# Association between functional capacity, sleep disorder and physical activity level in individuals with Parkinson's disease during the covid-19 pandemic period: a cross-sectional study

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## Abstract

*Objective*: To assess the level of exercise of older people with Parkinson's disease (PD), taking into account sociodemographic, clinical, and functional characteristics. *Method*: A cross-sectional study was carried out based on the following data: level of physical activity (International Physical Activity Questionnaire short version - short IPAQ), sleep disorders, cognitive complaints, duration of illness, degree of dependence to perform basic daily activities through Schwab & England (S&E) scale of older individuals with PD treated at a tertiary health service during the covid-19 pandemic. Poisson regression, Mann-Whitney U test and Student's t test were used for statistical analysis. *Results*: The prevalence ratio of being active increased by 1.04 (95% CI 1.01 - 1.08) for every 10 points of elevation on the S&E scale, whereas those who did not report sleep difficulties had a prevalence ratio of 1.17 (95% CI 1.02-1.34) times greater to be active. Inactive individuals with PD were older and had longer disease duration. *Conclusion*: Emphasis should be given to the functional capacity and sleep of individuals with PD for the adequate management of the PA level in periods of social restriction.

**Keywords:** Parkinsons's disease. Covid-19 pandemic. Physical Inactivity. Sleep disorders.

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## INTRODUCTION

Parkinson's disease (PD) is the second most prevalent neurodegenerative disease in the world and its incidence increases with aging [1]. In Brazil, a percentage of 100% growth in the number of people affected by PD between 2005 and 2030 is estimated [2].

PD is characterized by the presence of motor and non-motor symptoms, which cause physical, cognitive and emotional damage and consequent physical inactivity [3]. The greater severity of the disease, limitations in walking and activities of daily living are associated with lower levels of physical activity (PA) [3]. PA levels usually decrease with aging and this occurs more significantly in people with PD [4]. Individuals with mild to moderate PD have a lower level of PA when compared to healthy controls.

Physical impairments from PD results especially from the cardinal symptoms of the disease, such as rigidity, bradykinesia and postural instability; while cognitive and emotional symptoms result from non-motor symptoms such as depression, anxiety, attention deficit, apathy, executive dysfunction, dementia and memory impairment, among others [1].

Among the non-motor symptoms, sleep disturbances are frequent symptoms in individuals with PD due to nocturnal motor disorders (such as dystonias and akinesias), nocturia (due to detrusor hyperreactivity), side effects of parkinsonian therapy, of depression and REM sleep behavior disorder (RBD), which compromise the quality of life of these individuals [5].

During the covid-19 pandemic period, the lifestyle of the population as a whole underwent substantial changes, such as: a greater risk of assuming sedentary behaviors and changing sleeping habits [6]. The increase in physical inactivity during the pandemic can be associated with various damages, such as loss of aerobic capacity, loss of physical conditioning, cognitive and musculoskeletal decline [7]. Individuals with neuromuscular diseases and older people, in particular, demonstrated more significant muscle losses resulting from physical inactivity during the covid-19 [8] pandemic. In PD, losses in PA level, mental health and quality of life were also observed during the pandemic [9]. Sleep disorders, also present during the pandemic, were associated with declines in physical and mental health, since adequate sleep duration and quality facilitate the construction of coping mechanisms to adverse situations and good immune function [10].

As the practice of PA can be suggested as a protective factor in PD due to multiple mechanisms (mediation of inflammation and oxidative stress, promoting nerve regeneration and mitochondrial function and reducing the deposition of α-synuclein protein)[11], knowing the factors associated with PA in PD may be the basis for future therapeutic interventions that may delay the progression of PD and the functional decline associated with this condition [3].

Addressing the issue of physical inactivity, considered one of the main causes of death in the world and a pre-pandemic public health problem [12], during the pandemic is of strategic importance. In PD, this assumes even greater relevance, since, as a result of their underlying pathology, these individuals seem to be more prone to physical inactivity and sleep impairments in periods of social restriction. Therefore, the objective of this study was to evaluate the level of physical activity, considering the sociodemographic, clinical and functional conditions, of older people with Parkinson's Disease (PD).

## METHOD

The data used in this descriptive and cross-sectional study came from a cohort study conducted in the city of Fortaleza (Ceará) based on teleconsultations instituted during the covid-19 pandemic period. All teleconsultations were carried out once a week during the afternoon shift, following the routine procedure of face-to-face consultations as a strategy for maintaining the clinical follow-up of almost 350 individuals with PD followed up at the Movement Disorders Outpatient Clinic of a tertiary health service. Data were collected in teleconsultations, between the months of May and December 2020. The study was approved by the Research Ethics Committee (CEP) of the Hospital (Approval number: 31232720.2.0000.5045) and carried out in accordance with Resolutions nº 466/2012 and

510/2016 of the National Health Council, and carried out in accordance with the principles described in the Declaration of Helsinki. To ensure the quality of the study, STROBE *(Strengthening the reporting of observational studies in epidemiology)* was used.

The study included individuals with idiopathic PD, diagnosed by neurologists specialized in movement disorders, according to the criteria of the Brain Bank of the Parkinson's Disease Society of the United Kingdom[13], who underwent face-to-face follow-up at the outpatient clinic in the 12 months preceding the start of the project; (2) stages one through five on the Hoehn and Yahr (HY) stage of disability scale[14]. Subjects were excluded from the study if (1) they did not feel comfortable with virtual medical consultations, regardless of the reason, (2) if they had other types of parkinsonism, (3) if they did not have the necessary communication technology available, or (4) previous diagnosis of dementia according to the Diagnostic and Statistical Manual of Mental Disorders - V recorded in the medical record, and their caregiver was not available to attend the remote consultation with the participant.

## Data collection

The teleconsultations took place according to the service's usual appointment scheduling list, constituting a consecutive convenience sample. Individuals who met the inclusion criteria were included in the study according to the Service's scheduling list. The teleconsultations were carried out using the *WhatsApp*© application for video calls, whose tool was familiar to the studied population. Initially, all participants were informed about the research objectives and received an informed consent form and a code was assigned to each one of them.

After eligibility and consent, individuals answered the physical activity level questionnaires applied by physical education and physiotherapy students and the sleep questionnaires were self-completed because they were sent on WhatsApp© as a link to Research Electronic Data Capture (REDCap). We used Research Electronic Data Capture (REDCap) software for data collection and management. REDCap is a secure, web-based application designed to support data capture for research studies. Data entry takes place online, either by participants carrying out surveys, or by logged-in project team members. Integrated tools help manage data collection, which helps ensure the quality of their data. The researchers were part of a multidisciplinary team of the "Living with Parkinson's Disease Research and Extension Project" at the Federal University of Ceará. All researchers were trained and supervised by a geriatrician trained in movement disorders. After two months of training, the geriatrician collected the questionnaires with each student to standardize the procedures in the first two months of collection. Parkinsonian patients were evaluated during the "on" phase of the medication, within three hours of the last dose of the antiparkinsonian medication.

Clinical data were collected by a geriatrician with training in movement disorders, together with three neurology residents and one geriatrics resident. In the first two months, the geriatrician evaluated the clinical and demographic data together with each resident in order to calibrate data collection and recording.

Before the consultation, the patient's medical record was reviewed in order to assess comorbidities and the use of medications in order to reduce record bias. The remote consultations in which the collections were carried out took place in the afternoon shift and at a frequency of once a week, in accordance with the previous functioning of the outpatient clinic that attended to the participants. In an attempt to reduce interviewer bias, standardized questionnaires already validated in Brazil were used for PA level, daytime sleepiness and sleep quality.

Clinical and demographic data were collected, such as gender, age, levodopa equivalent dose, use of a walking aid, physical therapy, time since diagnosis of PD, activities of daily living *Schwab and England* (S & E), occurrence of falls in the last six months, sleep data (presence of disorders, including the clinical diagnosis of REM sleep behavior disorder (RBD) and application of the *Epworth and Pittsburg* scales), subjective cognitive complaint, presence of visual hallucinations , diagnosis of depressive disorder and use of medication (amount and use of specific classes such as benzodiazepines and antipsychotics). Sleep disorders were defined by the individual's anamnesis,

and the complaint of maintenance disorder, sleep onset or early awakening was considered as insomnia. The patient's or family member's report of exacerbated vocalizations and movements during sleep was characterized as the presence of RBD. Daytime sleepiness was recorded according to the presence of this complaint by the individual when questioned. Finally, the respiratory disorder obstructive sleep apnea syndrome (OSAS) was suggested when there was a report by the individual or his family member of an abrupt, repeated and temporary interruption of breathing during sleep, with or without the presence of snoring. The levodopa-equivalent dose of an antiparkinsonian drug was calculated from the Tomlinson scale, defined as the dose that produces the same level of symptomatic control as 100mg of immediate-release levodopa[15]. Polypharmacy was defined as the use of 5 or more drugs[16].

The International Physical Activity Questionnaire short version (short IPAQ) was used to assess self-reported PA levels. Because it is a quick and easy administration instrument, it allows population studies and international comparisons. The short IPAQ measures the weekly frequency, duration and intensity of PA, allowing the classification of individuals as sedentary, irregularly active A, irregularly active B, active and very active. Even in its short form, it presents coefficients of validity and reproducibility similar to other more expensive application instruments[17]. The short IPAQ consists of seven items, covering all domains of activity (addresses leisure, domestic, work-related and transportation activities)[18]. During its validation in Brazil, it was analyzed under different forms of application (self-assessment, telephone interviews) [17]. In the present study, due to the sample size, participants were organized into two groups: active individuals (categories: active and very active from the short IPAQ) and inactive individuals (categories: irregularly active and sedentary from the short IPAQ).

The Pittsburg Sleep Quality Index (PSQI) is a self-administered instrument that assesses the quality and presence of sleep disturbances over the past month. This questionnaire is validated in Brazil [19] and has its items grouped into seven components scored on a scale from zero to three, whose total score varies from zero to 21, showing adequate internal consistency and validity [19]. The seven components of the PSQI are: subjective sleep quality; sleep latency; sleep duration; habitual sleep efficiency; sleep disorders; use of sleep medications and daytime sleep disturbance. This questionnaire is also composed of five additional questions (usually used only for clinical purposes) that must be answered by a roommate. The higher the total score, the worse the sleep quality. A global score of 5 or more indicates poor sleep quality[20]. These properties of the PSQI mean that this questionnaire is used in clinical research in general 20 and in PD for subjective assessment of sleep quality[21].

The Epworth Sleepiness Scale (ESS) is a simple and self-administered questionnaire [22] that assesses sleepiness. Consisting of eight situations in which the probability of a person sleeping is evaluated on a scale from 0 to 24, in which a score greater than 10 indicates excessive sleepiness, which is a valid and reliable instrument for assessing daytime sleepiness in clinical practice and in research with the Brazilian population and in PD[22].

The Schwab & England Basic Activities of Daily Living Scale (S & E ) was used to stratify the degree of independence to perform activities of daily living and is commonly used to monitor the functional capacity of individuals with PD. The scale was first presented in 1968 at the *Third Symposium on Parkinson's Disease, Royal College of Surgeons in Edinburgh*[23]. In this scale, individuals are distributed in percentages that vary from 0 to 100%, where higher percentage values indicate better functional capacity [24]. The S&E scale has become a standardized assessment tool in PD and has been used in hundreds of studies. The clinometry properties of this scale, however, have never been established. Available data from studies primarily aimed at investigating the characteristics of other rating scales suggest moderate to substantial validity and good reliability[24].

Descriptive statistics was performed for all variables. Clinical and demographic characteristics of participants were described using measures of central tendency and dispersion. In the analysis of the comparison between the groups, the *Mann-*

*Whitney* U test and *Student's* t test were used, according to adherence or not to the Gaussian distribution. Pearson's chi-square test and Fisher's exact test were used to investigate the association between categorical variables. For the construction of the Poisson regression model, the association between the dependent variable level of physical activity (short IPAQ) (1= active individuals and 0= inactive individuals) with the independent variables: absence of sleep disorder, cognitive complaint, disease duration, S&E score. For goodness of fit, the "golden rule" of a maximum of one independent variable for every five individuals with a positive outcome was respected.

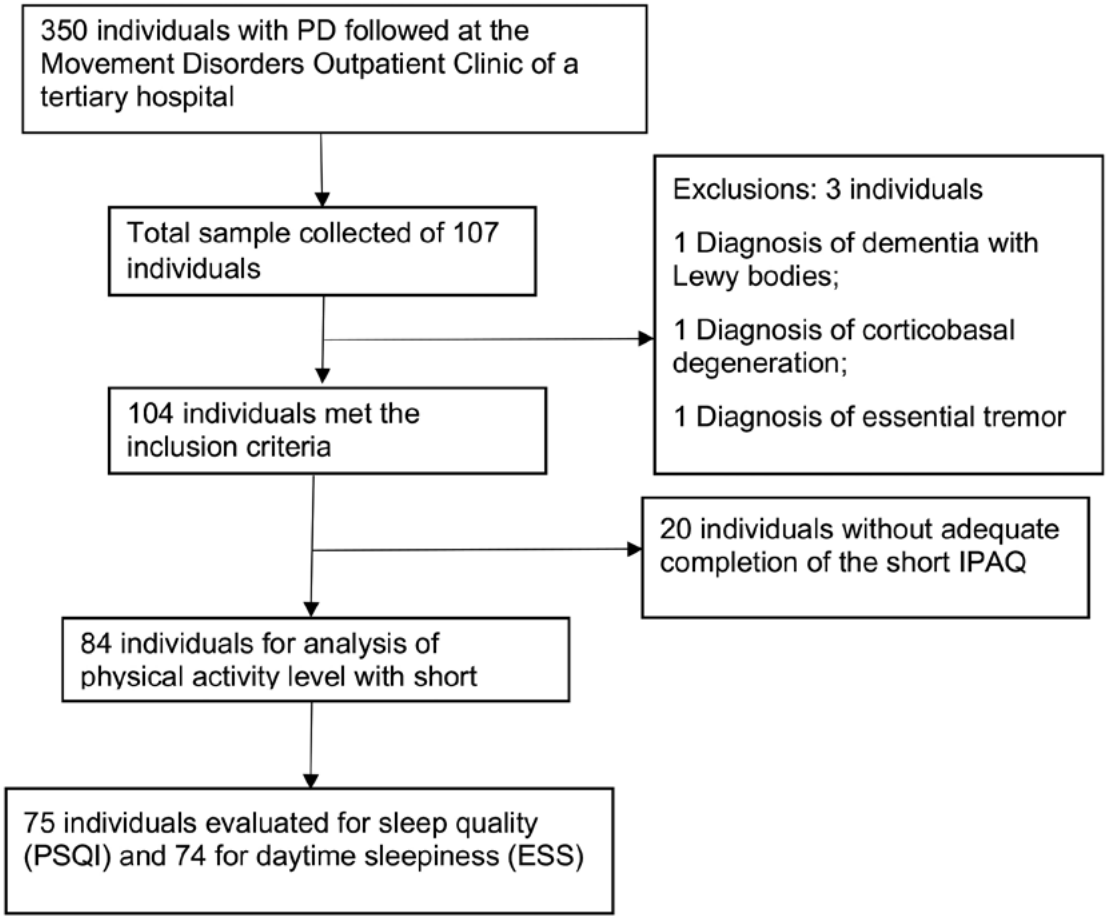
The Power of the sample of 84 patients was calculated a posteriori, using the G*Power 3.1.9.2 program, based on the comparison between the level of physical activity and the variable related to the severity of PD by S & E, obtaining the value of 93.6%.

## RESULTS

Of the 350 individuals monitored by the clinic, a total of 107 participants were initially evaluated for this study (30.6%). Of these, 84 individuals (Figure 1) adequately filled out the short IPAQ, constituting the sample used for analysis in this study. Of these, 52 (61.9%) were classified as non-active and 32 (38.1%) as active. Mean age was 68.1 (±12.9) years, mean disease duration was 10.1 (± 6.3) years, mean levodopa equivalent dose was 1,032mg (± 510.1) and the mean S&E score was 69.7(±24.5). The most prevalent health condition, excluding sleep disorders, was systemic arterial hypertension, which was present in 35 individuals (41.6%), followed by depressive disorder in 27 individuals (32.1%). Only six participants (7.1%) reported regular physical therapy practice. The clinical-epidemiological characteristics of the participants and their association with the level of PA according to the short IPAQ are shown in Table 1. Data regarding the presence of sleep disorders in their clinical anamnesis were also obtained due to the relevance of sleep for the health of these individuals (Table 2).

For the evaluation of sleep quality, 75 participants answered the *Pittsburgh*, of which only one individual (1.3%) had good sleep quality (score 0-4), with a mean score of 12.1(± 3.7). As for the assessment of daytime sleepiness, 74 individuals responded to the ESS and 45 (60.8%) of these classified themselves as having excessive daytime sleepiness, with a mean score of 11.5 (± 5.9). As the sleep scales were answered by the patients through a link from Redcap to Whatsapp, unfortunately there were greater losses because some patients did not respond.

Due to the sample size and because it is a cross-sectional study, Poisson regression was performed (Table 3) for which variables were selected that presented, according to the literature, greater association with the level of physical activity. Elevation in the S&E scale (variation of ten points) was associated with the outcomes: active and very active categories of the short IPAQ, with a prevalence ratio of 4.5%. It was also found that individuals who did not report sleep disorders had a 17.2% higher prevalence of being physically active.




PD: Parkinson's disease; Short IPAQ: International Physical Activity Questionnaire; PSQI: Pittsburg Sleep Quality Index; ESS: Epworth Sleepiness Scale

**Figure 1.** Sample recruitment flowchart. Fortaleza, CE, 2020

**Table 1.** Clinical and demographic characteristics of non-active and active individuals with Parkinson's disease (N=84). Fortaleza, CE, 2020.

| | | IPAQ | | |
|---|---|---|---|---|
| | Total | Non-active | Active | p |
| Sex | | | | 0,06[c] |
| Male | 51 (60,7%) | 31 (59,6%) | 20 (62,5%) | |
| Female | 33 (39,3%) | 21 (40,4%) | 12 (37,5%) | |
| Education | | | | 0,63[d] |
| Illiterate | 8 (9,5%) | 4 (7,7%) | 4 (12,5%) | |
| Incomplete Elementary | 39 (46,4%) | 28 (53,8%) | 11 (34,4%) | |
| Complete Elementary | 6 (7,1%) | 4 (7,7%) | 2 (6,3%) | |
| Incomplete High School | 3 (3,6%) | 2 (3,8%) | 1 (3,1%) | |
| Complete High School | 12 (14,3%) | 7 (13,5%) | 5 (15,6%) | |
| Incomplete Higher Education | 6 (7,1%) | 2 (3,8%) | 4 (12,5%) | |
| Complete Higher Education | 6 (7,1%) | 3 (5,8%) | 3 (9,4%) | |
| Postgraduate | 4 (4,8%) | 2 (3,8%) | 2 (6,3%) | |

to be continued

Continuation of Table 1

| | IPAQ | | | |
|---|---|---|---|---|
| | Total | Non-active | Active | p |
| Education in years | 7,3 ± 5,3<br>5 (0 - 20) | 6,8 ± 4,9<br>5 (0 - 17) | 8,1 ± 5,9<br>6,5 (0 - 20) | 0,43[b] |
| Age (years) | 68,1 ± 12,9<br>71 (0 - 94) | 70,5 ± 10,2<br>72,5 (47 - 94) | 64,2 ± 15,8<br>68,5 (0 - 89) | **0,03**[b] |
| Time since diagnosis of PD (years) | 10,1 ± 6,3<br>9,5 (0 - 28) | 11,1 ± 6,3<br>11 (1 - 28) | 8,4 ± 6,1<br>7 (0 - 27) | **0,03**[b] |
| S & E | 69,8 ± 24,5<br>80 (10 - 100) | 62,9 ± 25,4<br>70 (10 - 100) | 80,9 ± 18,4<br>85 (20 - 100) | **<0,01**[b] |
| Number of falls in 6 months | 4,1 ± 9,9<br>0 (0 - 60) | 4,4 ± 11,5<br>0 (0 - 60) | 3,6 ± 6,5<br>1 (0 - 26) | 0,29[b] |
| Equivalent dose of levodopa† | 1032 ± 510<br>1078 (25 - 2600) | 1030 ± 433<br>1200 (50 - 1648) | 1035 ± 622<br>1000 (25 - 2600) | 0,75[b] |
| Use of walking aid | 30 (36,1%) | 24 (46,2%) | 6 (19,4%) | **0,01**[c] |
| Report sleep disorder | 58 (69%) | 41 (78,8%) | 17 (53,1%) | **0,01**[c] |
| ESS Score* | 11,4 ± 5,9<br>11 (0 - 24) | 11,4 ± 6,3<br>11 (0 - 24) | 11,4 ± 5,2<br>11 (0 - 21) | 0,65[c] |
| ESS* | | | | 0,75[c] |
| Daytime sleepiness | 45 (60,8%) | 28 (37,8%) | 17 (22,9%) | |
| No daytime sleepiness | 29 (39,1%) | 17 (22,9%) | 12 (16,2%) | |
| *Pittsburg* Score** | 12,1 ± 3,8<br>12 (4 - 20) | 12,9 ± 3,5<br>13 (6 - 20) | 10,9 ± 3,7<br>11 (4 - 17) | **0,02**[b] |
| *Pittsburg*** | | | | 0,20[c] |
| Poor sleep quality | 74 (98,7%) | 46(61,3%) | 28 (37,3%) | |
| Good sleep quality | 1 (1,3%) | 0 (0%) | 1 (1,3%) | |
| Presence of cognitive complaint | 34 (40,5%) | 26 (51%) | 8 (25%) | **0,01**[c] |
| Presence of visual hallucinations | 26 (31%) | 22 (42,3%) | 4 (12,5%) | **<0,01**[c] |
| Use of benzodiazepine | 20 (23,8%) | 16 (30,8%) | 4 (12,5%) | 0,05[c] |
| Use of atypical antipsychotics | 10 (11,9%) | 9 (17,3%) | 1 (3,1%) | 0,05[c] |
| Use of typical antipsychotics | 0 (0%) | 0 (0%) | 0 (0%) | |
| Depression | 27 (32,1%) | 19 (36,5%) | 8 (25%) | 0,27[c] |
| Number of medications in use | 5,8 ± 3.1<br>5 (1 - 15) | 6,1 ± 3.2<br>5,5 (1 - 15) | 5,4 ± 2,9<br>5 (1 - 13) | 0,27[b] |
| Polypharmacy | 53 (63,1%) | 34 (65,4%) | 19 (59,4%) | 0,30[c] |

Data displayed in n (%) and Mean ± Standard Deviation, Median (Minimum-Maximum). b: Mann-Whitney test c: Pearson's chi-square test; d: Fisher's Exact Test. PD: Parkinson's disease; S&E: "Schwab and England" clinical assessment scale; ESS: Epworth sleepiness scale; *: number of 74 individuals; **: number of 75 individuals. † levodopa equivalent dose = (levodopa dose) + (amantadine dose x 1) + (pramipexole dose x 100) + (rasagiline dose x 100) + (levodopa dose plus entacapone x 0.33) + (extended-release levodopa dose x 0.75)

**Table 2.** Frequency of sleep disorder (N= 58). Fortaleza, CE, 2020

| Sleep disorder | N (%) |
|---|---|
| Insomnia | 36 (62) |
| REM sleep behavior disorder | 37 (63.7) |
| Daytime sleepiness | 26 (44.8) |
| OSAS suggestion | 17 (29.3) |
| Others | 5 (8.6) |

**Table 3.** Poisson regression for the physical activity level outcome (short IPAQ). Fortaleza, CE, 2020

| Variables | PR | 95%CI | p-Value |
|---|---|---|---|
| Absence of sleep disorder | 1.17 | 1.02-1.34 | **0.02** |
| cognitive complaint | 0.91 | 0.79-1.05 | 0.20 |
| Duration of disease | 0.99 | 0.98-1.01 | 0.60 |
| S&E Score (10)* | 1.04 | 1.01 – 1.08 | **0.01** |

*variations every 10 points; S&E: "Schwab and England" clinical assessment scale; PR: prevalence ratio



## DISCUSSION

In this study, absence of sleep disorders and better functional capacity, assessed by S&E, were associated with a higher level of PA. The worsening of motor capacity (strength, balance and flexibility) that occurs with disease progression is directly related to physical inactivity in PD[6]. PA improves functional capacity in PD, delaying or reversing physical decline[25]. The association between better functional capacity and higher levels of PA corroborates the importance of non-pharmacological management of this chronic health condition.

Another factor associated with a higher level of PA was the absence of sleep disorders. As well as physical inactivity, our population showed a high prevalence of sleep disorders as well as other studies previously carried out in PD [6]. Sleep disturbances are among the first symptoms experienced in PD and it is believed that this dysfunction can operate as a trigger exacerbating neurodegeneration from the early stages of the disease[26]. Insomnia and poor sleep quality were prevalent complaints during the pandemic period, not only due to the changes suffered in work routines, but also due to the stress generated by the fear of illness and irregular exposure to daylight, the main factor for timing the circadian cycle[10]. In this study, the presence of sleep disorders was associated with a greater chance of the studied individuals being more inactive. For the management of chronic diseases, maintaining a sufficient amount of physical activity and a good quality and quantity of sleep are beneficial habits, with a bidirectional relationship between both these behaviors, which directly influence each other[27]. In view of the findings, it is suggested that the sleep disorders seen in this study during the pandemic period may contribute to physical inactivity. However, other study designs are needed to prove this association. Evaluating the presence of daytime sleepiness and sleep quality during the period of the covid-19 pandemic is necessary, since increases of 40% in the prevalence of sleep disorders were recorded during this period[27].

Because it is a progressive neurodegenerative disease, PD involves motor and non-motor impairments that can lead to a more inactive lifestyle [28], which corroborates the result of the present study, in which older individuals and those with a longer duration of disease presented predominantly distributed in the non-active group. A fact that also occurred for participants who had worse functional capacity, as assessed by S&E. This result is in agreement with a pre-pandemic longitudinal study, in which PA was assessed by self-report, where a higher level of PA, obtained by self-report, was associated with a better score on the S&E[29]. In the same direction, studies carried out during the pandemic with individuals with PD described worsening of motor symptoms in these individuals associated with a reduction in PA[30].

The mean ESS and PSQI scores were greater than 11 and 12, respectively, which denotes a high prevalence of daytime sleepiness and poor sleep quality. In this study, higher PSQI scores were seen in the non-active group. Furthermore, previous records have shown that physical inactivity can worsen non-motor symptoms in PD, such as insomnia, for example[3].

The prevalence of sedentary and irregularly active individuals in the studied population of individuals with PD was high in the period (61.9%). This result is corroborated by other studies in individuals with PD [3]. As a result of home confinement being adopted as one of the main measures to control covid-19, a

reduction in physical activity levels was expected in that period. A similar result was observed in studies with diabetic individuals [31] in which both sexes showed an increase in inactive time during the pandemic period. Interestingly, Italian individuals aged over 12 years during the covid-19 pandemic with no previous habit of playing sports did not use this period to do so, however, those who had the habit now had more time to do so and increased the frequency of physical activity[6].

The average number of falls in 6 months was higher in the non-active group, with no relevant statistical significance. However, due to the impairment in functional capacity that these events cause and because they are related to the cardinal symptoms of PD, this information should be highlighted. Fear of falling and greater disease severity were previously associated with more physical inactivity[3]. Memory bias may have made data on the occurrence of falls in the last 6 months less reliable.

Present in more than 40% of the individuals in this study, the cognitive complaint was significantly related to physical inactivity. Previous studies have shown that physical activity can improve motor function (strength, balance and flexibility) and non-motor symptoms, alleviating cognitive impairment, depression and improving executive function in PD [12]. In Brazil, family members are often the main care providers for dependent individuals with PD due to physical, cognitive and social damage, a situation that can generate family and financial stress [32]. Studies have found a relationship between cognitive impairment and the PD phenotype in which postural instability and gait difficulty predominate[33], and there may be greater physical dependence between these. The dependence presented by individuals with cognitive impairment may be a factor related to their lower level of physical activity, which requires further investigation.

A limitation of this study was the fact that it was carried out without the physical examination of the patients due to the use of teleconsultations given the peculiarities of the period of social restriction, not being possible to evaluate them in terms of the HY scales (the most widely used and accepted staging system for PD severity) [34] and *Unified Parkinson Disease Rating Scale* (UPDRS). UPDRS is valid, reliable and sensitive to change, it has been translated through a rigorous process into 14 languages. It reflects the severity of symptoms across multiple aspects of the disease [35]. Another limitation is due to the fact that teleconsultations can negatively interfere with the motivation of eligible individuals to participate in the study. Finally, having considered the diagnosis of sleep disorders clinically without the use of other complementary tests may limit the interpretation of the data. On the other hand, the strengths of this study are the evidence that suggests that a more physically active behavior was associated with the absence of sleep disorders in individuals with PD during the period of social restriction that occurred during the pandemic.

## CONCLUSION

The present study showed that higher levels of functional capacity and absence of sleep disorders were associated with better levels of physical activity in individuals with PD, emphasizing the importance of optimizing the multidisciplinary approach in these areas for better health conditions, especially in periods of social restriction.

## AUTORSHIP

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