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# Assessment of Parkinson disease patients before and after a physical activity program

## *Avaliação de pacientes com doença de Parkinson antes e depois de um programa de atividade física*

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### Abstract

**Objectives:** The purpose of the present study was to assess the influence of a tailored physical activity program on specific parameters in Parkinson Disease (PD) patients. **Method:** PD patients were assessed before and after six months of a tailored physical activity program. Twenty PD patients (13 M, 7 F), mean age 55 years. Aerobic, resistance and stretching exercises. No special apparatus or machine was used at any stage of the program. There was no interference with the pharmacologic treatment, which remained at the discretion of the physician in charge. Fatigue, disability, joint amplitude, cardiorespiratory parameters and body fat composition were assessed. Comparisons were performed using the Student's t-test at baseline and after six months. **Results:** There was a significant ( $p < 0.001$ ) and positive effect of this physical activity program in all assessed parameters. **Conclusions:** Despite this chronic, disabling and progressive neurological disease, PD patients showed significant improvement in all assessed parameters after participating in a specific and tailored physical activity program.

**Key words:** Disability; Fatigue; Parkinson disease; Physical activity; Physical conditioning.

### Resumo

**Objetivos:** O propósito do presente estudo foi investigar a influência de um programa de atividade física individualizada, em parâmetros específicos de pacientes com doença de Parkinson (PD). **Método:** Pacientes com PD foram avaliados antes e depois de seis meses de um programa de atividade física individualizado. Vinte pacientes com PD (13 M, 7 F), idade média de 55 anos. Exercícios aeróbicos, de resistência e de alongamento. Não foi utilizado nenhum aparelho ou máquina especial em nenhum estágio do programa. Não houve interferência no tratamento farmacológico, que permaneceu aos cuidados exclusivos do médico responsável. Foram avaliados fadiga, incapacidade, amplitude articular, parâmetros cardiorespiratórios e composição de gordura corporal. **Resultados:** Houve um efeito positivo significativo ( $p < 0.001$ ) deste programa de atividade física em todos os parâmetros estudados. **Conclusões:** Apesar de portadores desta doença neurológica crônica progressiva e incapacitante, os pacientes com PD tiveram uma melhora significativa em todos os parâmetros após participarem de um programa de atividade física específica e individualizada.

**Descritores:** Incapacidade, Fadiga, Doença de Parkinson, Atividade física, Condicionamento físico.

## Introduction

The positive role of physical activity for Parkinson Disease (PD) patients is becoming very clear, as shown by systematic reviews of the literature<sup>1-3</sup>. There are inherent difficulties in randomized, double-blind, placebo-controlled trials, which are typical of studies involving a physical activity program<sup>4</sup>. Patients participating in these programs may be more willing to socialize and exercise, possibly creating a bias towards good results. However, it does not compromise the quality of open studies that compare a variety of parameters before and after a physical activity program, and the abovementioned recent publications point towards beneficial effects from exercise programs for PD patients.

PD may interfere with the body mass index (BMI) because of these individuals' sedentary lifestyle, behavioral disorders and withdrawal from social activities. The lack of regular physical activity may lead to cardiovascular changes in these patients, which may determine even higher degrees of fatigue, pain, inadequate posture, frailty, osteoporosis and falls. All of these alterations may ultimately affect disability, expressed by range of motion and muscle strength, contributing to an increment of the sedentary behavior and low physical conditioning.

The aim of the present work was to assess the effect of a six-month physical education program on clinical and anthropometric parameters in a group of PD patients.

## Patients and Methods

The present study was approved by UNIMES Ethics Committee. All participants signed an informed consent prior to entering the physical activity program. All patients were undergoing treatment in the coastal region of the state of São Paulo. They were recruited by their own interest in participating in a physical activity program in the region. Adults aged 18 years and over, with the diagnosis of PD could be in-

cluded in the program. Disease duration, as well as motor and cognitive alterations were no exclusion criteria for participating in this study. Their medical condition was assessed and the program was specifically tailored to each individual's limitations. Patients entering this study were not performing any other type of physical training.

The medical treatment with PD-specific drugs was conducted strictly by the neurologist in charge of each patient, without any interference or suggestion from our group. Other diseases that the patients may have presented at that time were also treated in accordance with their own physicians' recommendations.

When patients entered the program, their cardiovascular and respiratory condition was assessed by means of a three-minute aerobic session on a step. Patients with limitations were helped by the physical education trainers (for example, by holding hands). Blood pressure, heart rate and maximum breathing pressure (inspiration and expiration, assessed by manovacuometer) were measured immediately before starting the step exercise and immediately after finishing it. Patients who were not considered to be in good cardiovascular (arrhythmia, very high blood pressure) and/or respiratory (shortness of breath) condition were not allowed to proceed with the physical activity program. Instead, they were referred for assisted physical therapy.

Body weight was measured using an electronic scale, and percentages of fat and lean tissue were assessed by skinfold measurement, discarding the highest and the lowest values of three measurements. Each patient's disability level was measured on the Hoehn/Yahr scale<sup>5</sup>. The scale ranges from zero (no disease) to five (complete disability; totally dependent on a caregiver).

Fatigue was assessed on the Chalder scale<sup>6</sup>, validated in Portuguese<sup>7</sup>. This is a simple 14-item verbal rating and self-applicable inventory that is used in a variety of neurological and non-neurological diseases that can lead to fatigue.

The maximum amplitude angle of movement for shoulders, hips and knees was assessed. The patient actively abducted each shoulder in-

dividually for measuring the abduction angle. In sequence, the patient abducted each leg for measuring the hip abduction angle. Finally, the patient extended each knee for the measurement of the maximum possible extension.

Blood pressure and heart rate were assessed at the start and at the end of every session. Body weight, percentage of fat, fatigue, joint amplitude and respiratory muscle strength were assessed at baseline and after six months.

The program included an initial period of walking on a treadmill (50 to 60% of  $\text{VO}_2$  max). The maximum effort made was to walk up a slight slope, using leg weights of one to two kilograms (65 to 85% of  $\text{VO}_2$  max). This activity was followed by resistance training (25 to 30% of the maximum load), using repeated progressive sets of exercises, from three sets of 20 repetitions up to ten sets of 20 repetitions, depending on the individual's performance.

After three months, the program included specific strengthening work, with the aim of increasing the muscle mass. This included progressive weight increases (50 to 55% of the maximum load), with short repetitions (five sets of 12 repetitions to five sets of eight repetitions), depending on the load.

Each session finished with a 30-minute specific muscle stretching program, including passive and active movements. Sessions occurred twice a week.

Mean value and standard deviation (SD) were used for continuous variables. The t-test was used for assessing the significance of differences found from baseline to values after six months, using SPSS v 13.0.

## Results

Twenty PD patients completed the six-month program of physical activity, attending at least 75% of all sessions. This group consisted of 13 males and seven females, aged between 49 and 64 years (mean: 55 years  $\pm$  4.4). There were no medical complications relating to this program,

and no serious adverse events were reported by the patients. The table summarizes the results.

All analyzed parameters showed a very significant degree of improvement ( $p < 0.001$ ) af-

**Table 1: Assessment of disability, fatigue, body fat, cardiorespiratory parameters and joint amplitude in PD patients: effects of a six months physical activity program**

Parameter	Basal (SD)	After 6 months (SD)	Statistical significance
Hoehn/Yahr scale	2.65 (0.58)	1.90 (0.41)	$p < 0.001$
Fatigue (Chalder Scale)	5.95 (0.88)	3.70 (0.57)	$p < 0.001$
Body weight (kg)	78.90 (5.60)	85.10 (4.30)	$p < 0.001$
Percentage of body fat	30.40 (4.58)	22.95 (2.07)	$p < 0.001$
Heart rate at rest (beats per minute)	88.40 (12.72)	69.30 (4.79)	$p < 0.001$
Heart rate after exercise (beats per minute)	157.00 (7.95)	134.20 (1.88)	$p < 0.001$
Systolic blood pressure at rest (mmHg)	146.00 (8.20)	127.00 (4.70)	$p < 0.001$
Systolic blood pressure after exercise (mmHg)	148.50 (2.35)	134.50 (3.59)	$p < 0.001$
Diastolic blood pressure at rest (mmHg)	90.50 (5.35)	80.00 (3.97)	$p < 0.001$
Diastolic blood pressure after exercise (mmHg)	95.00 (5.12)	81.00 (2.05)	$p < 0.001$
Maximum inspiratory pressure (mmHg)	54.90 $\pm$ 7.55	69.45 $\pm$ 4.31	$p < 0.001$
Maximum expiratory pressure (mmHg)	66.55 $\pm$ 7.66	75.9 $\pm$ 4.42	$p < 0.001$
Maximum right arm abduction (angle)	132.00 (12.87)	150.80 (6.81)	$p < 0.001$
Maximum left arm abduction (angle)	129.75 (11.15)	147.50 (9.93)	$p < 0.001$
Maximum right leg abduction (angle)	26.35 (6.91)	45.60 (6.29)	$p < 0.001$
Maximum left leg abduction (angle)	27.05 (7.66)	47.60 (5.09)	$p < 0.001$
Maximum knees extension	40.60 (10.61)	117.00 (5.36)	$p < 0.001$

SD standard deviation

ter six months of regular exercises. The Hoehn/Yahr scale values of  $2.65 \pm 0.58$  observed at baseline improved to  $1.90 \pm 0.41$ . According to the Chalde fatigue scale, the baseline values of  $5.95 \pm 0.88$  decreased to  $3.70 \pm 0.57$ . The average body weight increased from  $78.90 \pm 5.60$  to  $85.10 \pm 4.30$ , due to the increment of muscle mass, since the body fat simultaneously decreased from  $30.40 \pm 4.58$  to  $22.95 \pm 0.70$ .

The same degree of significant improvement ( $p < 0.001$ ) was observed for cardiovascular parameters after six months of physical activity. The average heart rate at rest (bpm - beats per minute) decreased from  $88.40 \pm 12.72$  to  $69.30 \pm 4.79$ ; while the heart rate after exercising decreased from  $157.00 \pm 7.95$  to  $134.20 \pm 1.88$ . At rest, the systolic blood pressure decreased from  $146.00 \pm 8.20$  mmHg to  $127.00 \pm 4.70$  mmHg; while the diastolic blood pressure decreased from  $90.50 \pm 5.35$  mmHg to  $80.00 \pm 3.97$  mmHg. After exercising, the systolic blood pressure decreased from  $148.50 \pm 2.35$  mmHg to  $134.50 \pm 3.59$  mmHg; while the diastolic blood pressure decreased from  $95.00 \pm 5.12$  mmHg to  $81.00 \pm 2.05$  mmHg.

## Discussion

Results from the present study further corroborate the findings in the literature on the benefits of exercise programs for PD patients.

The present study did not use BMI to assess fat and lean composition. BMI is not always appropriate, since biased results may be obtained for individuals with high lean composition, thereby leading to higher weight<sup>8</sup>.

Our results add to the discussion by presenting data on the very significant improvement of important parameters among PD patients who underwent a specific physical activity program. The literature on the subject of physical activity for PD patients continues to show the advantages of this rehabilitation technique<sup>9-13</sup>. As reported by other authors<sup>14</sup>, the tailored approach to individual disabilities provides the best benefit for the elderly and the neurologically impaired.

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