

Physical activity in Parkinson's disease: examining prescription sources, patterns, and the influence of quality of life and disease severity

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Introduction. Limited research has explored the influence of quality of life (QoL) and disease severity on physical activity (PA) in Parkinson's disease (PD) patients, and the sources of PA prescription and advice for this population. This study aims to expand scientific knowledge on these topics.

Patients and methods. Two-hundred eleven PD patients were personally interviewed to collect data on PA levels using the International Physical Activity Questionnaire-Short Form and QoL using the Parkinson's Disease Questionnaire-8. An *ad hoc* questionnaire gathered information on disease severity (Hoehn and Yahr stages), PA behaviors, and PA recommendations.

Results. Weak but significant associations were found between PA levels, disease severity ($r = -0.218$; $p = 0.004$), and QoL ($r = -0.244$; $p = 0.001$). Most participants (85%) received PA counselling, predominantly from neurologists, either at diagnosis (52%) or shortly after (28%). Before PD onset, ~86% engaged in PA, decreasing to 66% post-diagnosis. Approximately 78% reported changes in PA, including reduced frequency (18.4%) and duration (32.8%), with walking as the primary activity.

Conclusions. Disease severity and QoL significantly affect PA levels in PD patients. Diagnosis is associated with decreased PA frequency and duration, and walking is the preferred activity. Neurologists primarily provide PA advice.

Key words. Exercise. Healthcare counselling. Movement disorders. Neurological patients. Quality of life. Rehabilitation.

Introduction

Physical activity (PA) benefits the health of individuals with Parkinson's disease (PD) in the short and long term [1]. Strong evidence underscores PA's importance as a coadjutant therapy in PD, and healthcare professionals managing recently diagnosed patients are advised to inform of those benefits and encourage participation in PD-specific exercise programs [2]. Conversely, people with PD display low levels of PA and prolonged sedentary behavior [3,4], which may negatively impact the clinical course of the disease [5]. Consequently, identifying and developing specific procedures to increase PA levels in this population is critical.

To achieve this objective, scientific research has mainly focused on identifying PA barriers among patients with PD; however, there is a paucity of research on other relevant factors related to PA behavior. For instance, there is a lack of knowledge

regarding the pre-diagnosis PA behavior of people with PD, which may be useful in understanding their PA engagement [6]. Similarly, additional studies are necessary to investigate the relationship between PA levels and factors like quality of life (QoL) or impairment level [7,8].

Besides, it is interesting to determine who prescribes PA to individuals with PD and whom they can refer to for PA advice. Neurologists are expected to provide tailored PA guidelines for patients with PD after identifying their barriers and motivations [9]. Nonetheless, non-neurologist practitioners can also deliver a diagnosis, initial treatment, and regular and timely management of PD [10], particularly in the clinical exercise field, where PA guidelines for populations with PD lack consensus regarding conceptualization and development [2].

Eventually, it is crucial to investigate the beliefs of people with PD regarding the benefits of PA and

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exercise programs, as well as the qualifications of those who prescribe or supervise exercise training, as these factors can significantly impact PA participation [11].

Considering the above reasons, this study primarily aimed to investigate PA behaviour in individuals with PD and, subsequently, assess the influence of disease severity, QoL, and PA beliefs on PA prevalence. Additionally, it aimed to identify healthcare professionals who provide information about PA and develop PA prescriptions for patients with PD.

Patients and methods

The sample consisted of PD patients that were recruited by two research staff members that contacted 11 Parkinson's associations from the north of Spain: Basque Country, and provinces of La Rioja, Asturias, Cantabria and León, via phone or in-person visits. Upon acceptance of participation one to two meetings were held to proceed with the completion of informed consents and questionnaires. In order to be included in the study patients had to: a) had a clinical diagnosis of PD confirmed by the association; and b) be fluent in Spanish. Patients with cognitive decline or unwillingness to participate were excluded. The University of León's institutional review board approved the study (ETICA-ULE-030-2020), and all participants provided written informed consent.

Throughout the scheduled meetings, the research staff conducted either individual or small group interviews employing a comprehensive questionnaire encompassing the following outcomes.

Demographic and clinical data

Sex, age, time since and age at PD diagnosis, and PD severity, according to Hoehn and Yahr (H-Y) stages, were extracted from participants' clinical records.

Physical activity behavior

Three researchers developed an *ad hoc* survey based on their prior experience with PD research. Participants were asked about their PA modality before PD onset, changes in PA behavior after diagnosis, and reasons for these changes. They also provided information about when they were advised to engage in PA and which professional encouraged them.

Physical activity prevalence

The International *Physical Activity Questionnaire-Short Form* was used to assess PA levels among PD patients. The questionnaire contains seven questions about the frequency and duration of vigorous activity, moderate activity, walking, and sitting. Participants were classified as active or inactive based on the World Health Organization's PA level. A cut-off point (sitting time \geq 360 minutes/day) was established to assess sedentary behavior [12]. This questionnaire has exhibited acceptable levels of validity and reliability in assessing PA among older adults in the Spanish population [13].

Quality of life

The Spanish version of the *Parkinson's Disease Questionnaire-8* (PDQ-8) was used to evaluate participants' QoL [14]. It includes eight items scored from 0 to 4. The summary index of all items is standardized on a 0-100 scale, with lower indices indicating better QoL. This questionnaire holds widespread utilization within the context of PD, having demonstrated its acceptability, ease of use, validity, and reliability as an effective instrument for assessing the QoL among individuals affected by PD [14,15].

Statistical analysis

After assessing normal distribution with the Kolmogorov-Smirnov test, we represented quantitative variables as mean (standard deviation) or median (interquartile range) and qualitative variables as *n* (%). We divided the patients into three groups according to their H-Y stage (1-1.5, 2-2.5 and 3-5 stages). Also, we divided the patients into tertiles according to their *Parkinson's Disease Questionnaire-8* score (0-13, 16-28, and 31-81). We compared differences among groups of continuous variables with the Kruskal-Wallis test. We used Pearson's correlation coefficient to analyze the association between variables. Contingency tables were calculated to detect systematic associations of the assessed variables. All variables were analyzed using a χ^2 test. A two-tailed *p*-value of less than 0,05 indicated statistical significance. All analyses were performed using the SPSS software (IBM Corp., Armonk, N.Y., USA).

Results

A total of 211 PD patients participated in the study. Their characteristics are shown in table I. Walking

was the main type of PA performed. The analyzed data indicated that around 58% of the participants were physically inactive and 43.2% exhibited a high sitting time.

Table II displays the PA behavior data. Before PD onset, ~86% of the participants engaged in PA, with walking (87.8%), swimming (22.8%), and cycling (21.8%) being the most common activities. The majority (70%) practiced PA without supervision. After PD onset, 66% continued PA, and 19% attempted to remain active for some time. About 78% of the participants reported changes in PA, including reductions in frequency (18.4%) and duration (32.8%). Approximately 65% altered their PA preferences, and over one-third practiced unsupervised PA. The primary PA barriers identified were lack of energy (51.1%) and fear of falling (44.3%).

A majority of participants (85%) received counseling on PA, either at the time of PD diagnosis (52%) or shortly thereafter (28%). The primary source of PA advice was the neurologist (74.7%), with other healthcare professionals, patients, and association employees also providing guidance in some cases (Table III).

Weak significant associations were observed between the amount of PA performed, H-Y stage ($r: -0.218; p = 0.004$), and QoL ($r: -0.244; p = 0.001$). A significant, low-magnitude direct relationship was found between sitting time, H-Y stage ($r: 0.250; p = 0.002$), and QoL ($r: 0.201; p = 0.015$). The H-Y stage also demonstrated a significant association with QoL ($r: 0.331; p = 0$).

Statistical analysis showed that the walking time was notably affected by the H-Y stage ($p = 0.004$) and also by QoL ($p < 0.001$). Results also indicated higher H-Y stages were associated with lower QoL levels ($p = 0.004$) (Figure).

Low QoL levels were associated with changes in PA, primarily involving less frequent and shorter activities. Exercise barriers, such as lack of energy and fear of falling, were also significantly impacted by QoL levels. Notably, no associations were observed when analyzing the severity of the disease, as assessed by H-Y, on PA behaviors. Finally, following the onset of PD, a notable direct correlation was identified between age and fear of falling ($p = 0.008$). Additionally, it was observed that the older the age, the less belief in the benefits of PA ($p = 0.027$).

Discussion

In this study we aimed to explore PA habits among PD patients, considering disease severity and QoL

Table I. Demographic, clinical, and physical activity characteristics of the sample.

Characteristic	
Male sex, individuals $-n$ (%)	122 (57.3)
Age, years $-mean$ (SD)	72 (7)
Time since PD diagnosis, years $-mean$ (SD)	8 (7)
Age at PD diagnosis, years $-mean$ (SD)	64 (9)
PDQ-8, score $-mean$ (SD)	24 (17)
Hoehn and Yahr scale, score $-mean$ (SD)	2,32 (0.87)
Hoehn and Yahr scale, stages $-n$ (%)	
1: unilateral involvement only	30 (14.2)
1.5: unilateral and axial involvement	22 (10.4)
2: bilateral involvement without impairment of balance	50 (23.7)
2.5: mild bilateral disease with recovery on pull test	44 (20.9)
3: mild to moderate bilateral disease; some postural instability; physically independent	47 (22.3)
4: severe disability; still able to walk or stand unassisted	15 (7.1)
5: wheelchair bound or bedridden unless aided	3 (1.4)
IPAQ-SF Physical activity, minutes-week ⁻¹ $-median$ (IQR)	
Walking ($n = 177$)	360 (155-615)
Moderate ($n = 176$)	120 (0-240)
Vigorous ($n = 183$)	0 (0-40)

IPAQ-SF: International Physical Activity Questionnaire-Short Form; IQR: Interquartile range; PDQ-8: Parkinson's Disease Questionnaire-8; SD: standard deviation.

levels. Additionally, we sought to identify the professionals responsible for prescribing PA and providing guidance. These areas warrant investigation due to the limited research conducted to date.

Our results revealed that many participants engaged in PA prior to PD onset. After diagnosis, 20% discontinued PA, while others attempted to remain active temporarily. Individuals who maintained PA occasionally experienced reduced frequency or duration, and a substantial number of patients modi-

Table II. Physical activity (PA), behavior, exercise supervision, and barriers pre- and post-Parkinson's disease diagnosis.

Before diagnosis	<i>N</i>	<i>n</i>	%	After diagnosis	<i>N</i>	<i>n</i>	%
Engaged in PA	211			Engaged in PA	209		
Yes		181	85.8	Yes, I continue		138	66
No		26	12.3	Yes, temporarily		40	19.1
Maybe		4	1.9	No		31	14.8
PA supervision	197			PA supervision	176		
Individual instructor		3	1.5	Individual instructor		22	12.5
Group instructor		40	20.3	Group instructor		99	56.3
No supervision		139	70.6	No supervision		55	31.3
NS/NA		15	7.6				
Types of activities (yes/no) ^a				Reasons for not Engaging in PA (yes/no) ^a			
Walking	197	173	87.8	Lack of energy	176	90	51.1
Swimming	197	45	22.8	Fear of falling	176	78	44.3
Cycling	197	43	21.8	Transportation issues	176	33	18.8
Running	197	20	10.2	Belief that PA will not help	176	11	6.3
Team Sports	197	7	3.6	Instructors' insufficient knowledge	176	5	2.8
Other	211	60	28.4	Not Interested	176	4	2.3

N: total number of responses for the question; *n*: number of responses for each selection option; NS/NA: Not sure/Not answered. ^a Only 'yes' answers are reflected within the '*n*' and % columns.

fied preferences, corroborating that PD patients tend to become less active over time [16]. Participants' PA preference changes might stem from PA barriers like lack of energy and fear of falling, previously reported [17,18], leading them to choose safer, less demanding activities like walking. This outcome aligns with prior studies highlighting walking as the predominant PA for this population [8,19]. Notably, patients believed in the beneficial effects of PA, which serves as a primary motivation for practice [20]. They also relied on instructors' expertise, with most performing PA under supervision, underscoring the importance of instructors' comprehension of PD and their ability to develop tailored programs [18].

Neurologists represent the linchpin for promoting PA among PD patients, with lack of information

from them constituting an exercise barrier [20]. Conversely, patients are more likely to exercise when encouraged by their neurologist [9]. Our results revealed that most participants received PA counseling primarily from their neurologist and learned about PA benefits often at the time of PD diagnosis or shortly after that. This finding is relevant, as early exercise guidance is essential for effective disease management [21]. Furthermore, we found that other healthcare professionals, association employees, and fellow patients also provided PA guidance, emphasizing the importance of inter-professional collaboration, social workers' roles, and the value of diverse counseling sources for better PD management [22].

Over half of the study's participants (58%) failed to meet PA guidelines, deemed inactive, aligning

with findings by Mantri et al [23], who examined self-reported activity scores in 383 PD subjects and informed that 53% fell short of standard PA recommendations. Likewise, an exploratory research by Zaman et al [8] revealed that 43% of 30 PD patients did not meet PA guidelines. We also observed that approximately 43% of participants exhibited sedentary behavior, a common occurrence among PD patients [3]. Nevertheless, studies using accelerometers have shown different results, suggesting that most PD patients do not adhere to daily activity recommendations [24]. For instance, Benka Wallén et al [4] analyzed data from 95 patients and reported that 73% were physically inactive. Similarly, Ellingson et al [25] detected that 65.5% of the 45 participants who completed accelerometer data were also classified as physically inactive. These discrepancies may arise from the overestimation of PA levels observed when using self-reported measures [23].

Disease severity has been considered a predictor of PA levels [16]. Our study found a significant, albeit weak, association between these outcomes. Various studies have yielded contradictory results on this matter. For example, Lockwich et al [19] observed no significant differences in self-reported exercise intensity levels, duration, and dosage among PD patients across disease severity. In this line, Lord et al [24] discovered few significant differences in the amount of ambulatory activity (measured by accelerometers) among PD patients with H-Y stages 1, 2, and 3, suggesting that disease severity exerts little influence on activity levels. In contrast, Nero et al [26] used accelerometry to report that PD patients in stage 2 accumulated more minutes of brisk walking than those in stage 3. Dontje et al [3] also noted significant differences in daily PA, determined by accelerometry, and disease severity, as indicated by the H-Y score. Comparably, in the study by Nimwegen et al [27], self-reported duration of daily PA decreased with increased disease severity, and inactivity correlated with poorer walking performance and greater disease severity. In conjunction with the significant association between walking time and disease severity revealed in the present study, this outcome reinforces the notion that gait impairment merits consideration as a substantial factor influencing PA levels [5].

Notably, we identified a significant association between sitting time and disease severity; however, this relationship was not uniform across H-Y stages, with noticeable disparities between patients at stages 2 and 3. This outcome may stem from prior observations suggesting that transitioning from

Table III. Counseling on physical activity (PA) for participants with Parkinson's Disease (PD)..

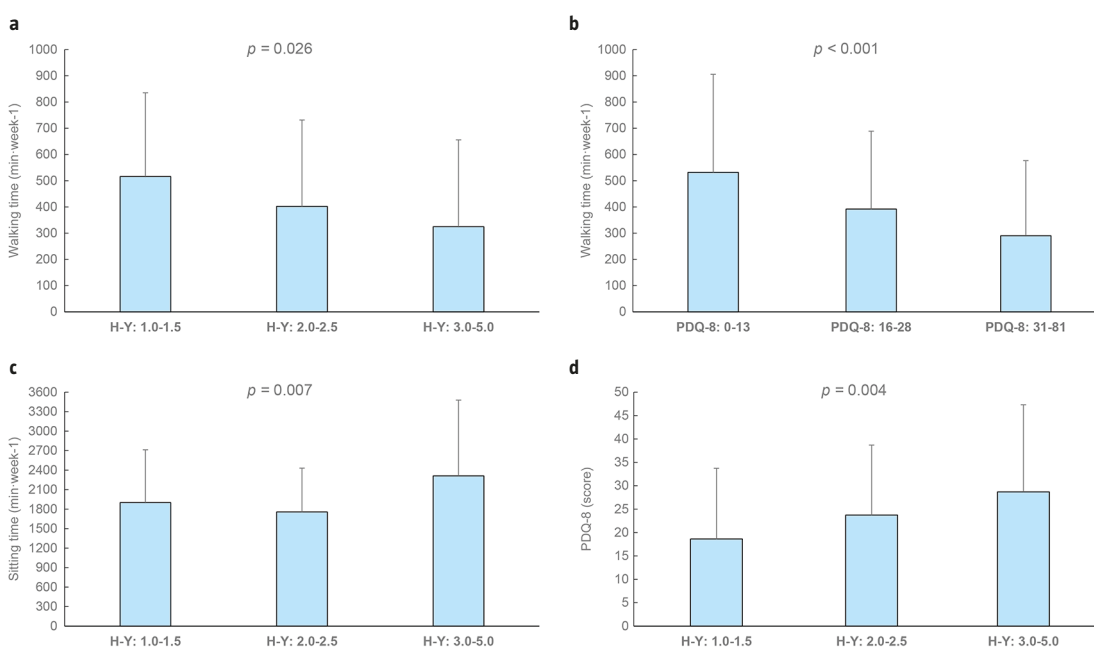
Questions	<i>N</i>	<i>n</i>	%
Counseling on PA	211		
Yes		180	85.3
No		20	9.5
Maybe		8	3.8
Not sure/Not answered		3	1.4
Timing of PA counseling	192		
At the time of PD diagnosis		100	52.1
Shortly after PD diagnosis		54	28.1
Much later		28	14.6
PA advice source (yes/no) ^a	194		
Neurologist		145	74.7
Parkinson's association employees (for example, physiotherapists, occupational therapists, monitors, volunteers, etc.)		99	51
Other healthcare professionals		38	19.6
Other individuals diagnosed with PD		35	18
Nurse		9	4.6

N: total number of responses for the question; *n*: number of responses for each selection option. ^a Only 'yes' answers are reflected within the '*n*' and % columns.

H-Y stage 2 to stage 3 corresponds to a marked decline in gait and balance dysfunction [28].

To date, the scant literature on the relationship between PA levels and QoL has produced incongruous outcomes. Cavanaugh et al [29] noted that as the disease progressed, both the quantity and intensity of ambulatory activity declined; however, QoL did not exhibit a corresponding pattern. Conversely, Jones and Alexander [30] reported a significant association between reduced PA levels and QoL decline. Van Uem et al [7] similarly observed that PD patients with higher levels of PA reported higher QoL levels and a drastic decline in QoL occurred as PA diminished. Our findings support the latter, confirming a significant link between PA and QoL among PD patients. Nonetheless, we cannot dismiss reverse causation, as it remains uncertain whether higher PA levels lead to better QoL or if patients with superior QoL engage in more daily activity.

Figure. Walking time (a), sitting time (c), and *Parkinson's Disease Questionnaire-8* (PDQ-8) score (d) grouped by Hoehn and Yahr (H-Y) classification, and walking time according to PDQ-8 tertile (b). Bars show mean and standard deviation per group, with p -value based on Kruskal-Wallis test.



However, we found that lower QoL levels were significantly associated with changes in PA behavior and barriers, suggesting QoL predicts PA behavior and supporting the view that low QoL determines exercise motivation in PD patients [31]. The scarcity of data in this area highlights the need for additional research to understand which aspects of QoL most influence PA behavior.

We found a significant, weak association between sitting time and QoL. Prior research indicates that sedentary time consistently correlates with QoL in PD patients [25] and predicts lower QoL in this population [7]. Our results confirm that inactivity adversely affects QoL, implying that sedentary time is a crucial factor to address when promoting QoL in PD patients, as previously mentioned [25].

Limited research has evaluated the relationship between QoL and disease severity in PD; however, our study's design provided data in this regard. Consistent with prior studies, our results suggest that QoL deteriorates with disease progression [32]. Balash et al [33] also identified a direct link between QoL and disease severity, recognizing that the relationship between these outcomes mainly stems from mobility issues. These findings under-

score the importance of promoting PA in PD patients to enhance QoL through improved mobility.

On a final note, it is noteworthy that age showed a significant association with both fear of falling and beliefs in the benefits of PA. This association suggests potential declines in PA levels as individual's age, emphasizing the importance of developing strategies to promote PA practice among elderly patients.

This research offers valuable insights into factors affecting PA behavior in PD patients, contributing to informed healthcare and rehabilitation decisions from a clinical practice perspective. To better interpret the results, it is important to acknowledge several limitations, including the cross-sectional design, which precludes exploring whether PA behavior and the observed associations with QoL and disease severity remain constant over time. Secondly, using the *Physical Activity Questionnaire-Short Form* could have led to overestimating PA levels and introduced reporting bias. Thirdly, we did not consider potential variables influencing the relationship between QoL, disease severity, and PA behavior, such as age, obesity, motor impairment or functional mobility. Fourthly, the presence or absence of freezing of gait (FOG) and motor fluctua-

tions was not registered. Many patients with motor fluctuations and/or FOG reduce their physical activity due to fear of falls, and therefore, participants could have been affected when reporting their physical activity. Fifthly, the small sample size for H-Y groups might have underpowered some analyses. Lastly, excluding patients with cognitive impairment implies that the findings may not represent the entire PD population.

Conclusion

According to our findings, PD diagnosis results in PA behavior changes, with walking as the preferred modality. Neurologists primarily provide PA advice, but other healthcare professionals also participate in PA counseling. Both disease severity and QoL significantly influence PA levels and sitting time. Further research is required to identify which aspects of QoL and disease severity most impact PA behavior in PD patients.

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La actividad física en la enfermedad de Parkinson: identificación de los responsables de su prescripción, hábitos e impacto en la calidad de vida, y de la gravedad de la enfermedad

Introducción. Pocas investigaciones han explorado la influencia de la calidad de vida (CV) y la gravedad de la enfermedad en la actividad física (AF) en pacientes con enfermedad de Parkinson (EP), así como las fuentes de prescripción de AF y consejos para esta población. Este estudio tiene como objetivo ampliar el conocimiento científico sobre estos temas.

Pacientes y métodos. Se entrevistó personalmente a 211 pacientes con EP para recopilar datos sobre los niveles de AF con el *International Physical Activity Questionnaire-Short Form* y la CV con el *Parkinson's Disease Questionnaire-8*. Un cuestionario *ad hoc* recopiló información sobre la gravedad de la enfermedad (etapas de Hoehn y Yahr), los comportamientos de AF y las recomendaciones de AF.

Resultados. Se encontraron asociaciones débiles, pero significativas, entre los niveles de AF, la gravedad de la enfermedad ($r = -0,218$; $p = 0,004$) y la CV ($r = -0,244$; $p = 0,001$). La mayoría de los participantes (85%) recibió asesoramiento sobre AF, principalmente de neurólogos, ya sea en el momento del diagnóstico (52%) o poco después (28%). Antes del inicio de la EP, ~86% participaba en AF, lo que disminuyó al 66% después del diagnóstico. Aproximadamente el 78% informó sobre cambios en la AF, incluida una reducción en la frecuencia (18,4%) y la duración (32,8%), y la caminata era la actividad principal.

Conclusiones. La gravedad de la enfermedad y la CV afectan significativamente a los niveles de AF en pacientes con EP. El diagnóstico se asocia con una disminución en la frecuencia y la duración de la AF, y la caminata es la actividad preferida. Los neurólogos aconsejan principalmente sobre AF a las personas con EP.

Palabras clave. Asesoramiento en salud. Calidad de vida. Ejercicio. Pacientes neurológicos. Rehabilitación. Trastornos del movimiento.