

Effects of aquatic physiotherapy on life quality on subjects with Parkinson disease

Efeitos da fisioterapia aquática na qualidade de vida de sujeitos com doença de Parkinson

Efectos de la fisioterapia acuática en la calidad de vida de sujetos con enfermedad de Parkinson

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ABSTRACT | Parkinson's Disease (PD) is a progressive, degenerative disease of the central nervous system, and its symptoms may lead to a decline in quality of life (QOL) of patients, which may be positively influenced by aquatic physiotherapy (AP). The AP is a physiotherapy tool that uses the physical, physiological and kinesiological effects that come from immersing the body in a heated pool. The Parkinson's Disease Questionnaire 39 (PDQ-39) is the most appropriate instrument for assessing QOL of PD patients. The aim of this study was to evaluate the effects of AP on QOL of patients with PD, in stages from mild to moderate, through the PDQ-39. 13 PD patients were included, aged between 45 and 74, who were between stages 1-3 of the disease (Hoehn-Yahr). The patients underwent 16 sessions of AP twice a week, lasting one hour, in a heated therapy pool. The perception of QOL was measured by the PDQ-39, before and after AP. After AP, there was a statistically significant reduction ($p < 0.0001$) both in the total score of the PDQ-39 and in all areas ($p = 0.032$). QOL was more affected at higher stages of the disease. Before FA, QOL was worse in the more advanced stage of the disease, and despite improvement of QOL scores after the FA, the most advanced stage continues to show worse perception of QOL. AP led to an improvement in the quality of life of patients with Parkinson's disease in this study.

Keywords | Parkinson disease; physical therapy specialty; hydrotherapy; quality of life; questionnaires.

RESUMO | A doença de Parkinson (DP) é uma doença degenerativa e progressiva do sistema nervoso central, e seus sintomas podem proporcionar um declínio da qualidade de vida (QV) dos pacientes, que pode ser influenciada positivamente pela fisioterapia aquática (FA). A FA é um recurso fisioterapêutico que utiliza os efeitos físicos, fisiológicos e cinesiológicos advindos da imersão do corpo em piscina aquecida. O questionário da doença de Parkinson 39 (PDQ-39) é o instrumento mais apropriado para a avaliação da QV do paciente com DP. O objetivo deste estudo foi avaliar os efeitos da FA na QV de pacientes com DP nos estágios de leve a moderado, utilizando-se do PDQ-39. Foram incluídos 13 pacientes com DP, com idade entre 45 e 74 anos, entre os estágios 1 a 3 da doença (Hoehn-Yahr). Os pacientes foram submetidos a 16 sessões de FA, duas vezes por semana, com duração de uma hora, em piscina terapêutica aquecida. A percepção da QV foi mensurada por meio do PDQ-39, antes e depois da FA. Depois da FA, ocorreu uma redução estatisticamente significativa ($p < 0,0001$) tanto no escore total do PDQ-39 quanto em todos os seus domínios ($p = 0,032$). A QV foi mais afetada em maiores estágios da doença. Antes da FA, a QV era pior no estágio mais avançado da doença, e apesar da melhora dos escores de QV depois da FA, o estágio mais avançado continuou apresentando pior percepção da QV. A FA proporcionou uma melhora na qualidade de vida dos pacientes com doença de Parkinson neste estudo.

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Descritores | doença de Parkinson; fisioterapia; hidroterapia; qualidade de vida; questionários.

RESUMEN | La Enfermedad de Parkinson (EP) es una enfermedad degenerativa y progresiva del Sistema Nervioso Central, y sus síntomas pueden proporcionar una disminución de la Calidad de Vida (CV) de los pacientes, la cual puede ser influenciada positivamente por la Fisioterapia Acuática (FA). La FA es un recurso fisioterapéutico que utiliza los efectos físicos, fisiológicos y kinesiológicos procedentes de la inmersión del cuerpo en una piscina climatizada. El cuestionario de enfermedad de Parkinson 39 (PDQ-39) es el instrumento más apropiado para la evaluación de la CV del paciente con EP. El objetivo de éste estudio fue evaluar los efectos de la FA en la CV de pacientes con EP en los estadios leve a moderado utilizando el PDQ-39. Fueron incluidos 13 pacientes con EP, con edades entre 45

y 74 años, entre los estadios 1 y 3 de la enfermedad (Hoehn-Yahr). Los pacientes fueron sometidos a 16 sesiones de FA, dos veces por semana, con duración de una hora, en piscina terapéutica climatizada. La percepción de CV fue medida por medio del PDQ-39, antes y después de la FA. Después de la FA ocurre una reducción estadísticamente significativa ($p < 0,0001$) tanto en la puntuación total del PDQ-39 como en todas sus áreas ($p = 0,032$). La CV fue más afectada en mayores estadios de la enfermedad. Antes de la FA la CV era peor en los estadios más avanzados de la enfermedad, y a pesar de la mejora de la puntuación de la CV después de la FA, los estadios más avanzados continúan presentando peor percepción de la CV. La FA proporcionó una mejora en la calidad de vida de los pacientes con enfermedad de Parkinson en este estudio.

Palabras clave | enfermedad de parkinson; fisioterapia; hidroterapia; calidad de vida; cuestionario.

INTRODUCTION

Parkinson's Disease (PD) is a degenerative and progressive condition of the central nervous system (CNS) which is characterized by the neuronal loss of dopaminergic cells from the compact portion of the substantia nigra of the mesencephalon. There is a dysfunction in the nigrostriatal pathway, with decreased dopamine concentration to the level of dopaminergic receptors placed in the corpus striatum^{1,2}.

The PD diagnosis is established as the presence of two among the following cardinal signs: resting tremor, bradykinesia (akinesia or hypokinesia), plastic-type muscle rigidity and postural instability^{2,3}.

Associated with these changes, the physical, mental, emotional, social and economical compromise related to the signs and symptoms of PD interfere in the subject's level of capacity and can negatively influence the his or her quality of life (QOL), leading to isolation and decreased participation in social life⁴.

The concept of QOL is multidimensional and reflects the subjective assessment of personal satisfaction in relation to physical, functional, emotional and social well-being⁵. It is important to point out that studies have not been investigating details concerning QOL in PD. However, knowing such aspects is essential to improve the planning of therapeutic interventions addressed to these patients, once the main focus of the treatment with subjects with chronic diseases, such as PD, should be the maintenance of QOL⁵.

Out of the specific instruments used to assess the QOL in patients with PD, there is the Parkinson's

Disease Questionnaire 39 (PDQ-39), recommended as the most appropriate tool for this purpose^{6,7}.

In order to improve the symptoms of PD and the QOL of patients, the base is the institution and the follow-up of pharmacologic therapy. However, other therapeutic strategies should be part of the assistance to the patient with PD. Physical therapy constitutes an important resource, since it promotes exercises that keep the muscular activity and preserve mobility, minimizing and slowing down the evolution of symptoms, consequently leading to the improvement of QOL⁸⁻¹⁰.

Aquatic physical therapy (APT) is a therapeutic resource that uses physical, physiological and kinesiological effects resulting from the immersion of the body in a heated pool as an auxiliary resource for rehabilitation or prevention of functional changes. The therapeutic action of the heated water leads to increased metabolism and decreased muscle tension by providing a pleasant, comfortable and relaxing environment^{11,12}. Besides, one of the effects caused by the immersion in a hydro environment would be the increased dopamine levels in the CNS, which is maintained for a few hours after immersion¹³.

Studies that used APT as a physical therapeutic resource to treat for PD focus on the improvement of balance, postural instability and risk of fall¹⁴⁻¹⁶, however, there are only a few studies in literature that measure the repercussion of this treatment in the perception of QOL of patients. Therefore, the objective of this study was to assess the effects of APT in the QOL of patients with PD from mild to moderate stages using the PDQ-39.

METHODOLOGY

Sample

This longitudinal intervention study was conducted with patients registered in the neurology outpatient clinic of *Hospital das Clínicas at Universidade Federal de Pernambuco (HC/UFPE)*, Recife (PE).

Patients of both genders were included in this study, aged between 45 and 74 years old, with clinical diagnosis of idiopathic PD, from mild to moderate stages (severity from 1 to 3), according to the original version of the Hoehn & Yahr scale (HY)¹⁷, assessed by the neurologist at HC/UFPE. The excluded patients were those with another neurological pathology, limiting orthopedic or heart associated conditions, as well as those who were submitted to another physical therapy resource or who needed to change the medication schedule.

The patients were randomly selected to compose a sample of 18 subjects; out of these, 5 were excluded, 4 for not presenting the mandatory dermatological aptitude test for the use of the therapeutic pool, and 1 for leaving the treatment, so the sample was comprised of 13 patients, being 6 males and 7 females.

All patients, before and after the APT treatment, answered the PDQ-39, which has 39 items distributed into eight dimensions: mobility, activities of daily life (ADL), emotional well-being, stigma, social support, cognition, communication and physical discomfort, in which higher scores indicate a poor perception of QOL^{18,19}.

Ethical aspects

The study was approved by the Research Ethics Committee of *Faculdade Maurício de Nassau*, (Report n. 134/2009). All patients were enlightened and accepted to participate in the study after signing the informed consent form, according to the resolution n. 196/1996 of the National Health Council.

Treatment protocol with aquatic physical therapy

The treatment protocol with APT was elaborated from the adaptation of protocols found in literature^{11,12,15,16}. Patients were submitted to the APT treatment, which consisted of 16 sessions that took place in a 2-month period, twice a week in non-consecutive days; each session lasted for one hour.

APT was conducted in a 6 m wide and 11 m long adapted therapeutic pool, with two depth levels, 1.40 and 1.00 m, heated between 32° and 33°C, located at the Clinical School of Physical Therapy of *Faculdade Maurício de Nassau*, in Recife. The patients were treated in the part where the pool was 1.40 m deep. A step was used for those with low stature, so that the water remained above the nipples for all patients.

A single treatment protocol was used, using the same sequence to facilitate its learning.

Stage 1 of the protocol: heating

This phase lasted five minutes and was composed of two laps of frontal, lateral and posterior walk, inside the pool, associated with activities concerning upper limb (UL) and lower limb (LL) coordination and the dissociation of the brachial plexus and pelvic waist with the assistance of low density balls.

Stage 2 of the protocol: stretching

In stage 2, which lasted 20 minutes, at first the patients performed passive stretching (for 30 seconds), which evolved to active muscle stretching, when possible: UL (pectoralis major and minor, deltoid, biceps, triceps, wrist flexor and extensor muscles); LL (ischiotibial muscle, triceps surae, femoral quadriceps, thigh adductor and abductor muscles with assistance of the aquatube); trunk (abdominal muscle, great dorsal muscle, psoas and the quadratus lumborum); neck (trapezius, sternocleidomastoid, scalene and paravertebral muscles).

Stage 3 of the protocol: active and proprioception exercises

Stage 3 lasted 25 minutes; during this period, resisted active exercises in the orthostatic position were performed (three series of ten repetitions, respectively). UL: flexion, extension, adduction, abduction, internal rotation, external rotation, and hip hyperextension, step (frontal and lateral climb), dorsiflexion and ankle plantar flexion.

The increase of resistance was progressive and adjusted in strengthening exercises, giving priority to extensor muscles. At first, only exercises with the resistance of the water were performed, without the use of floaters. Afterwards, there was the evolution to three levels of resistance, with floaters, every four sessions, if the physical potential of the patient allowed it.

In the ninth session, proprioception weight-bearing exercises on the elastic bed and walking on the aquatube were added, both submersed. During the exercises, participants were asked to associate breathing to the repetitions of the exercises.

Stage 4 of the protocol: relaxation/socialization

This stage lasted ten minutes and alternated one relaxation and one socialization stage. Relaxation was promoted by floaters and swirling massages. Socialization was conducted by means of group dynamics which stimulated memory and group bonding.

Statistical analysis

The data obtained from the PDQ-39 scores were statistically analyzed in the XlStat software, through the Kruskal-Wallis one-way analysis of variance with comparisons, later on, with the Dunn's test, with $p=0.05$, critical.

RESULTS

Table 1 presents a description of the sample referring to the classification of the patients by the stage of PD according to Hoehn & Yahr (HY), to mean age \pm standard deviation and to average time of disease \pm standard deviation.

After APT, there was significant reduction ($p<0,0001$) of the total PDQ-39 score, and in all the three assessed stages of PD (Table 2). This reduction was more present in patients in stage 3, for whom the

improvement percentage was 57%, while in stages 2 and 1 it was of 48 and 46%, respectively.

QOL, measured by the total PDQ-39 score, was affected according to disease stage, so that the higher the stage of PD, the higher the PDQ-39 scores, both before and after APT. It is also observed, by the verticality of the line, that the major gain after APT happened in stage 3 of PD (Figure 1).

The scores of each PDQ-39 domain presented significant reduction ($p=0.032$) after APT in the three assessed stages.

The major differences between the means of each PDQ-39 domain, before and after APT, occurred respectively in the domains of physical discomfort, stigma, mobility and communication (Table 3).

As to the resistance degree of active exercises, only three male individuals reached the fourth and the last level, being 2 in stage 2 and 1 in stage 1 of the HY scale.

DISCUSSION

The QOL in the studied population seems to be affected by the severity of the disease, since the higher the stage, the higher the PDQ-39 scores. So, before APT, QOL was worse in the most advanced stage of the disease, and despite the improved QOL scores after APT, the most advanced stage continued to present the worst perception of QOL, corroborating the statements by Souza et al.²⁰, who also found higher PDQ-39 scores in more advanced stages of PD.

However, it is not possible to confirm that the patients' perception of QOL was affected by PD, because,

Table 1. Sample description

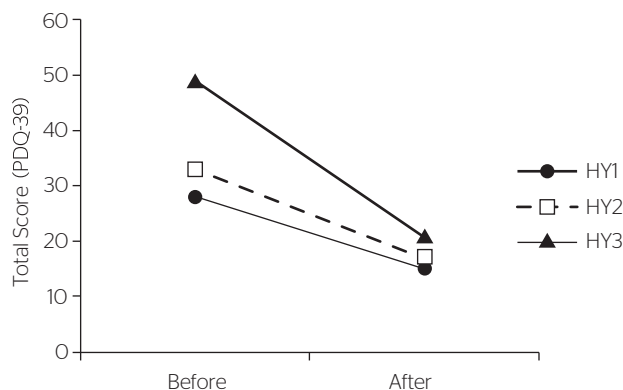
| Stage (HY) | n | Age (years) | Time of disease (years) |
|------------|----|-------------|-------------------------|
| 1 | 3 | 56 \pm 11 | 4 \pm 1 |
| 2 | 5 | 55 \pm 11 | 4 \pm 2 |
| 3 | 5 | 67 \pm 5 | 9 \pm 4 |
| Total | 13 | 60 \pm 10 | 6 \pm 3 |

HY: Hoehn & Yahr; n: number of patients.

Table 2. Total score of the Parkinson's Disease Questionnaire 39 (mean \pm standard deviation)

| HY | Before APT | After APT |
|-------|--------------|-------------|
| 1 | 28 \pm 15 | 15 \pm 11 |
| 2 | 33 \pm 23 | 17 \pm 7 |
| 3 | 49 \pm 18 | 21 \pm 12 |
| Total | 38 \pm 20* | 18 \pm 9* |

HY: Hoehn & Yahr; FA: Aquatic physical therapy; Kruskal-Wallis test: * $p<0,0001$.



HY1: Hoehn & Yahr - stage 1; HY2: Hoehn & Yahr - stage 2; HY3: Hoehn & Yahr - stage 3.

Figure 1. Means of the total score of the Parkinson's Disease Questionnaire 39 (PDQ-39) before and after aquatic physical therapy. Correlation of Parkinson's disease stages with PDQ-39 scores ($p=0.009$).

as stated by Lana et al.⁴ in relation to the total PDQ-39 scores, there is no cut off point that indicates which values represent good or bad perception of QOL in literature. So, the instrument is more adequate to assess and monitor intervention responses.

After APT, there was a significant reduction in the total PDQ-39 score, which is in accordance with the findings by Baatile et al.²¹, who used a ground activity program for 8 weeks, and Filippin, Costa e Mattioli²², who performed training on a treadmill with additional body load for 18 weeks, and both assessed QOL with the PDQ-39. Other authors also found improvements in QOL using the Nottingham Health Profile (NHP) to assess the QOL of patients with PD, like Goular et al.²³, who performed a ground exercise program for 12 weeks, and Paula et al.²⁴, who combined an aerobic conditioning program with muscle strengthening in 36 sessions.

In the study by Reuter et al.²⁵, exercises were performed in the water and in the gym for 14 weeks, but the QOL was not assessed. They analyzed motor dysfunctions, sensation of well-being and cognition, which was stable, while the other presented significant differences.

Some authors used water activities in the treatment of PD which could not be considered as APT. Liks Pellecchia et al.¹⁶, who used a protocol with ground and water exercises, however, associating swimming as a sport, thus reaching significant results as to the improvement of the motor function, ADL and gait.

Brefel-Courbon et al.²⁶ aimed to assess the QOL of patients with PD using the PDQ-39 and the Short Form-36 (SF-36), however, they used thermal baths, massages and ludic activities at a spa, significantly improving the perception of QOL among the patients.

However, none of the mentioned studies used only APT as a therapeutic resource. The methodological diversity among the authors makes it difficult to compare results and restricts the strength of evidence concerning the proposed interventions.

Vivas, Arias e Cudeiro¹⁵ performed a study proposing the elaboration of treatment protocols for PD. Therefore, they employed physical therapy protocols on the ground and in the water, however, they did not contemplate the perception of QOL. The focus was on functional activities, motor symptoms, gait and balance, and they observed better results concerning motor function in protocols performed in the water, and significant changes only in the balance of patients who performed APT, corroborating the findings by Andrade et al.¹⁴, who found significant improvement in the balance of patients with PD submitted to APT.

The influence of APT over balance may have contributed with the improved perception of QOL for the patients in this study, because, according to Jankovic²⁷, postural instability is the PD signal that mostly impacts the QOL, since it is related to changes in gait and risk of falls.

By analyzing the scores of PDQ-39 domains in this study alone, it is observed that major percentage differences between the means of each domain, before and after APT, occurred with physical discomfort, stigma, mobility and communication. In the study by Filippin, Costa e Mattioli²², the domains with significant reduction of scores were: mobility, ADL and cognition. Baatile et al.²¹ state that, in their study, all of the subjects improved the domains of mobility and ADL, which would be a viable explanation for the decline in the results of these subjects for emotional well-being, stigma and communication.

Besides impacting motor domains, APT may also have influenced non-motor domains, once the improvement of domains such as physical discomfort and mobility can influence psychological and emotional aspects. The form of treatment, providing a ludic environment of social interaction, may also have been an important factor for the reduced communication score.

The range of APT over the aspects involving QOL can be related to the physical properties and the heating of the water, which play an important role to improve

Tabela 3. Domains of the Parkinson's Disease Questionnaire 39 related to the degree of severity of Parkinson's disease and to the total of patients (mean \pm standard deviation)

| HY | Mobility | | ADL | | Emotional well-being | | Stigma | | Social support | | Cognition | | Communication | | Physical discomfort | |
|----|-------------|--------------|-------------|--------------|----------------------|--------------|-------------|--------------|----------------|-------------|-------------|--------------|---------------|--------------|---------------------|--------------|
| | A | D | A | D | A | D | A | D | A | D | A | D | A | D | A | D |
| 1 | 29 \pm 26 | 18 \pm 22 | 8 \pm 8 | 12 \pm 11 | 36 \pm 6 | 22 \pm 15 | 15 \pm 16 | 8 \pm 4 | 27 \pm 22 | 19 \pm 5 | 44 \pm 33 | 10 \pm 4 | 25 \pm 8 | 14 \pm 24 | 42 \pm 22 | 14 \pm 5 |
| 2 | 27 \pm 26 | 12 \pm 16 | 40 \pm 26 | 22 \pm 23 | 47 \pm 40 | 32 \pm 16 | 48 \pm 31 | 18 \pm 26 | 15 \pm 29 | 5 \pm 11 | 26 \pm 30 | 16 \pm 14 | 32 \pm 21 | 13 \pm 14 | 30 \pm 23 | 17 \pm 10 |
| 3 | 54 \pm 17 | 23 \pm 9 | 64 \pm 22 | 27 \pm 19 | 37 \pm 28 | 17 \pm 11 | 39 \pm 25 | 15 \pm 17 | 14 \pm 19 | 5 \pm 11 | 58 \pm 18 | 34 \pm 17 | 43 \pm 26 | 20 \pm 23 | 60 \pm 35 | 15 \pm 17 |
| T | 38 \pm 25 | 17 \pm 15* | 42 \pm 30 | 22 \pm 19* | 41 \pm 29 | 24 \pm 14* | 37 \pm 25 | 14 \pm 18* | 17 \pm 23 | 8 \pm 11* | 42 \pm 28 | 22 \pm 16* | 35 \pm 21 | 16 \pm 18* | 44 \pm 29 | 15 \pm 12* |

ADL: activities of daily living; A: before aquatic physical therapy; D: after aquatic physical therapy; T: total. Kruskal-Wallis test: *p=0.032; HY: Hoehn & Yahr.

and maintain the amplitude of joint movements, to reduce muscle tension and pain^{28,29}. The water is a different environment which enables the individual and the group care; it decreases the action of gravity, thus allowing tri-dimensional exercises without the risk of falls, and it also allows the performance of exercises with two lower and upper limbs at the same time. Besides, this type of intervention is associated with the leisure activity of relaxation, in a pleasant environment of easy socialization. All of these factors together contribute for the improvement of confidence and self esteem of the patients^{30,31}.

The lack of standardization in the studies concerning the evaluation scales of QOL in PD makes it difficult to compare results. The use of specific scales such as the PDQ-39 increases the reliability of results, since it is a more adequate tool for this purpose⁴.

According to Souza et al.²⁰, the PDQ-39 is an instrument able to detect the decline of QOL of patients with PD. The study by Lana et al.⁴, which also used the PDQ-39 to assess the QOL of PD patients, found a worse perception of QOL in the dimensions of mobility and ADL.

Sasco et al.³² affirmed that high levels of dopamine were found during the moderate exercise, suggesting that a regular program of moderate exercises could work to reduce the progression of PD. Goetz et al.³³ stated that the absorption of levodopa can be changed with exercise.

Yet, studies^{5,23,25} affirm that the effects of exercise programs on the QOL of patients with PD have been little recorded, even though the physical aspects have been considered as one of the main responsible factors for the worsened QOL among PD patients, since they act as precursors of the limitations in other areas, such as the mental and emotional ones.

There are few studies assessing the effects of APT in the QOL of patients with PD. With the PDQ-39, it was possible to identify a better perception of QOL of patients after participating in a APT exercise program, especially in relation to the domains of stigma, physical discomfort, mobility and communication. We recognize that the reduced sample constitutes a limitation that should be thought of in future studies.

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