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Article

Senior Fitness Test in the Assessment of Functional Fitness in Patients with Parkinson's Disease at Different Levels of Physical Activity

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Abstract

Parkinson's disease (PD) is a progressive neurodegenerative disorder characterized by a decline in functional capacity and increasing limitations in daily activities. Clinical assessment tools provide valuable information on symptom severity but do not fully capture functional capacity. The aim of this study was to determine the usefulness of the Senior Fitness Test (SFT) for assessing functional capacity in patients with PD, depending on met (group A) or did not meet (group B) health-promoting physical activity (PA) recommendations. The study included 74 patients with idiopathic PD classified as Hoehn and Yahr stage II. PA was assessed using ActiGraph GT3X+ triaxial accelerometer and activity diaries, functional capacity using SFT, and symptom severity by MDS-UPDRS scale. Group A achieved significantly better results in all SFT components and had lower MDS-UPDRS scores than group B. The synthetic functional index was higher in the A group (1.28 ± 2.25 vs. -0.64 ± 2.28; $p < 0.001$), whereas the total MDS-UPDRS score was lower (31.09 ± 4.97 vs. 34.99 ± 5.28; $p = 0.022$). The results indicate that the SFT may be a useful and practical tool to complement the clinical assessment of patients with PD and may support more individualized rehabilitation planning and monitoring.

Keywords: Parkinson's disease; Senior Fitness Test; functional fitness; physical activity; MDS-UPDRS; rehabilitation; accelerometry; functional capacity; exercise

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1. Introduction

Parkinson's disease (PD) is a progressive neurodegenerative disorder marked by worsening motor impairment and a gradual decline in functional fitness and independence [1,2]. Although its most characteristic clinical symptoms include bradykinesia, rigidity, resting tremor, and postural instability, the overall burden of the disease is most clearly reflected in the decreasing ability to perform basic activities of daily living. It may contribute to reduced daily activity and poorer quality of life [3,4].

Physical activity is considered an important component of comprehensive non-pharmacological management in PD. Scientific evidence indicates that aerobic training, resistance training, balance exercises, and multicomponent programs may improve motor function, mobility, functional fitness, and selected aspects of quality of life [5–7]. Despite the growing body of research, there remains a need for tools that enable assessment of both the severity of disease symptoms and actual functional capacity, as well as the effects of exercise interventions [8,9]. In clinical practice, one of the basic

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instruments used to assess patient status is the Movement Disorder Society – Unified Parkinson's Disease Rating Scale (MDS-UPDRS), which is recognized as a standard measure of symptom severity and motor complications [10]. However, this scale does not provide complete multidimensional information on functional fitness. Therefore, clinical assessment may be usefully complemented by physical fitness tests that reflect the ability to perform functional tasks.

The Senior Fitness Test (SFT) is a simple set of functional tests that requires little equipment, is easy to administer, relates closely to activities of daily living and may be a useful addition to the clinical assessment of patients with PD [11,12]. Functional limitations cannot be explained solely by the severity of clinical symptoms. They are also reflected in how well patients are able to perform everyday motor tasks. Reduced muscle strength, impaired postural control, slower gait, limited flexibility, and lower aerobic endurance, may directly influence performance in functional fitness tests [13,14]. From this point of view, SFT results may show the general level of physical fitness, and the functional consequences of motor symptoms related to the disease.

Although the MDS-UPDRS provides valuable information about symptom severity and motor complications, it does not directly measure functional capacity through the performance of specific motor tasks. Patients with a similar disease duration or the same Hoehn and Yahr stage may still differ considerably in strength, balance, mobility, endurance, and flexibility. For this reason, performance-based tests can provide additional information that is not fully captured by clinical rating scales [11,15].

It has been shown that daily physical activity may play an important role in shaping functional status in patients with PD by supporting functional fitness, but insufficient activity may contribute to progressive functional limitations and greater dependence in activities of daily living [6,16,17]. Therefore, even among patients at a similar stage of disease progression, meeting or not meeting health-promoting physical activity recommendations may clearly differentiate physical fitness and clinical status. Assessing SFT results in relation to physical activity recommendations may help determine whether this test battery is useful for identifying functional differences that are relevant to everyday functioning and rehabilitation planning.

The aim of this study was to determine the usefulness of the Senior Fitness Test in assessing functional fitness in patients with PD who either met or did not meet health-promoting physical activity recommendations.

2. Materials and Methods

A cross-sectional observational study was conducted including 74 patients diagnosed with idiopathic PD according to the MDS Clinical Diagnostic Criteria [18]. The cohort had a mean age of 63.49 ± 7.43 years, a mean disease duration of 6.93 ± 3.08 years, and was classified as Hoehn and Yahr stage II [19].

All participants were informed about the study procedures and provided written informed consent. Participants were recruited by purposive sampling from Parkinson's disease associations in the Silesian region of Poland. Medical supervision was maintained for all participants. Primary pharmacological treatment consisted of levodopa; ropinirole or piribedil was added as indicated. The levodopa equivalent daily dose (LED) was calculated using conversion factors reported in the literature [20].

The study was conducted in accordance with the Declaration of Helsinki and was approved by the Bioethics Committee of the Academy of Physical Education in Katowice (approval no. 30/2017). Required sample size was estimated using a sample size calculator for comparison of two independent groups, assuming a significance level of $\alpha = 0.05$ and statistical power of $1-\beta = 0.80$. A final sample of 74 participants was considered sufficient for the planned between-group comparisons and correlation analyses.

Inclusion criteria were: idiopathic PD diagnosed according to the MDS Clinical Diagnostic Criteria [18]; disease stage II on the Hoehn and Yahr scale [19]; Mini-Mental State Examination (MMSE) score ≥ 24 [21]; and Beck Depression Inventory (BDI) score < 10 [22]. Exclusion criteria

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comprised Parkinsonian syndromes other than idiopathic PD, coexisting neurodegenerative disorders, and medical conditions or comorbidities that reduced exercise tolerance or contraindicated physical exertion.

Clinical status was assessed using the MDS-UPDRS, including Part II: Motor Experiences of Daily Living (ME-DL), Part III: Motor Examination (ME), and Part IV: Motor Complications (MC) [10].

Weekly physical activity (PA) was measured with a triaxial ActiGraph GT3X+ accelerometer [23,24], which recorded accelerations in the sagittal, frontal, and transverse planes. To minimize the impact of seasonal variation, accelerometer-based measurements were performed during the transitional seasons (October and March), in accordance with physical activity assessment guidelines [25]. Devices were worn on the hip for seven consecutive days and were removed only for sleep and water-related activities, following the methodology of Ito et al. [26]. Accelerometer data were processed using ActiLife 5.10.0 software. Only records meeting predefined criteria for reliable monitoring were included in the analysis. A valid measurement day was defined as ≥10 hours of wear time. Non-wear time was defined as ≥60 consecutive minutes of zero counts and was excluded from the dataset. Data were analyzed in 60-second epochs. Physical activity intensity was classified using Freedson cut-points for adults: sedentary 0–99 counts/min; light 100–1951 counts/min; moderate 1952–5724 counts/min; and vigorous ≥5725 counts/min [27].

During the monitoring week, a physical activity diary was completed by each participant to record duration, type, and intensity of daily activities. Subjective intensity was recorded on a three-level scale (low, moderate, high). The diary included descriptions and examples to facilitate accurate reporting. Participation in individual, organized, and rehabilitation-based activities was recorded; diary entries were compared with accelerometer data for verification.

Participants were stratified into two groups according to adherence to physical activity guidelines jointly developed by the Parkinson's Foundation and the American College of Sports Medicine (ACSM) [28]. Group A (n = 23) comprised patients who met the minimum criteria for health-promoting physical activity (primarily ≥150 minutes/week of moderate-to-vigorous physical activity, with documented strength and balance exercises as recorded in the diary). Group B (n = 51) comprised patients who did not meet these criteria.

The physical activity recommendations applied in this study were as follows: aerobic training — 3 days per week, 20–60 minutes per session, moderate to high intensity (e.g., brisk walking, stationary cycling, treadmill, swimming); resistance training — 2–3 days per week, 10–15 repetitions for major muscle groups, 1–3 sets per group; balance/agility/coordination exercises — 2–3 days per week (e.g., tai chi, yoga, functional training); stretching/flexibility — daily or at least 2–3 times per week, holding each position for 10–30 seconds with 2–4 repetitions.

Physical fitness was assessed using the Senior Fitness Test (SFT), comprising six trials [29]. The Chair Stand Test was used to assess lower-body strength (number of stands in 30 s). The Arm Curl Test assessed upper-body strength (2 kg weight for women, 3 kg for men; number of lifts in 30 s). The Back Scratch Test evaluated upper-body flexibility as the distance between the tips of the middle fingers. The Chair Sit-and-Reach Test assessed lower-body flexibility (distance between fingertips and toes). The Up-and-Go test measured agility and dynamic balance as the time (seconds) required to rise from a chair, walk 3 m, turn, return, and sit down. The 2-Minute Walk Test was used to assess aerobic endurance (number of full steps completed in 2 minutes).

A synthetic functional index (SSFT) was calculated to provide a global measure of functional capacity. Individual scores for each of the six SFT items were converted to standardized z-scores. For tests in which a lower score indicated better performance (e.g., Up-and-Go), z-scores were multiplied by −1 to ensure consistent interpretation. The SSFT for each participant was computed as the arithmetic mean of the six standardized scores, following the methodology proposed by Cancela et al. [12]. The SSFT was used to evaluate the correlation between physical fitness and PD symptom severity.

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Statistical analyses were performed using STATISTICA software (version 13.3 PL; TIBCO Software Inc., Palo Alto, CA, USA). Descriptive statistics were reported as means ± standard deviations (SD). Normality of data distribution was assessed with the Kolmogorov–Smirnov test and homogeneity of variances with Levene's test. Between group differences were evaluated with independent-samples t-tests. Pearson's correlation coefficient was used to assess relationships between the SSFT index and MDS-UPDRS scores. Effect sizes for between-group comparisons were estimated using Cohen's d (small = 0.2, medium = 0.5, large = 0.8). Statistical significance was set at $p < 0.05$.

3. Results

Before the analysis of physical fitness in relation to symptom severity, the two groups were compared regarding age and disease duration. No statistically significant differences were observed between the study groups (Table 1).

Table 1. Characteristics of participants.

Characteristics	Group A (n=23)	Group B (n=51)	t-test	
	X± SD	X± SD	p-value	t
Age (years)	62.73±7.41	64.24±7.52	0.35	-0.94
Disease duration (years)	6.84±3.06	7.02±3.15	0.80	-0.25

A – meeting the criteria for health-promoting physical activity; B – not meeting the criteria for health-promoting physical activity; X – arithmetic mean; SD – standard deviation; t – t-test value; p – probability value.

Table 2. Comparison of the groups in terms of disease symptom severity (MDS-UPDRS) and physical fitness (SFT).

Parameter	Group A (n=23)	Group B (n=51)	t	p	Cohen_d (A-B)
		MDS - UPDRS			
ME-DL [points]	6.71 ± 1.16	7.49 ± 1.19	-2.40	0.019	-0.661
ME [points]	20.46 ± 4.63	22.89 ± 4.81	-2.05	0.044	-0.511
MC [points]	3.92 ± 0.98	4.61 ± 1.12	-2.65	0.010	-0.639
MDS-UPDRS Total [points]	31.09 ± 4.97	34.99 ± 5.28	-2.34	0.022	-0.752
		SFT			
Chair Stand (30 s)	12.95 ± 3.13	11.35 ± 2.95	2.07	0.045	0.532
Arm Curl (30 s)	16.01 ± 3.03	14.52 ± 2.57	2.06	0.047	0.548
Back Scratch (cm)	-1.83 ± 4.20	-4.87 ± 5.74	2.56	0.013	0.572
Chair Sit-and-Reach (cm)	1.82 ± 4.48	-1.16 ± 5.02	2.55	0.014	0.613
Up-and-Go (s)	7.41 ± 1.06	8.18 ± 1.55	-2.47	0.017	-0.543
2-Min Walk Test (n)	95.47 ± 13.19	86.93 ± 13.15	2.58	0.013	0.649
SSFT	1.28 ± 2.25	-0.64 ± 2.28	3.66	0.00057	0.845

Using the MDS-UPDRS to assess disease symptom severity, Group A, which met the criteria for health-promoting physical activity, had significantly lower scores across all analyzed parts of the scale than Group B. The differences were observed in Motor Experiences of Daily Living (ME-DL; p

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= 0.019), Motor Examination (ME; p = 0.044), and Motor Complications (MC; p = 0.010). The total MDS-UPDRS score was also significantly lower in Group A than in Group B (p = 0.022).

In the Senior Fitness Test (SFT), Group A performed better across all six trials. The largest differences were observed in the Back Scratch test (p = 0.013), the Chair Sit-and-Reach test (p = 0.014), and the 2-Minute Walk Test (p = 0.013), indicating significantly better flexibility and cardiorespiratory endurance among physically active participants. In the upper- and lower-limb strength tests, namely the Arm Curl and Chair Stand tests, the differences also reached statistical significance (p ≈ 0.045–0.047). The shorter time recorded in the Up-and-Go test for Group A (p = 0.017) indicates better coordination and balance.

The mean synthetic functional index (SSFT) was markedly higher in Group A (1.28 ± 2.25) than in Group B (-0.64 ± 2.28; p < 0.001). The absolute effect sizes for between-group differences ranged from medium (d = 0.51) to large (d = 0.85), with the largest effect observed for the synthetic functional index (SSFT).

To evaluate the relationship between symptom severity and physical fitness, Pearson's correlation coefficients were calculated between the SSFT index and individual MDS-UPDRS components (Part II: ME-DL, Part III: ME, Part IV: MC, and the Total score). These analyses were performed separately for Group A and Group B (Figure 1).

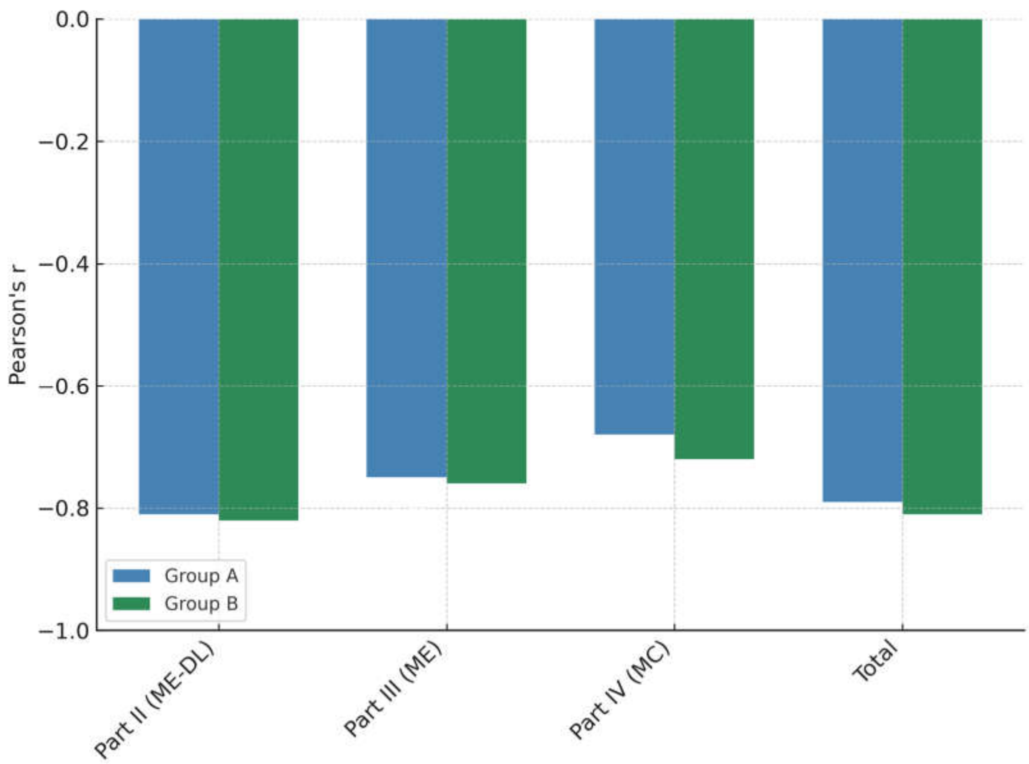

Figure 1. Pearson's correlation coefficients (r) between the SSFT index and the individual components of the MDS-UPDRS scale (Part II—ME-DL, Part III—ME, Part IV—MC, and Total score) in Groups A and B.

The correlation analysis revealed significant negative relationships between the SSFT index and all parts of the MDS-UPDRS scale in both groups. The strongest associations were observed for the Total MDS-UPDRS score and Part II (ME-DL), while the weakest correlations were found for Part IV (MC). Specifically, Group A showed a correlation of r = -0.52 (p < 0.01), and Group B showed r = -0.68 (p < 0.001) between the SSFT and the total MDS-UPDRS score.

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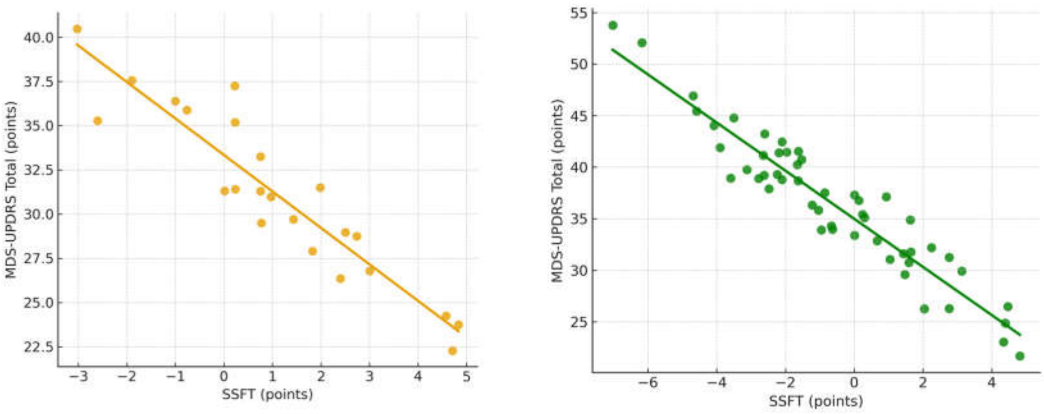

(**a**) Group A (**b**) Group B

Figure 2. Scatter plots illustrating the relationship between the SSFT index and the total MDS-UPDRS score: (a) Group A; (b) Group B.

4. Discussion

The study examined the usefulness of SFT in assessing functional fitness in patients with PD who differed in adherence to health-promoting physical activity recommendations. The findings clearly indicate that patients who met the recommendations achieved better results across all SFT components, had a higher synthetic functional fitness index (SSFT), and had lower MDS-UPDRS scores than patients who did not meet the recommendations. Moreover, the negative correlations between SSFT and MDS-UPDRS scores indicate that better functional fitness was associated with lower clinical severity. These results support the value of performance-based functional assessment in PD and suggest that the SFT may provide clinically useful information beyond standard symptom rating [11,12,30].

In our study, physically active patients performed better in strength, flexibility, agility, dynamic balance, and endurance. This suggests that meeting physical activity recommendations may be associated with broader preservation of functional capacity. Nevertheless, because the study was cross-sectional, these findings should be interpreted as associations. It cannot be concluded whether higher physical activity contributed to better functional fitness or whether patients with better functional capacity were more able to remain active [16,17].

The present findings reinforce the practical value of the SFT in patients with PD. The test battery assesses several domains directly relevant to everyday functioning. These domains are particularly important in PD because functional limitations often become visible during daily motor tasks such as standing up, walking, turning, reaching, or maintaining balance. Previous work by Cholewa et al. showed that SFT performance is related to MDS-UPDRS scores in people with PD, supporting its clinical relevance as a performance-based assessment tool [11]. Similarly, Urgacz et al. indicated that the SFT may be useful for evaluating the effects of physical rehabilitation on quality of life in patients with PD [31].

The clinical relevance of individual SFT components is also supported by studies showing that chair-rising ability and functional gait are associated with activities of daily living and physical activity in PD [13,32]. The present study extends these observations by showing that SFT results also differentiate patients according to whether they meet health-promoting physical activity recommendations [28].

A main importance is the inverse relationship between SSFT and MDS-UPDRS scores. This means that patients with higher overall functional fitness tended to have lower severity of disease-related symptoms and complications. The association was observed in both groups, which strengthens the interpretation that functional performance is meaningfully related to clinical status. At the same time, the relationship appeared slightly stronger among patients who did not meet physical activity recommendations. One possible explanation is that, in less active individuals,

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functional performance may more directly reflect the combined burden of neurological impairment, secondary deconditioning, and reduced mobility. In more active patients, regular movement may partly buffer the functional consequences of motor symptoms [5,6]. However, the direction of this relationship remains uncertain and should be tested in longitudinal studies.

The results also underline that functional fitness assessment may complement clinical scales. The MDS-UPDRS remains a standard and highly informative tool for assessing symptom severity and motor complications, and its clinimetric value has been well established [10]. However, it does not directly measure how well patients perform functional tasks. Functional capacity depends on neurological impairment and also on strength, endurance, balance, coordination, flexibility, and confidence in movement. Therefore, two patients with similar clinical scores may differ substantially in their ability to function independently in daily life. The SFT can help capture this task-oriented dimension of functioning. It may serve as a practical supplementation between neurological assessment and real world functional performance.

This approach is consistent with current rehabilitation frameworks and with recent perspectives emphasizing the need for a multidimensional understanding of PD, including lifestyle, functional capacity, and patient-related factors [1,7,33].

From a clinical and rehabilitation perspective, these findings indicate that regular physical activity should be considered an integral component of PD care [34]. Patients who met activity recommendations demonstrated better functional performance and lower clinical severity, which supports the relevance of maintaining movement habits beyond supervised rehabilitation sessions. The SFT may also be useful for monitoring functional status over time, as it is simple, inexpensive, and feasible in clinical, rehabilitation, and community settings. Its multidimensional structure allows clinicians to identify specific functional deficits and adjust rehabilitation programs more precisely.

Lower performance in Chair Stand or Up-and-Go may indicate the need to emphasize lower-limb strength, transfers, balance, and mobility, whereas reduced endurance may suggest the need for carefully dosed aerobic training [7,29].

We acknowledge the limitations of the study. The cross-sectional observational design does not allow for conclusions about causal relationships between physical activity, functional ability, and disease severity. Limiting the study to patients classified as Hoehn and Yahr stage II increased sample homogeneity but limited the generalizability of the results to patients with earlier or more advanced stages of PD. Implementation of an accelerometer improved the objectivity of physical activity assessment; however, the recorded activity levels may still have been influenced by diurnal variability, medication timing, motor fluctuations, and adherence to monitoring procedures. Furthermore, although SFT addresses important areas of functional ability, it is not specific to PD and does not directly assess disease-specific symptoms such as freezing of gait, nonmotor symptoms, or motor fluctuations [35,36].

5. Conclusions

In conclusion, the study supports the usefulness of the Senior Fitness Test as a feasible and clinically meaningful tool for assessing functional fitness in patients with PD. The ability of the SFT to differentiate patients according to their adherence to physical activity recommendations, together with its association with MDS-UPDRS scores, suggests that it may complement standard clinical assessment. Integrating functional performance measures with neurological evaluation may improve the interpretation of patient status and support more individualized rehabilitation planning.

6. Patents

Not applicable.

Author Contributions: Conceptualization, J.C., J.Ch. and A.G.; methodology, J.C., J.P., G.M. and A.G.; software, J.C., J.P. and G.M.; validation, J.C., I.U., J.Ch., J.P., G.M. and A.G.; formal analysis, J.C., J.Ch. and A.G.; investigation, J.C., J.Ch. and A.G.; data curation, J.C. and J.Ch.; writing—original draft preparation, J.C. and

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J.Ch.; writing—review and editing, J.C., I.U., J.Ch., J.P., G.M. and A.G.; supervision, J.C. and A.G.; project administration, J.C. All authors have read and agreed to the published version of the manuscript.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on reasonable request from the corresponding author. The data are not publicly available due to privacy and ethical restrictions.

Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

PD	Parkinson's disease
SFT	Senior Fitness Test
SSFT	Synthetic functional fitness index
PA	physical activity
MDS-UPDRS	Movement Disorder Society–Unified Parkinson's Disease Rating Scale
MEDL	Motor Experiences of Daily Living
ME	Motor Examination
MC	Motor Complications
ACSM	American College of Sports Medicine
LED	levodopa equivalent daily dose
MMSE	Mini-Mental State Examination
BDI	Beck Depression Inventory

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