

## EFFECTS OF PARTICIPATION IN PHYSICAL TRAINING PROGRAM FOR PATIENT WITH PARKINSON'S DISEASE: A CASE REPORT

### *EFEITOS DA PARTICIPAÇÃO EM PROGRAMA DE ATIVIDADE FÍSICA PARA PESSOAS COM DOENÇA DE PARKINSON: UM ESTUDO DE CASO*

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**ABSTRACT:** The aim of this study was to investigate the effects of physical activity in people with Parkinson's disease PD (case study). To this, a subject (54 years) participant of the PARKVIDA project performed physical exercise training 3 days/week. The intensity of physical activity was mild-moderate monitored by frequencimeter and consisted of aerobic exercises, strength and specific (motor coordination and balance) adapted from Gobbi's protocol. Before and after the period of 8 months were applied the tests: quality of life (SF-36), balance (unipodal support test), body composition, cardio respiratory fitness (spirometry) and a part of AAHPERD battery: coordination, agility, strength and flexibility. The results showed changes in physical aspects such as agility, balance, flexibility and coordination, concomitant with improvement in cardiorespiratory fitness and quality of life (dimension "pain"). In conclusion, this study suggests that changes promoted by physical activity can contribute to improve cardio respiratory conditioning, reducing the perception of pain and physical and motor improvements in patient with PD.

**KEYWORDS:** Parkinson Disease. Physical exercise. Balance. Strength.

## INTRODUCTION

The Parkinson's disease (PD) is an idiopathic, chronic and gradual disease that affects the central nervous system and produces symptoms such as muscle stiffness, bradykinesia, tremors, akinesia and postural instability. Besides to affect diverse age groups in adult life, the PD prevalence is proportionally larger with the advance of the age, over 60-years-old (KUMAR et al.2011; SOUZA et al., 2011).

Regarding the anatomic-functional aspects, the PD promotes degeneration in the basal ganglia, particularly in the claustrum, amygdaloid body, striatum body (caudate nucleus, putamen, and Globus pallidus and accumbens core) and basal nucleus of Meynert and basal regions like substantia nigra (mesencephalon) and subthalamus (diencephalon). The specific function of the basal ganglia has been studied, but it is known that it is involved in the movement control, motor activity, planning and motivation (MACHADO et al., 2006; DEXTER et al., 2013). The loss of dopaminic cells, such as neurons from compact part of the substantia nigra can be the effect of oxidative stress, metabolic energy deficit (mitochondria) or inflammatory process. The substantia nigra that promotes motor

control and the destruction of this region is proportional to the symptoms of Parkinson's (MACHADO et al., 2006; KUMAR et al., 2011; DEXTER et al., 2013).

The physical activity prescribed for a person with Parkinson's has characteristics and objectives specifics to this group, and it may prevent the common comorbidities. For this physical activity, for example, the main objective was improvements in motor functions. Because of the degeneration of neurons and neuronal pathways that promote the motion control, it is necessary that this physical activity prizes for maintenance of motor function (SPEELMAN, et al., 2011).

Despite the efforts of researchers, the possible effectiveness of exercise training for people with PD requires more studies. The use of effort tests to investigate the effects of a training program in cardinal signs is scarce, particularly due to the limitations of this population. Thus, the present study aimed to investigate the effects of eight months of physical exercise in aerobic capacity, balance, agility, strength, flexibility and quality of life of a person diagnosed with Parkinson's disease (PD).

## MATERIAL AND METHODS

This is a case study of a man, 54- years-old, caucasian, with PD diagnosed 2 years before the beginning of the experimental period, whose clinical diagnosis was performed by a neurologist. The other patient characteristics are presented in Table 1.

### Ethical aspects

The project was submitted for appreciation to the ethics on Research Committee of the Unisalesiano, having been approved under the file number of 850.242. After completing a Free and Clarified Consent Term and anamnesis, as well as receiving the medical certificate of aptitude for physical activity, the described evaluations and the physical training program were initiated.

### Procedures

After the procedures related to the ethical aspects, the initial evaluations were performed, they consisted of anthropometric evaluations (body mass, stature and fat percentage), cardiorespiratory endurance, functional aptitude (flexibility, agility, force, motor coordination and balance) and quality of life. Later, he was submitted to the physical training for 8 months and, at the end of this period, he was submitted to the same evaluations again.

The sessions of physical exercise were completed in the areas of the College of Physical Education (FEFIL), Unisalesiano Center University. The sessions were adapted from the routine presented by Gobbi and collaborators (2014), with insertion of another exercises and consisting of aerobic activities, resisted exercise, flexibility and dual task.

The activities were accomplished in a weekly frequency of three days and length of 8 months. The sessions were performed in the late morning, scheduled from 11:00 AM to 12:00 PM (1-hour duration) and the intensity of the physical exercise can be classified from mild to moderate, monitored through heart rate monitor made by Polar®.

The sessions were divided in three days:

Day 1 – Predominantly aerobic, consisted of 10 minutes of stretching (in the beginning and/or in the end), 30-40 minutes of aerobic exercises comprised of walking, cycle ergometer or treadmill and 10-15 minutes of activities for motor coordination and proprioception.

Day 2 - Predominantly resisted, comprised of 10 minutes of stretching (in the beginning and/or in the end), 10-15 minutes of aerobic exercises comprised of walking, cycle ergometer, treadmill or

circuit training workout, and 25-30 minutes of exercises in resistance machine or free weight.

Day 3 - Exercises in the format of circuit training workout, comprised of 10 minutes of stretching (in the beginning and/or in the end), 25-30 minutes of circuit training workout and 15-20 minutes of activities for motor coordination and proprioception with emphasis in the dual task. Sporadically, days 1 and 3 were performed in the water, keeping the same objectives.

### Evaluations

The evaluations below were completed before and after the period of 8 months to identify possible modifications promoted by physical training.

- For the body mass evaluation, it was measured the mass (digital scale Tanita®, model TBF-305) and stature (stadiometer, Sanny® analogical model) and body mass index (BMI= body mass/stature<sup>2</sup>);

- For the fat mass evaluation was used a scientific adipometer (CESCORF®);

- For the evaluations of agility, strength and coordination were used the tests of the APPHERD (OSNESS et al., 1990);

- For the static balance was used the unipodal support test, it was registered the time that the participant remains uprightly, with a support kept underneath one of his feet, while the other foot was kept approximately the 10 centimeters of the ground (CAMARA et al., 2008);

- For the flexibility evaluation was used the sit and reach test (Wells Bank) (WELLS & DILLON, 1952);

- Cardiorespiratory Evaluation: VO<sub>2</sub>max was obtained, using variable respiratory values measured by a gas analyzer (METALYSER 3B - CORTEX), the data was collected from respiration to respiration, then calculated the average of last 30 seconds of each training. The highest VO<sub>2</sub> obtained during the 30 seconds was considered as VO<sub>2</sub> max. The participant initiated the test moderately walking on a treadmill (INBRAMED, model 10,200) inclined with increment of 2%. During the test the Borg Rating of Perceived Exertion (RPE) Scale (BRUNETTO, 2002), was used as parameter of effort perception, the test finished when the participant reached his limit (ACSM, 2006);

- Evaluation of the quality of life (QL): To evaluate the QL was used the test SF-36, consisted of eight scaled scores. Each scale is directly transformed into a 0-100 scale and each question carries equal weight. The lower the score the more disability, the higher the score the less disability, a

score of zero is equivalent to maximum disability and a score of 100 is equivalent to no disability. The score of the SF-36 were calculated for each scaled scores for the total of the sample (CICONELLI et al, 1999).

## RESULTS

The main limitation of this present investigation is the fact of being a case study. In such a way, the results are presented in the text as percentage of modification between the data found along the experimental period.

It was found subtle reduction in the values of anthropometric results (Table 1), therefore it was not found differences (pre - post) more than 6 %.

Table 2 shows cardiorespiratory values, performed on treadmill, shows increased  $\text{VO}_2\text{max}$  (17%) after the experimental period. In an evaluation after the trial period, the participant advanced four stages, incrementing 4 minutes until exhaustion, equivalent to 40% of the initial treadmill inclination. This change in cardiorespiratory fitness demonstrates a possible effectiveness of proposed activity.

The evaluation of the quality of life is showed in Table 3. The overall result, there was a slight improvement. However, specifically in the intensity of pain was found a decrease of 28%, which is a fundamental point in PD.

**Table 1.** Values of body mass (kg), percentage of fat, body mass index ( $\text{kg}/\text{m}^2$ ), fat mass (kg) and lean mass (kg) anthropometric evaluations taken before the experimental period (evaluation 1) and anthropometric evaluations taken after the experimental period (evaluation 2) and delta of these variables (final-initial).

Parameter	Evaluation1	Evaluation 2	$\Delta$ (Final-Initial)
Body mass	70,4	69,2	-1,2
Fat percentage	17,1	16,32	-0,78
BMI	21,5	21,16	-0,34
Adipose mass	12	11,29	-0,71
Lean mass	58,4	57,9	-0,5

**Table 2.** Results of the  $\text{VO}_2$  (ml/kg/min), speed (km/h), inclination, perception of subjective effort (PSE) and heart rate (HR-bpm), cardiorespiratory assessments carried out on the treadmill with anterior inclination (evaluation 1) and posterior inclination (evaluation 2) and the delta of these variables (initial-final).

Parameters	Evaluation 1	Evaluation 2	$\Delta$ (Initial-Final)
$\text{VO}_2$	29,6	34,5	4,9
Speed (km/h)	6	6	0
Inclination	12	17,5	5,5
PSE	10	10	0
HR	172	185	13

**Table 3.** Results of the SF-36 quality of life, applied anterior (evaluation 1) and posterior (evaluation 2) to the experimental period.

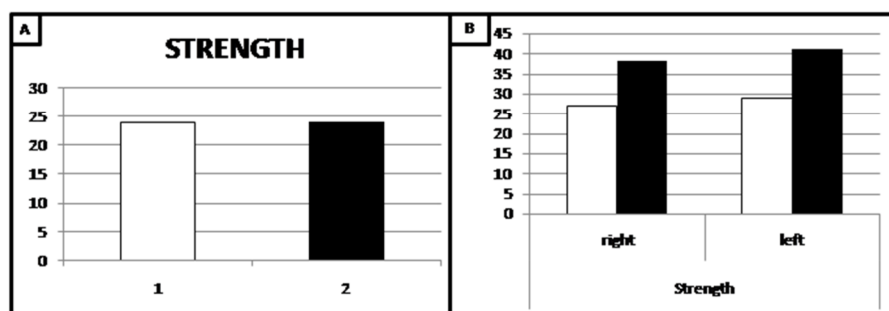
Parameters	Evaluation1	Evaluation 2
Functional capacity	95	95
Physical aspect	100	100
Pain	72	100
General health	82	82
Vitality	100	100
Social aspects	100	100

Emotional aspects	100	100
Mental health	100	100
Overall results	137,6	140,4

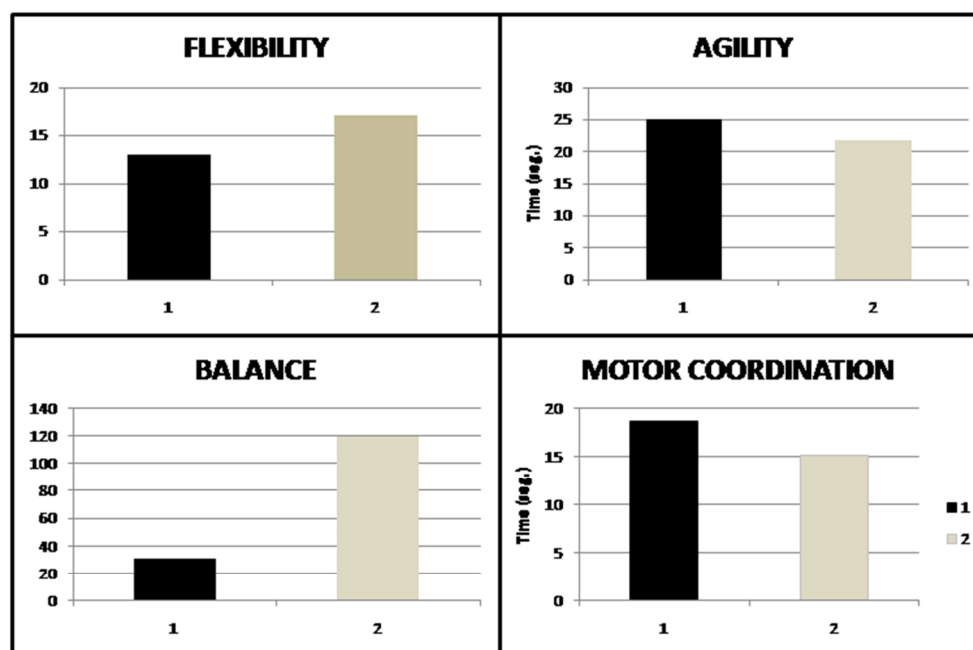
The evaluation of lower limbs strength had the same result anterior and posterior the experimental period (Figure 1A). But the upper limbs strength presented a noticeable difference, with 41% increase for both members, right (41.4%) and left (40.7%) (Figure 1B).

Figure 2A shows the values related to motor coordination, whose pre and post data reveals 19%

reduction in time, showing possible improvement in this respect. With respect to agility (Figure 2B), can be noticed a reduction of 13% during the experimental period, also showing possible improvement in this respect and regarding the balance values (Figure 2 c), results posterior the experimental period showed an increase compared to the anterior values.



**Figure 1.** Strength test results of the lower limbs (A) and superior limbs (B) from the participant anterior (1) and posterior (2) the experimental period.



**Figure 2.** Results of the tests of coordination (Seconds), flexibility (centimeters), agility (Seconds) and balance (Seconds) completed posterior the experimental period (Evaluation 1 - bars in black color) and at the end of the experimental period (evaluation 2 – bars in white color).

## DISCUSSION

Notwithstanding the growth of sedentary population, the practice of physical activity oriented

became a necessity to health promotion, and scientific research can help understand and determine how to properly prescribe physical activity for certain pathological conditions. The

relationship between Parkinson's disease (PD) and exercise, for example, still can be better understood. With this intention, the present study was elaborated aiming to evaluate the effects of eight months program of physical exercises in a participant with the PD.

The anthropometric data had shown that the participation in the program promoted very slight changes in the studied values, as observed in the delta. The absence of more prominent changes can be related to a series of factors as characteristics of the patient, as he presented adequate values of corporal mass, BMI and percentage of fat. Moreover, in the present study the alimentary ingestion was not controlled, factor that can modify the energetic control resulting in changes in the corporal mass (McCARTHY, 2014).

In the present study were performed cardiorespiratory evaluations, being observed very low values in the data collected at the beginning of the experimental period. In this way, the proposed exercises have promoted an improvement in these parameters, that was expected, since the assessed individual had low initial levels.

The increase in relative VO<sub>2</sub>max (29.6 to 34.5 ml/kg/min) resulted in extension of the test which advanced 4 minutes until exhaustion, increasing 40% inclination of the treadmill. This result is important evidence that, despite the limitations, the person with PD can introduce improvements in cardiopulmonary capacity. In his studies, Duchesne e colleges (2015) showed that aerobic exercise training program was able to promote in early PD physical fitness, increase in VO<sub>2</sub> max, better cognitive and procedural functioning. The findings of the present study corroborates with Duchesne conclusions, reinforcing the relations between increases in aerobic conditioning and benefic effects to PD.

In terms of quality of life, the participant in this study, despite Parkinson's disease, maintained great quality of life. Normally, it is expected that patients with the PD have poor quality of life assessment (KUPIO et al., 2000; CHRISTOFOLETTI et al., 2009). For this reason, his insertion in the program had little effect in the 7 out of 8 scales evaluated. The exception was observed in the dimension "pain", that showed 28% improvement. The pain is present in most of the cases of PD, being related in 72% of the patients studied by Silveira (2009). One explanation is the hyperalgesia caused by the PD development, generating the hypersensitivity to pain (URAMAKI, 1990). The reduction in pain perception presented in

this study may be an important beneficial factor of the physical activity practice.

In the present study were investigated changes in the strength of the inferior and superior limbs through the APPHERD tests and were found an increase in right and left upper limbs (41%), but there were no differences in the lower limbs. Previous studies using other evaluation methodologies or different volumes and types of exercise also found similar results. Among these studies, Rastogi et al. (2011) have shown that the practice of aerobic exercise and muscle building resulted in functional and performance improvement in the physical capacity of patients with mild to moderate PD. These results demonstrate that the physical activity program proposed in this study was effective in increasing strength in the upper limb of the participant studied.

Among the complications linked to PD are the cardinal signs as akinesia, bradykinesia, tremor, postural instability, and reduction in strength (SOUZA et al., 2011). Among the tests applied were found relevant improvement in agility, flexibility, coordination and balance. Changes in dopamine and acetylcholine neurotransmitter, as well as degeneration of the substantia nigra and basal ganglia leads to loss of muscle control and coordination (REIS, 2004; GEORGE et al., 2004). The improvement in tests of agility and coordination demonstrates a beneficial effect of physical training in mitigating the damage caused by the disease. This alterations influenced by synaptic plasticity, increases in synaptic strength and sinaptogenesis, particularly involving dopaminergic neurotransmission in basal nucleus (ABBRUZZESE et al., 2015; AUDIFFREN, ANDRÉ, ALBINET, 2011). Also, physical exercise may promotes plasticity in the cortico-cerebellar and cortico-striatal systems (DOYON et al., 2009)

In his studies, Gobbi and colleagues (2009) showed improvement in several parameters, such as balance and mobility after a workout program. Fischer and his colleagues (2008) also showed beneficial effects of a physical training program in people with PD, noting that the activity performed in high intensity promotes stabilization of the corticomotor excitability. The increases in balance showed in the present study corroborates with this previous studies, contradicting the results of Schenkman and colleges (2012) that found no difference in individuals with PD after 16 month of function exercise or supervised aerobic exercise.

The present study contributes to the concept that the practice of regular physical activity brings beneficial effects to people with Parkinson's disease,

particularly in cardiorespiratory fitness, pain perception, balance, coordination, strength, flexibility and agility, all these hobbled by Parkinson's disease. The limitation for being a case

study, does not allow the results to be designed for the population, however, opens up great prospects for future studies with larger number of participants.

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**RESUMO:** O objetivo deste estudo foi investigar os efeitos da atividade física em pessoas com PD doença de Parkinson (estudo de caso). Para isso, um sujeito (54 anos) participante do projeto PARKVIDA realizou o treinamento de exercício físico 3 dias/semana. A atividade física foi realizada em intensidade leve a moderada tendo sido monitorada por cardiofrequencímetro e consistiu em exercícios aeróbicos, de força e específicos (coordenação motora e equilíbrio) adaptados do protocolo de Gobbi. Antes e após o período de 8 meses foram aplicados os testes: qualidade de vida (SF-36), equilíbrio (teste de apoio unipodal), composição corporal, aptidão cardio respiratória (espirometria) e uma parte da bateria AAHPERD: coordenação, agilidade, força e flexibilidade. Os resultados mostraram alterações em aspectos físicos, tais como agilidade, equilíbrio, flexibilidade e coordenação, concomitante com a melhoria na aptidão cardiorrespiratória e qualidade de vida (medida "dor"). Em conclusão, este estudo sugere que as mudanças promovidas pela atividade física podem contribuir para melhorar o condicionamento cardiorrespiratório, reduz a percepção da dor e promove melhorias físicas e motoras em pacientes com DP.

**PALAVRAS-CHAVE:** Doença de Parkinson. Exercício Físico. Equilíbrio. Força.

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