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Original Article

Correlation Between Functional Mobility and Depression Among Patients with Parkinson's Disease

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ABSTRACT

Background: Parkinson's disease is a progressive neurodegenerative disorder associated with motor impairment and non-motor symptoms, including depressive symptoms that may worsen functional independence and quality of life. Functional mobility limitation and depressive symptom burden frequently coexist, but their clinical relationship requires further evaluation in local Parkinson's disease populations. Objective: To determine the correlation between functional mobility and depressive symptoms among patients with Parkinson's disease and to examine secondary associations with age and gender. Methods: This cross-sectional observational study included 130 clinically diagnosed patients with Parkinson's disease recruited from Mayo Hospital and Lahore General Hospital, Lahore. Functional mobility was assessed using the Timed Up and Go test, and depressive symptoms were assessed using the Hospital Anxiety and Depression Scale. Coded Timed Up and Go and HADS depression scores were analyzed using non-parametric procedures because both variables showed significant departure from normality. Spearman's rank-order correlation and Mann–Whitney U testing were applied, with significance set at $p < 0.05$. Results: The sample included 74 males and 56 females, with a mean age of 60.95 ± 10.88 years. Timed Up and Go score showed a strong positive correlation with HADS depression score ($\rho = 0.833$, $p < 0.001$). Age showed a weak positive correlation with Timed Up and Go score ($\rho = 0.194$, $p = 0.027$), while gender-based comparison of HADS depression scores was not statistically significant ($U = 1814.00$, $p = 0.197$). Conclusion: Functional mobility limitation was strongly associated with depressive symptom burden among patients with Parkinson's disease. Integrated assessment of mobility and psychological symptoms may improve rehabilitation planning and clinical monitoring. Keywords: Parkinson's disease; functional mobility; depression; Timed Up and Go test; Hospital Anxiety and Depression Scale.

INTRODUCTION

Parkinson's disease is a progressive neurodegenerative disorder characterized by the combined burden of motor and non-motor symptoms, both of which contribute substantially to reduced independence, impaired participation in daily activities, and diminished quality of life. Although tremor, rigidity, bradykinesia, gait disturbance, and postural instability are commonly recognized as core clinical manifestations, non-motor symptoms such as depression, anxiety, fatigue, cognitive dysfunction, and sleep disturbances frequently coexist and may intensify the functional impact of the disease. Among these, depression is particularly important because it can reduce motivation, activity participation, treatment adherence, and perceived self-efficacy, thereby worsening the lived experience of Parkinson's disease beyond motor impairment alone. Evidence from recent literature indicates that psychological

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symptoms are highly prevalent among individuals with Parkinson's disease and are closely related to physical function, mobility limitations, and broader health-related quality-of-life outcomes (1).

Functional mobility represents a clinically meaningful domain in Parkinson's disease because it reflects the patient's ability to perform essential transitional and ambulatory tasks required for independent living. Decline in functional mobility may appear as delayed sit-to-stand performance, slower gait initiation, reduced walking speed, impaired turning, poor postural control, and increased difficulty completing daily mobility tasks. The Timed Up and Go test is commonly used in rehabilitation and neurological practice because it captures integrated mobility performance involving standing, walking, turning, and sitting. Previous evidence has shown that functional mobility impairment progresses across stages of Parkinson's disease and is associated with worsening balance, motor control, and daily activity limitations (4). Since mobility impairment restricts social participation and independence, it may also contribute to psychological distress, while depressive symptoms may further reduce physical activity and engagement in rehabilitation, creating a clinically important association between motor and mood-related outcomes.

Depression in Parkinson's disease has been linked with both motor and non-motor disease burden. Studies have reported that depressive symptoms may coexist with axial motor disorders, postural impairment, reduced balance, and poorer motor functioning, suggesting that psychological and physical manifestations may interact within the clinical course of the disease (2). Similarly, physical inactivity and reduced functional activity have been identified as important factors connecting depressive symptoms with worse neurological and cognitive outcomes in individuals with Parkinson's disease (7). Evidence also suggests that depression, fatigue, cardiovascular dysfunction, and other comorbid conditions may contribute collectively to functional dependence over time, emphasizing that mobility decline in Parkinson's disease should not be interpreted only as a motor phenomenon but as part of a broader biopsychosocial disability profile (5).

The relationship between depression and Parkinson's disease may also be explained through shared neurobiological and behavioral pathways. Dopaminergic dysfunction, alterations in serotonergic and noradrenergic regulation, inflammatory mechanisms, and disease-related neurodegeneration have been implicated in the pathobiology of depression in Parkinson's disease (8). At the same time, behavioral consequences of depression, including reduced motivation, inactivity, low confidence, and social withdrawal, may aggravate mobility limitation and rehabilitation disengagement. Population-level evidence has further suggested an association between depression and the risk or clinical burden of Parkinson's disease, highlighting the need to consider depressive symptoms as an important component of routine assessment rather than a secondary or unrelated complaint (6).

Although international literature increasingly recognizes the association between mobility impairment and depressive symptoms in Parkinson's disease, local clinical evidence remains limited, particularly in rehabilitation-relevant hospital settings where patients often present with both functional limitations and psychological distress. Existing studies have examined physical activity, posture, motor progression, quality of life, and depression in Parkinson's disease; however, fewer studies have directly examined the relationship between functional mobility performance and depressive symptom burden using practical clinical tools such as the Timed Up and Go test and the Hospital Anxiety and Depression Scale in local patient populations. This gap is important because early identification of patients with concurrent mobility limitation and depressive symptoms may support integrated rehabilitation planning, timely referral, and more patient-centered management.

Therefore, the present study was conducted to determine the correlation between functional mobility and depressive symptoms among patients with Parkinson's disease. The primary objective was to assess whether greater functional mobility limitation, measured through the Timed Up and Go test, was associated with higher depressive symptom burden, measured through the Hospital Anxiety and Depression Scale. The secondary objective was to examine whether age and gender were associated with

functional mobility and depressive symptoms in this population. It was hypothesized that patients with greater functional mobility limitation would demonstrate higher depressive symptom scores.

MATERIALS AND METHODS

This cross-sectional observational study was conducted among patients with clinically diagnosed Parkinson's disease recruited from Mayo Hospital and Lahore General Hospital, Lahore. A cross-sectional design was selected because the study aimed to examine the association between functional mobility and depressive symptoms at a single point in time rather than to establish causal direction or evaluate treatment effects. The study population included adult patients with Parkinson's disease aged 40 years or above who were able to walk and understand the questionnaire items sufficiently to complete the assessment process. Patients with atypical Parkinsonism, cognitive impairment affecting questionnaire comprehension, acute illness, severe mobility restriction preventing completion of the Timed Up and Go test, or a previously diagnosed psychiatric disorder unrelated to current symptom screening were excluded to ensure that the measured outcomes reflected functional mobility and depressive symptom burden within a clinically comparable Parkinson's disease sample.

A total of 130 eligible participants were recruited using convenience sampling after obtaining informed consent. All participants were informed about the purpose of the study, the voluntary nature of participation, and the confidentiality of their responses before data collection. Demographic and clinical information was collected using a structured data collection form, including age, gender, height, weight, body mass index, socioeconomic status, assistive device use, and comorbidity status where available. Parkinson's disease diagnosis was treated as the defining clinical condition for study eligibility, while functional mobility and depressive symptoms were assessed as the principal study variables.

Functional mobility was assessed using the Timed Up and Go test. During the test, participants were required to rise from a chair, walk a short standardized distance, turn, return to the chair, and sit down. The test was used as a practical measure of integrated mobility performance, including transitional movement, gait, turning ability, and postural control. For analysis, Timed Up and Go performance was coded into ordered categories ranging from 1 to 4, with higher values representing greater functional mobility limitation. Depressive symptoms were assessed using the depression component of the Hospital Anxiety and Depression Scale. Responses were coded into ordered categories ranging from 1 to 3, with higher values representing greater depressive symptom burden. These operational definitions were used consistently during statistical analysis so that the direction of association could be interpreted as the relationship between increasing mobility limitation and increasing depressive symptoms.

To reduce measurement variability, data collection followed a uniform procedure for all participants. Eligible patients were approached in the clinical setting, consent was obtained, demographic and clinical information was recorded, depressive symptom assessment was completed using the Hospital Anxiety and Depression Scale, and functional mobility was then assessed using the Timed Up and Go test. Participants were assessed under comparable clinical conditions, and data forms were checked for completeness before statistical entry. The use of standardized tools, predefined eligibility criteria, and a uniform data collection sequence was intended to reduce information bias and improve reproducibility. Potential confounding by age and gender was explored through secondary analyses because both variables may influence mobility performance and depressive symptom burden in Parkinson's disease.

Data were analyzed using SPSS version 25. Descriptive statistics were calculated for demographic, anthropometric, clinical, and outcome variables. Continuous variables such as age, weight, and height were summarized using mean and standard deviation, while categorical variables were summarized using frequencies and percentages. The distribution of Timed Up and Go and Hospital Anxiety and Depression Scale scores was assessed using Kolmogorov–Smirnov and Shapiro–Wilk tests. Since both primary outcome variables showed statistically significant departure from normality and were analyzed as ordered categories, non-parametric statistical procedures were applied. Spearman's rank-order

correlation was used to examine the association between Timed Up and Go score and Hospital Anxiety and Depression Scale score, and also to assess the relationship between age and Timed Up and Go score. The Mann–Whitney U test was used to compare depressive symptom scores between male and female participants. Statistical significance was set at $p < 0.05$.

Ethical approval for the study was obtained from the Institutional Ethical Review Committee of the University of Lahore under approval number UOL/IREB/26/20/09/0028. The study was conducted in accordance with ethical principles for human participant research. Informed consent was obtained from all participants before data collection, participation was voluntary, and confidentiality and anonymity were maintained throughout the research process.

RESULTS

A total of 130 patients with clinically diagnosed Parkinson's disease were included in the analysis. The sample comprised 74 males and 56 females, representing 56.9% and 43.1% of the study population, respectively. The mean age of the participants was 60.95 ± 10.88 years, with an observed age range of 40 to 85 years. The mean body weight was 72.94 ± 5.96 kg, while the mean height was 166.29 ± 6.86 cm. The coded Timed Up and Go score ranged from 1 to 4, with a mean of 2.60 ± 0.85, while the coded Hospital Anxiety and Depression Scale depression score ranged from 1 to 3, with a mean of 2.09 ± 0.80. These descriptive findings indicate that the study sample included older adults with Parkinson's disease and measurable variation in both functional mobility limitation and depressive symptom burden.

Table 1. Demographic and Clinical Characteristics of Participants With Parkinson's Disease (N = 130)

Variable	n (%)	Minimum	Maximum	Mean ± SD
Male	74 (56.9)			
Female	56 (43.1)			
Age (years)		40	85	60.95 ± 10.88
Weight (kg)		60	84	72.94 ± 5.96
Height (cm)		155	176	166.29 ± 6.86
Timed Up and Go score		1	4	2.60 ± 0.85
HADS depression score		1	3	2.09 ± 0.80

SD, standard deviation; HADS, Hospital Anxiety and Depression Scale.

The distribution of sex showed a modest male predominance, with males accounting for 74 of 130 participants. The mean age of approximately 61 years reflects the older clinical profile commonly observed in Parkinson's disease populations. The coded Timed Up and Go and HADS depression scores showed sufficient spread across their reported ranges to permit rank-based association testing between functional mobility limitation and depressive symptom burden.

The normality assessment demonstrated statistically significant departures from normal distribution for both the coded Timed Up and Go score and the coded HADS depression score. The Kolmogorov–Smirnov test showed $D = 0.227$ for Timed Up and Go and $D = 0.240$ for HADS depression, with p-values below 0.001 for both variables. The Shapiro–Wilk test similarly showed $W = 0.872$ for Timed Up and Go and $W = 0.795$ for HADS depression, again with p-values below 0.001. Based on these findings and the ordinal coded nature of the primary variables, non-parametric statistical procedures were used for inferential analyses.

Table 2. Normality Assessment for Timed Up and Go and HADS Depression Scores (N = 130)

Variable	Kolmogorov–Smirnov D	df	p-value	Shapiro–Wilk W	df	p-value
Timed Up and Go score	0.227	130	<0.001	0.872	130	<0.001
HADS depression score	0.240	130	<0.001	0.795	130	<0.001

HADS, Hospital Anxiety and Depression Scale.

Both primary study variables showed non-normal distributions across the study sample. The larger departure observed for the HADS depression score on the Shapiro–Wilk statistic supports the use of

Spearman's rank-order correlation rather than Pearson correlation for assessing the relationship between depressive symptoms and functional mobility limitation.

Spearman's rank-order correlation demonstrated a strong positive association between coded Timed Up and Go score and coded HADS depression score. The correlation coefficient was 0.833, with a p-value below 0.001, indicating that higher functional mobility limitation scores were closely associated with higher depressive symptom scores. Age also showed a statistically significant positive association with Timed Up and Go score, although the magnitude of the correlation was weak. The correlation between age and Timed Up and Go score was 0.194, with a p-value of 0.027.

Table 3. Spearman Rank-Order Correlations Between Study Variables (N = 130)

Variable Pair	Spearman's rho	p-value
Timed Up and Go score and HADS depression score	0.833	<0.001
Age and Timed Up and Go score	0.194	0.027

HADS, Hospital Anxiety and Depression Scale.

The strongest observed association was between functional mobility limitation and depressive symptom burden. The positive coefficient indicates that participants with higher Timed Up and Go category scores also tended to report higher HADS depression category scores. The association between age and functional mobility limitation was statistically significant but weak, suggesting that advancing age contributed only modestly to variation in mobility limitation within this sample.

Comparison of depressive symptom scores between male and female participants was performed using the Mann–Whitney U test. The test statistic was 1814.00 with a p-value of 0.197, indicating no statistically significant difference in HADS depression score distribution between male and female participants based on the available analysis.

Table 4. Gender-Based Comparison of HADS Depression Scores (N = 130)

Comparison	Male n	Female n	Mann–Whitney U	p-value
HADS depression score by gender	74	56	1814.00	0.197

HADS, Hospital Anxiety and Depression Scale.

The gender-based comparison did not show a statistically significant difference in depressive symptom scores between male and female participants. Although the study sample included more males than females, the available inferential result suggests that depressive symptom burden was not significantly different across gender groups in this cohort.

Overall, the results demonstrate a strong positive relationship between functional mobility limitation and depressive symptom burden among patients with Parkinson's disease. The association between age and mobility limitation was present but weak, while gender was not significantly associated with depressive symptom score in the reported analysis. These findings support the clinical relevance of assessing depressive symptoms alongside functional mobility in patients with Parkinson's disease, particularly because greater mobility limitation was closely associated with higher depressive symptom burden in this sample.

Reviewer-style data note: BMI categories, socioeconomic class, assistive device use, and comorbidity distributions were described narratively in the original manuscript but were not included in the revised Results tables because the supplied values were approximate or internally inconsistent. For publication, these variables should be rechecked against the original dataset and added as exact n (%) values with denominators summing correctly to N = 130, unless categories are non-mutually exclusive.

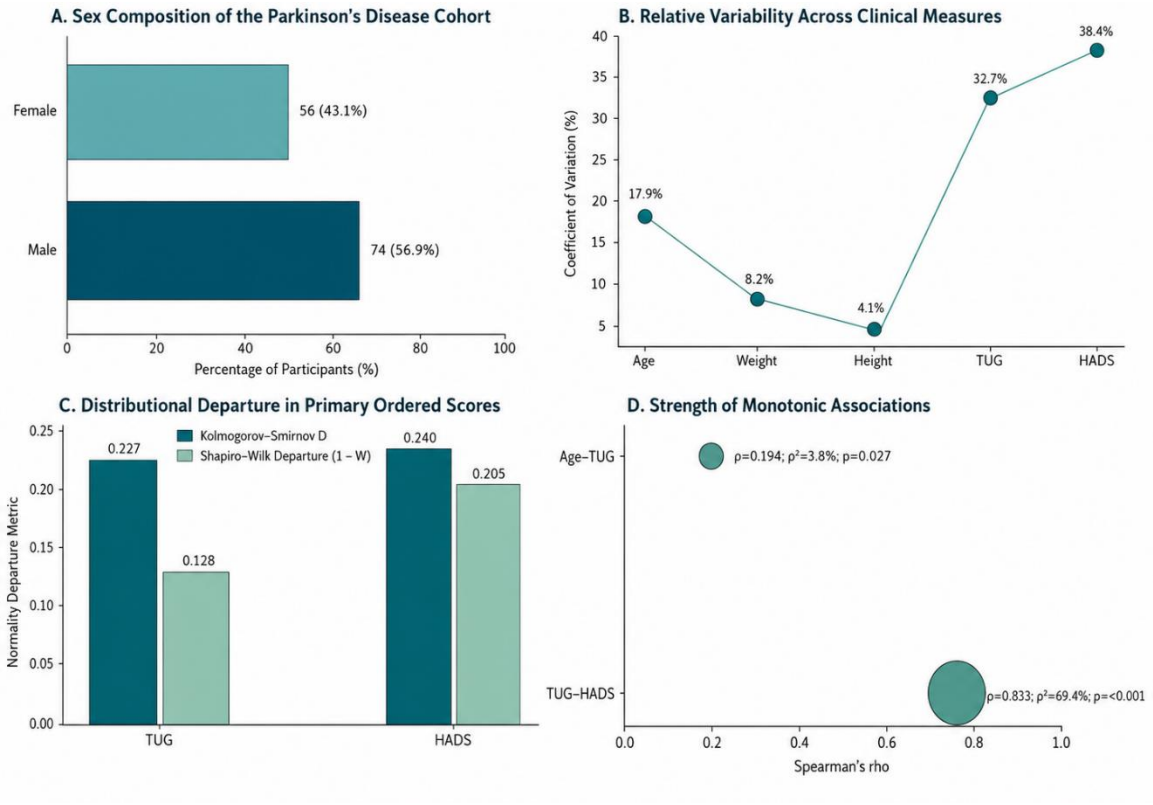

Figure 1 presents an integrated clinical profile of the Parkinson's disease cohort using derived aggregate indicators. Males constituted 56.9% of the sample and females 43.1%, indicating modest male predominance. Relative variability was highest for HADS depression score, with a coefficient of variation of 38.4%, followed by Timed Up and Go score at 32.7%, suggesting greater dispersion in symptom and mobility categories than in anthropometric measures. Distributional assessment showed measurable departure from normality for both primary ordered scores, with Kolmogorov–Smirnov values of 0.227 for Timed Up and Go and 0.240 for HADS, while Shapiro–Wilk departure was greater for HADS (1 − W = 0.205) than Timed Up and Go (1 − W = 0.128). The association panel demonstrates that the Timed Up and Go–HADS relationship was substantially stronger (ρ = 0.833; ρ² = 69.4%; p < 0.001) than the age–Timed Up and Go relationship (ρ = 0.194; ρ² = 3.8%; p = 0.027), supporting the clinical interpretation that depressive symptom burden was more closely aligned with functional mobility limitation than with chronological age alone.

DISCUSSION

The present study demonstrated a strong positive association between functional mobility limitation and depressive symptom burden among patients with Parkinson's disease. Patients with higher coded Timed Up and Go scores, indicating greater mobility limitation, also had higher coded HADS depression scores, with a Spearman's rho of 0.833 and a p-value below 0.001. This finding supports the clinical relevance of assessing psychological symptoms alongside functional mobility in Parkinson's disease rather than treating motor and mood-related impairments as separate clinical domains. Because the study used a cross-sectional design, the observed relationship should be interpreted as an association rather than evidence of temporal sequence or causality. Nevertheless, the strength of the correlation suggests that patients presenting with greater difficulty in functional mobility tasks may warrant closer screening for depressive symptoms during routine neurological and rehabilitation assessment.

The observed association is consistent with broader evidence showing that non-motor symptoms in Parkinson's disease, including depression, are closely linked with disease burden, functional impairment, and reduced quality of life. Neurobiological explanations proposed in previous literature suggest that depressive symptoms in Parkinson's disease may involve disturbances in dopaminergic, serotonergic, and noradrenergic pathways, hypothalamic–pituitary–adrenal axis dysregulation, inflammatory mechanisms, and broader neurodegenerative changes affecting both mood regulation and motor control. These mechanisms provide a plausible background for the present finding, although they were not directly measured in this study. Therefore, the current results should be understood as clinical evidence of co-occurrence between mobility limitation and depressive symptom burden, while

mechanistic explanations remain dependent on prior neurobiological literature rather than the present dataset itself (9).

The strong relationship between Timed Up and Go score and HADS depression score is also compatible with evidence that poorer gait performance, balance impairment, reduced endurance, and greater functional dependence are associated with worse psychosocial outcomes in Parkinson's disease. Previous clinical research has shown that individuals with Parkinson's disease may demonstrate slower gait, impaired balance, lower endurance, and poorer quality-of-life indicators compared with healthy older adults, and that comorbid conditions may further intensify both motor and psychological burden. In the present study, the mobility–depression association was stronger than the age–mobility association, suggesting that depressive symptom burden was more closely aligned with functional mobility limitation than with chronological age alone. This distinction is clinically important because it indicates that mobility assessment should not be interpreted only through ageing, but also in relation to concurrent psychological health and rehabilitation engagement (10).

The present findings also correspond with studies reporting a substantial prevalence of depressive symptoms among patients with Parkinson's disease and identifying motor severity, activities of daily living impairment, and higher disability scores as relevant correlates of depression. Prior evidence from clinical samples has shown that depressive symptoms in Parkinson's disease are frequently mild to moderate but clinically meaningful, especially when accompanied by greater disease severity and functional limitation. The current study similarly found that patients with higher mobility limitation scores had higher depressive symptom scores, reinforcing the need for integrated clinical pathways in which functional performance and mood screening are assessed together. Such an approach may support earlier identification of patients at risk of reduced activity participation, poor rehabilitation adherence, and decline in perceived independence (11).

Age showed a weak but statistically significant positive association with functional mobility limitation in this study. The correlation between age and Timed Up and Go score was 0.194, indicating that advancing age was associated with poorer mobility performance, but the magnitude of association was small. This finding suggests that while age may contribute to mobility limitation in Parkinson's disease, it is unlikely to explain most of the variability in functional mobility within the sample. Previous research has suggested that older patients with Parkinson's disease and comorbid depressive symptoms may show poorer baseline motor and functional profiles, but age-related effects are often intertwined with disease duration, disease severity, comorbidity burden, medication status, and general physical conditioning. Since these variables were not fully adjusted in the present analysis, the age-related finding should be interpreted cautiously and should be tested in future studies using multivariable models (12).

The gender-based comparison showed no statistically significant difference in HADS depression scores between male and female participants. Although the sample had a modest male predominance, the Mann–Whitney U test did not indicate a significant difference in depressive symptom burden by gender. This finding is consistent with prior work suggesting that while some gender-related differences may exist in motor, cognitive, psychosocial, or quality-of-life domains among patients with Parkinson's disease, depression scores may not always differ significantly between men and women in mild-to-moderate clinical samples. The absence of a significant gender difference in the present study suggests that depressive symptom screening should be applied broadly to all patients with Parkinson's disease rather than selectively based on gender (13).

The clinical implication of this study is that functional mobility assessment may help identify patients who also require psychological screening and supportive care. In rehabilitation settings, patients with higher Timed Up and Go scores may benefit from a more integrated assessment approach that includes depressive symptom screening, education, fall-risk reduction, physical activity counseling, and referral for psychological or psychiatric support when indicated. However, the findings do not establish whether mobility limitation leads to depressive symptoms, whether depressive symptoms contribute to poorer

mobility, or whether both arise from shared disease-related mechanisms. Longitudinal and interventional studies are needed to determine directionality and to evaluate whether combined mobility-focused rehabilitation and psychological support can improve both functional and mood-related outcomes.

This study has several limitations. The cross-sectional design prevents causal inference and does not allow assessment of symptom progression over time. Convenience sampling from two hospital settings may limit generalizability to community-based patients or those with different disease severity profiles. The Timed Up and Go and HADS variables were analyzed as coded ordinal scores, and the absence of raw TUG time in seconds and raw HADS depression subscale scores limits detailed interpretation of severity gradients. Important clinical variables such as disease duration, Hoehn and Yahr stage, medication status, levodopa equivalent dose, cognitive status scale scores, fall history, and disease-specific quality-of-life measures were not incorporated into adjusted analyses. Despite these limitations, the study provides clinically useful evidence that mobility limitation and depressive symptom burden are strongly associated in patients with Parkinson's disease and supports the need for integrated motor and psychological assessment in routine care.

CONCLUSION

This study found a strong positive association between functional mobility limitation and depressive symptom burden among patients with Parkinson's disease, indicating that participants with poorer mobility performance on the coded Timed Up and Go measure also had higher coded HADS depression scores. Age showed a weak but statistically significant association with functional mobility limitation, while depressive symptom scores did not differ significantly by gender. These findings support the clinical importance of assessing depressive symptoms alongside functional mobility in patients with Parkinson's disease and suggest that rehabilitation planning should consider both motor performance and psychological wellbeing. Because the study was cross-sectional, the findings should be interpreted as associative rather than causal, and future longitudinal and interventional studies are required to clarify directionality and determine whether integrated rehabilitation and psychological support can improve both mobility and mood-related outcomes.

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