom seen in people with PD. Its prevalence reflects heterogeneity and complexity in the patient population. Anxiety significantly increases caregiver burden, challenges treatment adherence, impairs cognition, and increases the risk of falls among PD patients.[31] In the current study, the prevalence of anxiety was 73.9%, with nearly one fifth of the participants having severe anxiety. The prevalence of anxiety among people with PD varies greatly, ranging from 20% to 46%, with reported extreme values as high as 73%.[32,33] Several factors contribute to this wide range in prevalence, including the variety of scales used to assess anxiety, the difficulty in accurately identifying different types of anxiety disorders, and the presence of overlapping symptomatology with depression. The difficulty in distinguishing between anxiety and depression symptoms contributes to the variation in reported prevalence rates.[33] The complex interplay of these factors emphasizes the importance of comprehensive and nuanced approaches to assessing and treating anxiety in Parkinson's disease patients, with the goal of improving diagnostic accuracy and management strategies for this common non-motor symptom.

Predictors of Depression and Anxiety in PD Patients

Social Support

Social support can be perceived as a resource provided by others, offering coping assistance or facilitating an exchange of resources. Typically, support emanates from family and partners, highlighting the significance of strong relationships between individuals with PD and their partners in mitigating symptoms of anxiety and depression.[4,34,35] In this study social support was a significant predictor of depression and anxiety among patients with PD. Similarly, in a study conducted by Cheng et al in China, social support was observed to exert a moderating effect on depression among a sample of 121 PD patients.[36] Moreover, Saeedian et al found that gender, disease duration, disease severity, and social support collectively accounted for 31% of the total variance in anxiety among younger PD patients, although they did significantly contribute to the explanation of depression.[37] Finally, the passage suggests that developing strong social support networks, particularly within familial and partner relationships, can help people with Parkinson's disease manage their anxiety and depression symptoms.

Stigma

Stigma experienced by PD patients has been associated with depressive symptoms, particularly self-stigma, which significantly impacts the quality of life.[38] In our study, patients suffered from stigma had 16.5 more likelihood of anxiety symptoms. Stigma has been shown to be a key determinant of overall quality of life in PD, with a higher correlation with quality of life than with depression or motor difficulties of daily living.[39] Additionally, stigma has been found to be more prevalent among PD patients with the tremor-dominant motor subtype, younger age, shorter disease duration, higher disability level, and presence of depression symptoms.[40]

Cognition Impairments

It is evident that there is a complex relationship between cognitive impairment, depression, and anxiety in PD patients. Our participants who suffered from cognition impairment had 11 times higher likelihood of anxiety. Aligned with that, Rahman et al highlighted that depression and cognitive impairment are among the main predictors of poor quality of life in PD patients.[41] However, Weintraub et al found no association between cognitive performance and depression or anxiety severity in early, untreated PD patients.[42] Conversely, Hu et al identified lower education, increased age, male sex, and quantitative motor and non-motor measures (including depression and anxiety) as predictors of cognitive impairment in early-stage PD patients.[43]

Furthermore, Pachana et al suggested that cognitive behavior therapy is an effective approach for treating anxiety and depression in PD patients.[44] Chua et al found that subjective cognitive complaints in cognitively normal PD patients were associated with anxiety but not depression.[45] Additionally, Dissanayaka et al demonstrated an association between anxiety and cognitive impairment, specifically in the memory domain.[46] Khedr et al reported that cognitive impairment was a significant predictor of depression but not anxiety.[3] Moreover, Toloraia et al conducted a follow-up study and aimed to investigate the predictive value of anxiety, depression, and apathy on the development of Mild Cognitive Impairment (MCI) in PD patients.[47]

However, the interplay between these factors is complex, and future research could aim to disentangle the influence of anxiety versus depression on cognitive impairments in PD.

In Saudi Arabia, cultural factors significantly influence the reporting and prevalence of depression and anxiety in individuals with Parkinson's disease. Stigma leads to underreporting of symptoms, while cultural attitudes may downplay emotional struggles. Strong family ties can provide support but may also result in reliance on family care over professional help. Additionally, limited access to culturally sensitive mental health resources and the impact of religious beliefs can hinder acknowledgment and treatment of mental health issues, creating a complex environment for this population.

The findings of this study are particularly relevant to Saudi Arabia, but their applicability to other regions should be approached with caution due to the unique cultural and social context in Saudi Arabia. Factors such as mental health stigma, family roles, and gender expectations may differ in Western or non-Arab cultures, which may have alternative approaches to caregiving and healthcare. However, common biological and clinical factors, like cognitive decline and social isolation, are universal across regions. Thus, while cultural differences may impact the experience of Parkinson's disease, the need for integrated care addressing both physical and psychological aspects is a global concern.

Strengths and Limitations

The study, which took place among adult PD patients in various parts of Saudi Arabia from August to December 2023, has several strengths and limitations. The study employed standardized tools like the PDQ-39, PHQ-9, and GAD-7 questionnaires, ensuring the reliability and validity of collected data. Additionally, a pilot study validated the web tool's viability before data collection. However, limitations include the use of convenience sampling, which may introduce selection bias and limit generalizability. While convenience sampling introduces challenges, the study minimized potential biases by using multiple recruitment methods, standardized tools, and efforts to ensure inclusivity. However, the findings should be interpreted cautiously, with the acknowledgment that the sample may not fully represent all PD patients. Future studies might use random sampling or stratified methods to enhance representativeness. Self-reported data from web-based questionnaires may also introduce response bias and language differences, affecting response accuracy and consistency, especially for mental health constructs such as depression and anxiety. However we addressed response bias by using validated tools, culturally sensitive survey designs, and multiple modes of data collection. These measures help account for linguistic and cultural differences in understanding mental health constructs while minimizing bias in self-reported data. The study's recruitment methods may have resulted in selection bias, favoring individuals with higher income and education levels, potentially making the sample unrepresentative of the broader Parkinson's disease population in Saudi Arabia. Additionally, having internet access or being tech-savvy could have influenced who chose to take part in the online survey. Future studies should adopt more inclusive recruitment strategies to provide more accurate and generalizable prevalence estimates. Finally, while the study used epidemiological statistics to calculate sample size, a larger sample size may have increased statistical power and precision, particularly for subgroup analyses and variable associations. The limited sample size may affect the generalizability of the results. Cultural factors in Saudi Arabia, including stigma, family dynamics, and healthcare access, influence mental health in PD patients and affect depression diagnosis and reporting. These factors contribute to regional prevalence variations, highlighting the need for culturally sensitive diagnostic and treatment strategies. The limitations of the study also include the issue of not accounting for certain confounding factors in a timely manner, such as medication use or the severity of Parkinson's disease (PD). Adjusting for confounding factors like medication use, disease duration, and comorbidities is crucial in studies linking physical impairments with mental health symptoms in Parkinson's disease (PD). These factors can influence both motor and mental health symptoms. Statistical methods like multivariable analysis and sensitivity testing can help account for these confounders, ensuring accurate results that isolate the impact of physical impairments on mental health. Future studies should adjust for these confounders for clearer results. A limitation of the study is the lack of exploration into how stigma associated with Parkinson's disease varies across different demographic or clinical subgroups. This absence of detailed analysis limits understanding of how stigma impacts various groups of PD patients and their quality of life.

Ursolic acid, benfotiamine (BFT), and plant extracts from *Centella asiatica* and *Withania somnifera* (Ashwagandha) have demonstrated potential as therapeutic agents for Parkinson's disease. These compounds exhibit neuroprotective effects, help reduce oxidative stress, and interact with key signaling pathways such as WNT-β catenin, which play a significant role in neurodegeneration.[48–51] Given these promising findings, further research is necessary to assess their clinical application in treating Parkinson's disease. To address limitations of self-reported mental health data, strategies like caregiver reports and participant training are recommended to be used in future. These methods enhance accuracy and reduce bias, ensuring more reliable findings.

Conclusions

The study of Parkinson's Disease (PD) patients indicates an alarming prevalence of depression (84.7%) and anxiety (73.9%), indicating a significant burden of mental health concerns in this population. Depression and anxiety symptoms vary in severity among Parkinson's patients, indicating the need for individualized interventions to address the wide range of emotional distress encountered. Importantly, impairments such as reduced mobility, communication difficulties, and cognitive impairments have a strong correlation with sadness and anxiety symptoms, highlighting the complicated interplay between physical and mental health in PD. Communication difficulties in Parkinson's disease can worsen isolation, frustration, and anxiety. Treatment should include speech therapy, communication devices, psychological support, and caregiver education, with a multidisciplinary approach to improve both communication and mental health. A lack of social support is identified as a crucial element associated with both depression and anxiety symptoms, emphasizing the necessity of building social support networks and treating social isolation among PD patients. Key strategies to reduce stigma and improve support for Parkinson's patients include education, peer support, caregiver training, and inclusive activities, all aimed at enhancing patient well-being and reducing isolation.

Despite receiving Parkinson's drugs, a significant proportion of patients reported no improvement in their symptoms, highlighting the difficulties in managing mental health issues in this population. Overall, the findings underline the importance of including mental health assessment and therapy in routine care for Parkinson's disease patients, with an emphasis on screening, social support, and functional impairments to enhance overall outcomes and quality of life. Integrating mental health screening and social support in PD care involves regular screenings, multidisciplinary teams, and psychological interventions. In Saudi Arabia, this can be implemented through training, culturally appropriate programs, telemedicine, national guidelines, and community support. The lack of improvement in mental health symptoms with Parkinson's drugs underscores the need for a more integrated approach that includes both pharmacological and non-pharmacological strategies. Additionally, it opens the door for future research and development of drugs that address both motor and mental health symptoms in PD patients. To address treatment-resistant mental health symptoms in PD patients, we recommend using psychotherapy, adjusting medications, and considering advanced treatments like Deep Brain Stimulation (DBS) and Transcranial Magnetic Stimulation (TMS), with a personalized approach combining pharmacological and non-pharmacological methods. Therapies for mobility and communication issues, such as physical therapy, exercise, assistive devices, and speech therapy, alongside mental health support to improve overall well-being in Parkinson's disease patients is also recommended. Cognitive behavioral therapy (CBT) findings for treating anxiety and depression in Parkinson's disease (PD) patients can be applied to various non-pharmacological interventions. These include Mindfulness-Based Stress Reduction (MBSR) for anxiety relief, other supportive psychotherapies, exercise to improve mood, and art and music therapy for emotional expression.

Major Depressive Disorder (MDD) is treated with a combination of pharmacological, psychological, and brain stimulation techniques like transcranial magnetic stimulation (TMS). Future research is needed to personalize rTMS treatment based on individual depression subtypes. Electroconvulsive therapy (ECT) is the gold standard for treatment-resistant depression (TRD), while ketamine has demonstrated rapid antidepressant effects. Other emerging treatments include esketamine nasal spray and psilocybin.[51–53]

The cross-sectional design offers insights into mental health at one point but cannot track long-term changes or causality. A longitudinal approach would be better for monitoring mental health over time and understanding its relationship with disease progression. Further research with larger sample sizes and diverse populations is needed to enhance the generalizability and understanding of the findings. A larger and more diverse sample would enhance reduce bias, and improve statistical power, allowing for more accurate results, meaningful subgroup analyses, and deeper insights into depression and anxiety in Parkinson's disease patients. The study's outcomes depend on cultural norms, stigma, healthcare resources, and population differences, limiting their universal applicability.

Future studies should prioritize variables like disease severity, cognitive impairment, social support, cultural stigma, and healthcare access. These factors influence mental health and quality of life in Parkinson's disease patients. Understanding them can guide tailored interventions, reduce stigma, improve care access, and enhance overall patient outcomes. We intend to research the intricate relationships between cognitive health, depression, and anxiety, focusing on Parkinson's disease. We aim to enhance diagnostic criteria and develop specific assessment tools to improve diagnosis accuracy and reliability. This initiative seeks to address the differing prevalence rates of depression and anxiety in Parkinson's patients and clarify previously identified complexities through improved assessment methods.

Abbreviations

PD, Parkinson's Disease; DSM-IV, Diagnostic and Statistical Manual of Mental Disorders–Fourth Edition; PHQ-9, Patient Health Questionnaire-9; GAD-7, Generalized Anxiety Disorder-7; SD, Standard Deviation; OR, Odds Ratio; CI, Confidence Interval.

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Disclosure

The authors declare that they have no conflicts of interest in this work.

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