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RESEARCH ARTICLE

Correlation between freezing of gait and fear of fall in patients with Parkinson disease

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ABSTRACT

Background: Parkinson's disease (PD) is a degenerative movement disorder characterized by the presence of Lewy bodies in the midbrain and the loss of dopamine producing neurons in the substantia nigra. PD presents with a wide range of symptoms, encompassing both motor or non-motor aspects.

Objective: To assess the relationship between gait freezing and fear of falling in individuals diagnosed with Parkinson's disease.

Methods: A cross-sectional study having ethical approval number LCPT/DPT/18/804 was conducted on 72 PD patients at Stage III (Hoehn & Yahr), aged between 55 to 75 years, using convenient non-probability sampling. Participants were recruited from multiple hospitals in Lahore, while patients with comorbidities, cognitive dysfunction and secondary Parkinsonism were excluded. Gait freezing was assessed using Freezing of Gait Questionnaire (FOG-Q), with a validity of 0.96 and reliability 0.95; whereas, fear of falling was evaluated using Fall Efficacy Scale- International (FES-I), which has a validity of 0.84 and reliability 0.95 among PD patients. The duration of study was 6 months from June 2022 to Jan 2023.

Results: Among the 72 patients, 42 individuals (58.3%) were male, while 30 individuals (41.7%) were female. Mean age of study subjects was 62.09±5.93 years. The results of the study showed that freezing of gait and fear of fall were moderately positively correlated, with the correlation coefficient of r= 0.611 and a p-value of < 0.001.

Conclusion: Moderate Correlation was reported between gait freezing and fear of falling in individuals diagnosed with third stage of Parkinson's disease.

Keywords: Cognitive Dysfunction, Correlation, Parkinson disease, Tremors.

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Introduction:

Parkinson's Disease (PD) is a neurodegenerative condition that progresses over time and impacts the central nervous system (CNS), resulting in various motor and non-motor challenges.(1,2) It ranks as the second most prevalent degenerative condition causing neurological deficits, impacting over 1% of individuals aged 65 and above.(3) Pathologically, PD is marked by the deterioration of dopaminergic neurons in the midbrain's substantia nigra, often accompanied with appearance of Lewy bodies which are aggregation of misfolded α-synuclein cytoplasmic inclusions.(4) Incidence of PD is on the rise and is expected to reach 13 million cases by 2040.(5) PD affects over 450,000 people in Pakistan; more men than women get the condition.(6,7)

PD is recognized as a disease of the motor system, the primary characteristics of this condition include tremors, stiffness, slowed movement and difficulty in maintaining balance.(8) Additional signs of motor dysfunction encompass a decline in muscle power and function as well as abnormalities in walking pattern.(9) Non motor symptoms encompass autonomic nervous system dysfunction, olfactory loss, mood and cognitive disorders, and sleep disturbances like insomnia, daytime sleepiness, or rapid eye movement (REM) issues. (10) The Hoehn & Yahr (H&Y) classification scale categorizes PD into five stages, reflecting symptom severity and disease progression.(11) The first stage signifies minimal disability on one side of the body, second stage is minimally disabled in both directions

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but not affecting balance, third stage involves decreased reflexes and poor balance, fourth stage indicates extreme disability requiring help with standing and mobility, and fifth stage denotes wheelchair or bed confinement.(12) Stage 0 represents no symptoms, while stage 5 indicates complete bedridden state.(13)

The term "freezing of gait" (FOG) refers to the intermittent difficulty in initiating effective stepping motions, frequently leading to sudden and temporary immobilization of the feet despite the intent to walk.(14) Gait freezing is a prevalent symptom in PD, characterized by episodes of halted movement lasting seconds or more and people commonly reporting they feel their feet are 'glued to the floor'.(15,16) It leads to falls and injuries related to falls, as well as disability, feelings of depression, diminished quality of life, and decreased ability to carry out daily activities independently.(17,18) Sudden episodes of FOG are a significant contributor to balance disruption and are among the leading causes of falls in individuals with PD.(19) Studies have shown that FOG is correlated with greater variability in stride, lack of coordination in bilateral walking, and pronounced imbalance in gait symmetry.(20) During episodes of gait freezing, center of gravity (COG) keeps moving forward while foot remain stationary, potentially resulting in instability and falls.(21) Difficulty in voluntarily controlling the COG might contribute to the balance disturbances observed during episodes of freezing.(22) Hence, FOG and falls are prevalent and disabling issues in Parkinson's disease, often interconnected.(23) They share common risk factors, with FOG being a leading cause of falls.(24)

Parkinson's disease is prevalent in our society, often leading to challenges such as freezing of gait and the consequent fear of falling among patients. This study aims to assess the relationship between gait freezing and fear of falling in individuals diagnosed with Parkinson's disease. Understanding this correlation could help healthcare professionals to develop more tailored treatment strategies, refine diagnostic approaches, and provide targeted advice to potentially enhance the quality of life of individuals with Parkinson's disease.

Methods:

It was a cross-sectional study; the following Lahore hospitals were used to recruit (n= 72) PD patients: Mayo, Jinnah, General, Services, and Ghurki Trust Teaching Hospital. From June 2022 to January 2023, the study was conducted. Non-probability convenience sampling was the method of sampling that was applied. The sample size was calculated using the WHO Sample Size Calculator. The estimated size was n=72, based on a 95% confidence interval, an expected population proportion of p=0.045, and an absolute precision of d=0.05.(25) The study received approval from the ethics board of Lahore College of Physical Therapy under the reference number LCPT/DPT/18/804. The criteria for inclusion included middle-aged and elderly people aged 55 to 75 who had a clinical diagnosis of Parkinson disease at stage 3 of Hoehn & Yahr classification of the disease. Individuals with co morbidities like cardiac conditions, pulmonary illness and paralysis of any limb, traumatic brain injury and cognitive dysfunction along with secondary Parkinsonism were not included in this study. Prior to the study, written consent was obtained from every patient.

The participants were requested to fill out two essential questionnaires: Freezing of Gait Questionnaire (FOG-Q) and Fall Efficacy Scale-International (FES-I) Questionnaire. These questionnaires are chosen for their established reliability and validity in assessing freezing of gait and fear of fall among PD patients. The FOG-Q, with validity is 0.96 and reliability is 0.95, consists of six questions and provides a score ranging from 0 to 24, where a higher score indicates more severe FOG.(26)

On the other hand, the FES-I, comprising 16 items, is designed to evaluate fear of fall among PD patients across 16 social and physical activities conducted both indoors and outdoors, the assessment considers whether the individual engages in these activities, regardless of actual participation. Its reliability is 0.95 and validity is 0.84. Greater the score, greater the fear for falling. The scoring system runs from minimal 16 (no care about falling) to maximal 64 (severe fear about falling).(27-29)

Statistical Package for Social Sciences (SPSS) version 26 was utilized for data entry and analysis. Descriptive statistics were presented using frequency tables; whereas, Pearson's correlation was used to evaluate the correlation between fear of falling (FES) and freezing of gait (FOG). The correlation is statistically significant when the significance level is $p<0.01$.

Results:

Among the 72 participants, the youngest individual was aged 56, while the oldest was 70. The mean age of the participants was 62.09±8.82), with a minimum age of 56 and maximum age of 70. Male participants accounted for 58.3% (n=42), while females comprised 41.7% (n=30) of the total.

Freezing of Gait among patients with PD was assessed with FOG-Q as shown in Table 1.

Out of 72 participants, 45.8% (n=33) required assistance at their worst walking state. Additionally, 33.3% (n=24) experienced moderate impact on daily activities, while 26.4% (n=19) felt that once a day their feet get glued on the floor. Notably, 34.4% (n=25) endured longer freezing episodes. Furthermore, 38.9% (n=28) faced hesitation episodes lasting over 1 second, and 41.7% (n=30) encountered turning hesitations lasting 3-10 seconds. Whereas, table 2 shows the descriptive statistics of FOG-Q where mean value is 12.63±4.22.

Table 1: Freezing of Gait Questionnaire (FOG-Q)

FOG-Q		
Questions	**Responses**	**n (%)**
Do you work when you're at your worst state?	Normally	0(0%)
	Moderately mobile with occasional slowness	13(18.1%)
	Slow-moving yet self-sufficient	19(26.4%)
	Requires assistance or mobility aid for walking	33(45.8%)
	Incapable of walking	7(9.7%)
Do your everyday activities and independence suffer as a result of your gait problems?	No	1(1.4%)
	Slightly	21(29.2%)
	Moderately	24(33.3%)
	Severely	24(33.3%)
	Incapable of walking	2(2.8%)
When turning, walking, or even just trying to start walking, do you ever feel like your feet are stuck to the ground?	Absolutely no	1(1.4%)
	Very seldom, perhaps once a month	15(20.8%)
	Rarely-once a day	19(26.4%)
	Occasionally, about once a week	26(36.1%)
	Consistently whenever walking	11(53.3%)
What is the duration of your longest episode of freezing?	Never occurred	2(2.8%)
	1-2 sec	28(38.9%)
	3-10 sec	25(34.7%)
	11-30 sec	14(19.4%)
	Incapable of walking >30 sec	3(4.2%)
What is the average duration of an episode of start hesitation for you?	None	2(2.8%)
	Requires >1 sec to initiate walking	22(30.6%)
	Requires >3 sec to initiate walking	28(38.9%)
	Requires >10 sec to initiate walking	20(27.8%)
	Requires >30 sec to initiate walking	0(0%)
How long is your typical turning hesitation?	None	2(2.8%)
	Resume turning in 1-2 sec	26(36.1%)
	Resume turning in 3-10 sec	30(41.7%)
	Resume turning in 11-30 sec	13(18.1%)
	Incapable of resuming turning > 30 sec	1(1.4%)

Table 2: Descriptive Statistics of Freezing of Gait Questionnaire (FOG-Q)

No.	Min	Max	Mean	Std. Dev
72	3	20	12.63	4.22

Fear of falling among participants was assessed using the Falls Efficacy Scale-International (FES-I), with results summarized in Table 3. Activities such as shopping (54.2%), social events (51.4%), and walking in the neighborhood (45.8%) elicited higher levels of concern among participants, particularly during tasks involving mobility or uneven surfaces. Whereas, table 4 shows the descriptive statistics of FES-I with a mean score of 36.69±10.07.

Table 3: Fall of Efficacy Scale-International (FES-I)

FES-I				
Questions	**Not at all Concerned n (%)**	**Somewhat Concerned n (%)**	**Fairly Concerned n (%)**	**Very Concerned n (%)**
Cleaning the house	21 (29.2%)	23 (31.9%)	23 (31.9%)	5 (6.9%)
Making basic meals	28 (38.9%)	30 (41.7%)	12 (16.7%)	2 (2.8%)
Bathing or showering	9 (12.5%)	29 (40.3%)	26 (36.1%)	8 (11.1%)
Visting to the store	16 (22.2%)	39 (54.2%)	12 (16.7%)	5 (6.9%)
Sitting & standing from a chair	9 (12.5%)	37 (51.4%)	24 (33.3%)	2 (2.8%)
Climbing and descending stairs	5 (6.9%)	20 (27.8)	32 (44.4%)	15 (20.8%)
Strolling around the neighborhood	21 (29.2%)	33 (45.8%)	13 (18.1%)	5 (6.9%)
Grasping anything from the ground or above your head	24 (33.3%)	35 (48.6%)	12 (16.7%)	1 (1.4%)
Answering the telephone before it stops ringing.	15 (20.8%)	25 (34.5%)	25 (34.5%)	7 (9.7%)
Strolling on a slippery surface	9 (12.5%)	17 (23.6%)	27 (37.5%)	19 (26.4%)
Paying a visit to a loved one	18 (25.0%)	37 (51.4%)	16 (22.2%)	1 (1.4%)
Strolling on an uneven ground	3 (4.2%)	20 (27.8%)	27 (37.5%)	22 (30.6%)
Strolling uphill or downhill	5 (6.9%)	22 (30.6%)	30 (41.7%)	15 (20.8%)
Attending a social gathering	17 (23.6%)	37 (51.4%)	18 (25.0%)	0 (0%)

Table 4: Descriptive Statistics of Fall of Efficacy Scale-International (FES-I)

No.	Min	Max	Mean	Std. Dev
72	21	59	36.69	10.07

Table 5 revealed a significant positive correlation ($r = 0.611$, $p < .001$) between gait freezing and fear of fall in people with PD. This suggests that as freezing of gait increases, so does fear of fall, indicating a potential interdependence between these two factors in Parkinson's disease.

Table 5: Correlation between FOG & FES

Correlation		FOG	FES
Freezing of gait	Pearson correlation	1	.611*
	Sig. (2-tailed)		.000
Fear of fall	Pearson correlation	.611**	1
	Sig. (2-tailed)	.000	

*** Significant correlation is found at the 2-tailed 0.01 level.*

Discussion:

The aim of this study was to ascertain a correlation between gait freezing and fear of fall in individuals with PD by using Freezing of Gait Questionnaire (FOG-Q) and Fall of Efficacy Scale (FES). By understanding this correlation, healthcare professionals can better tailor treatment strategies, optimize diagnostic approaches, and provide targeted advice to enhance Parkinson's patients' quality of life. Whereas, results of current study revealed a strong positive correlation between FOG and FES ($r = 0.611$, $p < 0.001$), demonstrating that as freezing of gait increases, so did the fear of falling. According to the FOG-Q score, 33.3% of participants had a moderate impact on daily tasks, 45.8% required assistance and 34.4% experienced prolonged episodes of freezing. These results demonstrate how motor and non-motor symptoms in PD are interrelated, highlighting the necessity of thorough evaluations and focused treatments to improve patient outcomes.

In 2020, a study studied the relationship between pain, falls, and FOG in PD patients, concluding that both falls and FOG occur more frequently in PD patients as their motor symptoms worsened. Whereas, among male individuals, FOG severity is positively linked with pain and lower extremity pain is more prevalent in PD patients who experience falls. Thus, pain shows a correlation with both FOG and falls.(30) Hence, results of the current study highlights that there is a significant correlation between gait freezing and fear of fall in PD. This aligns with findings of above study; thus, FOG is one of the major factors which leads to functional impairments in PD.

A cross-sectional study assessed gait attributes linked to apprehension of falling in hospitalized individuals with PD. Fear of falling (FOF) was assessed by using the FES-I (Falls Efficacy Scale International) on 79 people with advanced Parkinson's disease. FES-I scoring revealed, 22.5% participants expressed mild concerns, 28.7% moderate concerns, and 47.5% significant concerns regarding falling. The majority of apprehensions were noted during walking on slippery or uneven surfaces, as well as on up and down slopes. The study concluded that a significant relationship exists amongst FOF and alterations in gait among hospitalized PD patients.(31) Similarly, current study measured FOF using the same tool FES-I and demonstrated increased concern among participants, predominantly during specific activities like stairs climbing (44.4%), walking on uneven surface (37.5%), walking on slopes (41.5%) and neighborhood walking (45.8%).These similarities in findings validate the importance of FOF in daily life situations and highlight the necessity of individualized patient treatment plans focusing on environment-specific challenges to lessen the risk of falls.

A cross-sectional study determined the association between FOG and restrictions on daily activities in people with PD who were experiencing minimal cognitive impairment. The findings revealed a significant association between gait freezing and self-perceived limitations in daily activities, both within the home environment and in community settings, among individuals with PD measured by Activities of Daily Living Questionnaire (ADLQ).(32) However, current study highlighted the fear dimension and showed a positive association between FOG and FOF, while John V Rider et al. focused on functional restrictions across a wide variety of daily tasks.

Another study conducted a longitudinal analysis to determine the association between FOG, FOF and anxiety among PD patients. They found a substantial association between all the factors; however, the association between FOG and anxiety diminished when FOF was taken into account as an independent variable. This implies that the association between anxiety and gait issues may be mediated by FOF.(33) Conversely, current study reported strong association ($r=0.61$, $p<0.001$) between FOG and FOF, but our study did not analyse anxiety relation with PD.

A cross-sectional study explored the relationship between pain, FOG, and falls in PD patients. This study

demonstrated that FOG and falls were associated with severe motor symptoms, and advanced disease stages. Lower extremity pain was more common in patients with falls, and a positive correlation was observed between FOG severity and pain in male patients.(34) While Yilmaz reported a correlation between FOG severity and pain in PD patients, current study focused on the psychological dimension of fear of falling, revealing a moderate positive correlation (r = 0.611) between FOG and fear.

A study explored gender-specific associations between body composition, FOG and falls in PD. The study found that in males, lower leg lean mass was significantly associated with FOG but not with falls, while in females, higher leg adipose mass was associated with falls but not with FoG. These findings suggest that gender differences in body composition may influence the manifestation of gait difficulties and falls in PD patients.(35) While current study observed a moderate positive correlation (r = 0.611) between FOG and fear of falling, it did not explore gender differences nor did it investigate body composition as a contributing factor.

Limitations of this study includes potential underreporting of PD cases owing to patients delayed medical consultations, leading to possible sampling bias. Moreover, the small sample of Parkinson's patients may limit the generalizability of findings. Additionally, relying solely on the FOG-Q for freezing of gait evaluation may overlook relevant measures like FOG-Q3-6 and FOG-Q3, potentially narrowing the assessment scope.

Future research should aim for broader data collection across Pakistan to enhance representation. Including patients across all Hoehn-Yahr stages would provide a more comprehensive understanding. Exploring associations between freezing of gait and other cognitive domains, like memory and attention, is crucial. Implementing occupational therapy interventions for safe mobility and home hazard prevention could be valuable in future studies.

Conclusion:

This study reveals a positive correlation between fear of falling and gait freezing in stage III PD patients, emphasizing their interdependence. These finding emphasizes the importance of addressing both symptoms in patient management strategies to improve patient mobility, confidence and quality of life. Thus, integrated strategies that address both motor and non-motor symptoms may be essential for enhancing outcomes in PD patients.

Disclaimer: None to declare.

Conflict of Interest: One of the co-authors of this manuscript is also a member of the Institutional Review Board. He was not part of the ethical review process.

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References:

1. Tansey MG, Wallings RL, Houser MC, Herrick MK, Keating CE, Joers V. Inflammation and immune dysfunction in Parkinson disease. Nature Reviews Immunology. 2022 Nov;22(11):657-73.
2. Fatima R, Safdar N, Faisal S, Asim HM. Functional Status Among Patients with Stage III Parkinson's Disease. Pakistan Journal of Rehabilitation. 2023 Jul 4;12(2):52-9.
3. Aarsland D, Batzu L, Halliday GM, Geurtsen GJ, Ballard C, Ray Chaudhuri K, Weintraub D. Parkinson disease-associated cognitive impairment. Nature Reviews Disease Primers. 2021 Jul 1;7(1):47.
4. Gómez-Benito M, Granado N, García-Sanz P, Michel A, Dumoulin M, Moratalla R. Modeling Parkinson's disease with the alpha-synuclein protein. Frontiers in pharmacology. 2020 Apr 23;11:356.
5. Zhu J, Cui Y, Zhang J, Yan R, Su D, Zhao D, Wang A, Feng T. Prevalence of Parkinson's Disease and its Trend from 1980 to 2023: A Systematic Review and Meta-Analysis. Available at SSRN 4724377.
6. Imtiaz N, Mehreen S, Saeed K, Akhtar N, Ur H, Rehman SA, et al. Study of prevalence of Parkinson's disease in elderly population in Rawalpindi, Pakistan. 2016.
7. Patel R, Kompoliti K. Sex and Gender Differences in Parkinson's Disease. Neurologic Clinics. 2023 May 1;41(2):371-9.
8. Church FC. Treatment options for motor and non-motor symptoms of Parkinson's disease. Biomolecules. 2021 Apr 20;11(4):612.
9. Shearin S, Medley A, Trudelle-Jackson E, Swank C, Querry R. Differences in predictors for gait speed and gait endurance in Parkinson's disease. Gait & Posture. 2021 Jun 1;87:49-53.
10. Rukavina K, Batzu L, Boogers A, Abundes-Corona A, Bruno V, Chaudhuri KR. Non-motor complications in late-stage Parkinson's disease: recognition, management and unmet needs. Expert Review of Neurotherapeutics. 2021 Mar 4;21(3):335-52.

11. Santos García D, de Deus Fonticoba T, Paz González JM, Cores Bartolomé C, Valdés Aymerich L, Muñoz Enríquez JG, Suárez E, Jesús S, Aguilar M, Pastor P, Planellas LL. Staging Parkinson's disease combining motor and nonmotor symptoms correlates with disability and quality of life. Parkinson's disease. 2021 May 13;2021:1-6.

12. Mirabella G, Pilotto A, Rizzardi A, Montalti M, Olivola E, Zatti C, Di Caprio V, Ferrari E, Modugno N, Padovani A. Effects of dopaminergic treatment on inhibitory control differ across Hoehn and Yahr stages of Parkinson's disease. Brain Communications. 2024;6(1):fcad350.

13. Kwok JY, Huang TW, Tretriluxana J, Auyeung M, Chau PH, Lin CC, Chan HY. Symptom burden and unmet support needs of patients with Parkinson's disease: a cross-sectional study in Asia-Pacific regions. Journal of the American Medical Directors Association. 2021 Jun 1;22(6):1255-64.

14. Falla M, Cossu G, Di Fonzo A. Freezing of gait: overview on etiology, treatment, and future directions. Neurological Sciences. 2022 Mar 1:1-3.

15. Zhang W, Yang Z, Li H, Huang D, Wang L, Wei Y, Zhang L, Ma L, Feng H, Pan J, Guo Y. Multimodal data for the detection of freezing of gait in Parkinson's disease. Scientific data. 2022 Oct 7;9(1):606.

16. Gan J, Liu W, Cao X, Xie A, Li W, Yuan C, Jin L, Liu S, Jin L, Guo D, Shen Y. Prevalence and clinical features of FOG in Chinese PD patients, a multicenter and cross-sectional clinical study. Frontiers in Neurology. 2021 Mar 8;12:568841.

17. Frank A, Bendig J, Finkbeiner S, Hähnel T, Schnalke N, Feige T, Reichmann H, Falkenburger BH. Development and validation of a fall questionnaire for patients with Parkinson's disease. Movement disorders clinical practice. 2022 Oct;9(7):900-8.

18. Santos-García D, de Deus-Fonticoba T, Suarez Castro E, M Aneiros Díaz Á, Feal-Painceiras MJ, Paz-Gonzalez JM, Garcia-Sancho C, Jesus S, Mir P, Planellas L, Garcia-Caldentey J. The impact of freezing of gait on functional dependency in Parkinson's disease with regard to motor phenotype. Neurological Sciences. 2020 Oct;41:2883-92.

19. McKay JL, Lang KC, Bong SM, Hackney ME, Factor SA, Ting LH. Abnormal center of mass feedback responses during balance: A potential biomarker of falls in Parkinson's disease. Plos one. 2021 May 27;16(5):e0252119.

20. Glover A, Pillai L, Doerhoff S, Virmani T. Differential gait decline in Parkinson's disease enhances discrimination of gait freezers from non-freezers. Journal of Parkinson's disease. 2020 Jan 1;10(4):1657-73.

21. Bayot M, Delval A, Moreau C, Defebvre L, Hansen C, Maetzler W, Schlenstedt C. Initial center of pressure position prior to anticipatory postural adjustments during gait initiation in people with Parkinson's disease with freezing of gait. Parkinsonism & related disorders. 2021 Mar 1;84:8-14.

22. Valverde-Guijarro E, Alguacil-Diego IM, Vela-Desojo L, Cano-de-la-Cuerda R. Effects of contemporary dance and physiotherapy intervention on balance and postural control in Parkinson's disease. Disability and Rehabilitation. 2022 Jun 5;44(12):2632-9.

23. Zhang F, Shi J, Duan Y, Cheng J, Li H, Xuan T, Lv Y, Wang P, Li H. Clinical features and related factors of freezing of gait in patients with Parkinson's disease. Brain and behavior. 2021 Nov;11(11):e2359.

24. Kwon KY, Park S, Lee EJ, Lee M, Ju H. Association of fall risk factors and non-motor symptoms in patients with early Parkinson's disease. Scientific reports. 2021 Mar 4;11(1):5171.

25. Asif S, Farooq R, Jawad U, Irfan MS, Fuaad M, Ullah S. Depression and Anxiety among Parkinson's Disease Patients: Prevalence, Risk Factors, and Impact on Life Quality. Pakistan Journal of Medical & Health Sciences. 2022 Apr 5;16(02):843-.

26. Scully AE, Tan DM, de Oliveira BI, Hill KD, Clark R, Pua YH. Validity and reliability of a new clinician-rated tool for freezing of gait severity. Disability and Rehabilitation. 2023 Aug 4:1-8.

27. McColl L, Strassheim V, Linsley M, Green D, Dunkel C, Trundle H, Gibbon JR, Parry SW. Falls efficacy scale International (FES-I) as a predictor of gait and balance abnormalities in community dwelling older people. medRxiv. 2022 Sep 30:2022-09.

28. Canever JB, Danielewicz AL, Leopoldino AA, Corseuil MW, de Avelar NC. Gender differentiated score on the Falls Efficacy Scale International (FES-I Brazil) to assess self-efficacy in falls in community-dwelling older adults. Aging clinical and experimental research. 2022 Jun;34(6):1341-7.

29. Kuo CT, Chen DR, Chen YM, Chen PY. Validation of the short falls efficacy scale-international for Taiwanese community-dwelling older adults: associations with fall history, physical frailty, and quality of life. Geriatric nursing. 2021 Sep 1;42(5):1012-8.
30. Yilmaz NH, Saricaoğlu M, Eser HY, Düz ÖA, Polat B, Özer FF. The relationship between pain, and freezing of gait and falls in Parkinson's disease. Archives of Neuropsychiatry. 2020 Mar;57(1):56.
31. Uhlig M, Prell T. Gait Characteristics Associated with Fear of Falling in Hospitalized People with Parkinson's Disease. Sensors. 2023 Jan 18;23(3):1111.
32. Rider JV, Manalang KL, Longhurst JK. Freezing of Gait Is Associated with Daily Activity Limitations among Individuals with Parkinson's Disease and Mild Cognitive Impairment. Occupational Therapy In Health Care. 2024 Feb 3:1-5.
33. Ghielen I, Koene P, Twisk JW, Kwakkel G, van den Heuvel OA, van Wegen EE. The association between freezing of gait, fear of falling and anxiety in Parkinson's disease: a longitudinal analysis. Neurodegenerative disease management. 2020 Jun 1;10(3):159-68.
34. Yilmaz NH, Saricaoğlu M, Eser HY, Düz ÖA, Polat B, Özer FF. The relationship between pain, and freezing of gait and falls in Parkinson's disease. Archives of Neuropsychiatry. 2020 Mar;57(1):56.
35. Pongmala C, Stonsaovapak C, van Emde Boas M, Bhanderi H, Luker A, Michalakis F, Kanel P, Albin RL, Haus JM, Bohnen NI. Body composition, falls, and freezing of gait in Parkinson's disease: gender-specific effects. The Journal of Frailty & Aging. 2024 Apr 2:1-7.

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Nadeem S: Conception and design, data collection.
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Faisal S: Drafting of article, analysis of data, statistical expertise.
Asim HM: Final approval and guarantor of article.