


## RESPIRATORY MUSCLE STRENGTH AND DYSPNEA IN PARKINSON'S DISEASE: A CROSS-SECTIONAL ANALYSIS

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### ABSTRACT

**Objective:** To evaluate respiratory muscle strength in patients with Parkinson's disease (PD) and to investigate the association of these parameters with dyspnea intensity.

**Methods:** A cross-sectional study was conducted with 26 patients (12 women and 14 men) with PD, aged between 49 and 81 years, participants of the Parkinson's Association of Pernambuco. The sample was defined by convenience. Data were collected through clinical questionnaires, assessment of respiratory muscle strength (MIP and MEP), and application of the modified dyspnea scale (MRC). Respiratory muscle strength was measured using a manometer. Statistical analyses included one-way ANOVA and post-hoc LSD t-test for comparisons between groups stratified by dyspnea intensity. **Results:** The mean age was  $64.3 \pm 7.5$  years. The participants were divided into three groups according to the answers to the questionnaire regarding the intensity of dyspnea: dyspnea only with intense exercise (n=8), dyspnea with moderate exercise (n=9), and dyspnea with daily activities (n=9). There was a significant difference between the groups about age and stage of the disease ( $p < 0.05$ ). Respiratory muscle strength (MIP) was significantly reduced in the groups with the highest intensity of dyspnea. **Conclusion:** The intensity of dyspnea in patients with PD is associated with decreased inspiratory muscle strength. Individuals with greater dyspnea have lower inspiratory force values, which can impact the sensation of dyspnea in their daily activities and quality of life. These findings suggest the need for therapeutic strategies aimed at improving respiratory muscle strength and preserving pulmonary function in patients with PD.

**Keywords:** Parkinson's disease. Physiotherapy. Old.

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## INTRODUCTION

Aging is an inevitable biological process, characterized by a progressive functional decline of various functions, tissues, and organs, increasing the risk of chronic diseases, including neurodegenerative and respiratory diseases (Lima; Silva; Galhardoni, 2008; Zhong et al., 2023). Parkinson's Disease (PD) is one of the most prevalent neurological pathologies in elderly individuals, with an increasing incidence with advancing age (Hou et al., 2019).

PD, first described in 1817 by physician James Parkinson, is characterized by motor and non-motor symptoms. The evolution of the disease can impact respiratory function, resulting in reduced lung elasticity and complications such as respiratory muscle weakness and increased dyspnea (Silverman et al., 2016; Ramos et al., 2014). These factors can compromise the mobility and functional independence of these individuals, justifying the investigation of respiratory patterns, respiratory muscle strength, and possible therapeutic interventions.

## METHODS

This was a cross-sectional study conducted with 26 individuals with PD, aged between 49 and 81 years, registered with the Parkinson's Association of Pernambuco (ASP). The sample was selected for convenience. Exclusion criteria included a history of lung disease, other associated neurological diseases, and significant cognitive impairment. The study complied with Resolution No. 466/12 of the National Health Council (CNS), which deals with the Code of Ethics for research on human beings, and was approved by the Research Ethics Committee of the Federal University of Pernambuco (CAEE: 82533724.8.0000.5208) and registered with opinion number: 7.106.49. The study participants were previously informed about the objective of the research and signed the Informed Consent Form (ICF) to authorize the use of the data obtained and the image for dissemination restricted to the scientific environment.

Data collection included clinical questionnaires with information on age, sex, weight, height, time, and stage of the disease. Respiratory muscle strength was assessed using an analog manometer, according to the guidelines of the American Thoracic Society (ATS). Dyspnea was measured using the modified dyspnea scale (MRC).

## RESULTS

The sample consisted of 26 people with PD, 12 women, and 14 men, with ages ranging from 49 to 81 years. The participants were divided into three groups according to the answer about the evaluation of the intensity of dyspnea. The analyses showed a significant difference in age ( $p=0.039$ ) and disease stage ( $p=0.042$ ), suggesting that older individuals have worse feelings of dyspnea.

**Table 1.** Means (standard deviations) of age, weight, time, and stage of the disease in the groups stratified by the level of dyspnea at exercise.

Variable	Dyspnea on intense exercise (n=8)	Dyspnea on moderate exercise (n=9)	Dyspnea when walking/daily activities (n=9)	p-value
Age (years)	59 (7.2) <sup>1</sup>	68 (9.2) <sup>2</sup>	68 (7.2) <sup>3</sup>	0,039*
Weight (Kg)	72,4 (10,4)	63,7 (13,0)	73,4 (20,7)	0,363
Disease time (years)	3,5 (3,2)	4,4 (3,8)	6,2 (5,3)	0,583
Disease stage (HY)	2 (1)	2 (0.7) <sup>2</sup>	3 (0.7) <sup>3</sup>	0,042*

**Note:** One-way analysis of variance (ANOVA) Post hoc LSD t-test: Age 1 vs 2 =  $p = 0.027$ ; 1 vs 3 =  $p = 0.024$  and Disease Stage (HY): 2 vs 3 =  $p = 0.017$

**Table 2.** Inspiratory and expiratory pressures (in cmH<sub>2</sub>O), expressed as mean (standard deviation), were measured in the groups stratified by the level of dyspnea at exercise.

Variable	Dyspnea on intense exercise (n=8)	Dyspnea on moderate exercise (n=9)	Dyspnea when walking/daily activities (n=9)	p-value
Pi Max	102.5 (48.6) <sup>1</sup>	71,1 (31,5)	47.8 (39.7) <sup>3</sup>	0,037*
Pe Max	53,8 (15,3)	47,8 (13,0)	41,1 (21,9)	0,336

**Note:** One-way analysis of variance (ANOVA). Post hoc test t-LSD: Pi Max: 1 vs 3 =  $p = 0.01$

## DISCUSSION

In the present study, a more prevalent male sample was identified, with a mean age > 60 years, a finding already described in the literature as in the study by (Tolosa et al 2021), which describes age as the most significant risk factor for the development of Parkinson's disease, and men are more susceptible than women, with a prevalence ratio of approximately 3:2. (Tolosa et al 2021).

Studies such as those by Santos et al 2019 demonstrate that maximal respiratory pressures decreased with the progression of PD, with significant differences at each stage of the disease. This finding demonstrates that the fact that the subject has PD already reduces the maximum respiratory pressures of the population without the disease. PD's characteristics may be involved in this process, overcoming the damage naturally caused

by aging. However, in our findings, the reduction in expiratory muscle strength was not significant.

However, our findings of reduced inspiratory muscle strength and worsening of the sensation of dyspnea corroborate the literature on the relationship between respiratory muscle weakness, especially inspiratory muscles, and symptoms of dyspnea and intolerance to exertion. However, the diagnosis is usually delayed, because most protocols for the investigation of dyspnea do not include the evaluation of respiratory muscle strength. (Albuquerque 2015)

Studies investigating breathing patterns in patients with Parkinson's Disease (PD). Although the mixed breathing pattern (combination of restrictive and obstructive features) is not widely described in the literature, some studies point to significant changes in the respiratory function of these patients. (PEREIRA, FERREIRA, Schultz)

As a limitation of the study, we can highlight the number of participants, the small number of participants limits the generalization of the results, the age of the participants since the aging process alters lung strength and function, and the lack of a healthy control group is an important limitation, which should be addressed in future studies.

## **CONCLUSION**

Patients with PD and higher intensity of dyspnea have lower inspiratory muscle strength, which can compromise their daily activities. These findings highlight the importance of physical therapy interventions to preserve lung function and improve the quality of life of these individuals. Future studies should investigate effective therapeutic strategies to minimize the impact of respiratory muscle weakness on the functionality of PD patients.

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