

Effects of four months of periodized aquatic exercise program on functional autonomy in post-menopausal women with parkinson's disease

Efecto de cuatro meses de entrenamiento de ejercicio acuático periodizado sobre la autonomía funcional en mujeres posmenopáusicas con enfermedad de parkinson

*Javier Arturo Hall-López, *Paulina Yesica Ochoa-Martínez, *Cristhian Obed Lara Monzon, **Rodrigo Gomes de Souza Vale.

*Autonomous University of Baja California (México), **Estácio de Sá University (Brasil)

Abstract. Objective: To determine the effect of a periodized aquatic exercise program on functional autonomy in post-menopausal women with Parkinson's disease. Methods: Nine post-menopausal women diagnosed with idiopathic Parkinson's disease, with stage I-III according to Hoehn and Yahr scale, (age 60.4 ± 3.87 years) participated in the 16-week of periodized aquatic exercise program five times a week, 30 minutes of aquatic exercise with work heart rate reserve of 40-50% (1-8th week) increasing the load to 50-60% (9-16th week). The protocol of the Group of Latin-American Development for Maturity (GDLAM) was used to evaluate functional autonomy; As statistical analyses student T test for paired samples was used, also percent changes (\dot{A} %) were calculated, the results showed significant improvement ($p < 0.05$) comparing before and after the aquatic exercise program in 10 meters walk test (C 10m) ($p = 0.001$) and general GDLAM index (IAF) ($p = 0.003$), percent changes (\dot{A} %) showed positive improvements in the five components of GDLAM. Conclusion: Periodized aquatic exercise program was able to enhance (C 10m) and (IAF) however, will be appropriated in the future more studies to better clarify the possibilities of improvements between aquatic exercise program and functional autonomy in post-menopausal women with Parkinson's disease.

Keywords: functional autonomy, post-menopausal women, parkinson's disease, physical activity.

Resumen. Objetivo: Evaluar el efecto de un programa de entrenamiento periodizado de hidrogimnasia sobre la autonomía funcional en adultos mayores con enfermedad de Parkinson. Método: once adultos mayores diagnosticados con enfermedad de Parkinson idiopática, con estadios I-III según la escala de Hoehn y Yahr, (5) masculinos y (6) femeninos (edad 66.8 ± 4.81 años), participaron en un programa de entrenamiento de hidrogimnasia 5 veces por semana en un periodo de 16 semanas, compuesto por ejercicios aerobios de hidrogimnasia con intensidad de 40% a 50% de su frecuencia cardíaca de reserva de la semana 1 a la 8 y una periodización con aumento de carga de 50% a 60% de su frecuencia cardíaca de reserva de la semana 9 a la 16, monitoreado por pulsómetro polar FT1. La autonomía funcional se evaluó mediante el protocolo del Grupo de Desarrollo Latino Americano para la Madurez (GDLAM) antes y después del programa. Resultados: Se mostraron mejoras significativas ($p < 0.05$) al comparar la igualdad de la varianza mediante la prueba t Student para muestras relacionadas en el test de caminar 10 metros (C 10m) ($p = 0.002$) y el índice de autonomía funcional (IAF) ($p = 0.002$), los cambios porcentuales (\dot{A} %) mostraron mejoras en los componentes del protocolo GDLAM. Conclusión: El entrenamiento periodizado de hidrogimnasia fue capaz de mejorar (C 10m) e (IAF) en adultos mayores con enfermedad de Parkinson, aun sin embargo, se requieren futuros estudios para aclarar las posibilidades de mejora en el ejercicio de hidrogimnasia y autonomía funcional.

Palabras clave: autonomía funcional, mujeres post menopáusicas, enfermedad de parkinson, actividad física.

Introduction

Post-menopausal in women is an aging natural process characterized for gradual reduction in the release of estrogen (Botero et al., 2013) associated with several morphofunctional changes (Fulop et al., 2010). These changes include a decrease in muscle mass than reduce strength and joint mobility (Serra Rexach, 2006), being an important contributing factor to the increase in loss of independence (Hernández-Murúa et al., 2015) and decrease in functional autonomy in completing activities of daily living such as walking, climbing stairs, or rising from a chair without the help of a person or device (Dantas & Vale, 2004). Moreover, scientific evidence have been related negative functional autonomy in elderly and post-menopausal women with Parkinson's disease (Alkhuja, 2013) by other hand, Parkinson's disease is the second most common neurodegenerative disorder that affects approximately 1% of people over 60 years (Alkhuja, 2013; Fernandez, 2015), the occurrence of falls as accident lead the burden of reason for hospital admission in people with Parkinson's disease (Duncan et al., 2012) being more frequently the fall related injuries and bone fractures in woman than in man (Benzinger et al., 2014). According with the Group of Latin-American Development for Maturity (GDLAM), the functional autonomy covering three aspects: Autonomy of action that relates to the notion of physical independence; autonomy refers to the possibility of self-determination and autonomy than allows the person to judge any situation (Dantas & Vale, 2004, Dantas, 2014).

Evidence from systematic review clearly show than negative, physical fitness, functional autonomy and independence of movement have been related to sedentary lifestyle in people with Parkinson's disease (Murray, Sacheli, Eng, & Stoessl, 2014; Tabak, Aquije, & Fisher,

2013; Villarreal et al., 2016; Hall Lopez et al., 2017). Also results of controlled trials focused on exercise in post-menopausal woman have been improve functional autonomy (Borges et al., 2012; Goncalves, Vale, Barata, Varejao, & Dantas, 2011; Pernambuco et al., 2013; Jiménez et al., 2013). Hence, physical exercise in post-menopausal woman has been proposed to prevent falls and during the rehabilitation (Fulop et al., 2010; Sanders, Takeshima, Rogers, Colado, & Borreani, 2013, Bohórquez et al., 2014). To minimize these health problem, also has been recommended in elderly people with Parkinson's disease (Zurita-Ortega et al., 2011; Cabanillas et al., 2011; Alkhuja, 2013; Benzing et al., 2014). This research considered the aquatic exercise than have been especially recommended among people who have limitations with do exercise on dry land due to impact than in the last ten years, has taken popularity and preference among post-menopausal woman. It was found than aquatic exercise in elderly women provides functional autonomy and other health related problems (Colado et al., 2012; Pernambuco et al., 2013).

In this context, it has been proven that aerobic exercise prescription with training periodization increasing the load heart rate reserve has been produce grater adaptations in previous studies (Stanley, Peake, & Buchheit, 2013). The present study involves a periodized aquatic exercise training program with different frequency, work load intensity and time than other references. Thus, the aim of this study was to determine the effects of a periodized aquatic exercise program on functional autonomy in post-menopausal women with Parkinson's disease. The initial hypothesis was that aquatic exercise training would improve functional autonomy among these subjects.

Methods

Participants and setting

Nine women diagnosed with post-menopausal and idiopathic

Parkinson's disease, with stage I-III according to Hoehn and Yahr scale, (age 60.4 ± 3.87 years) volunteered to partake in the aquatic exercise program, the participants were recruited in the aquatic complex of the Faculty of Sports at the Autonomous University of Baja California, before starting the periodized aquatic exercise training the subjects completed a medical examination in order to identify the inclusion and exclusion criteria; the inclusion criteria were ambulation capacity, not have performed a systematical routine of exercise in the previous six months and exclusion criteria were to possess any sort of acute or chronic complication that would hinder water exercise, such as heart problems, diabetes mellitus, hypertension or asthma; physical complications that could affect the ability to accomplish exercise such as osteoarthritis, joint injuries or recent bone fractures, psychological and neurological problems.

Procedures

A quasi-experimental design was conducted followed the ethical principles regarding human experimentation proposed by the Helsinki declaration; all the subjects provided a written consent in order to participate in the study (Puri, Suresh, Gogtay, & Thatte, 2009), that was approved by the research program of the Faculty of Sports of the Autonomous University of Baja California; Protocol # 149/998.

Measures

The functional autonomy was determined according with the guidelines of the Group of Latin-American Development for Maturity (GDLAM) protocol (Dantas & Vale, 2004; Dantas, 2014), than is composed by the following five tests: 10 m walk (10 mW), getting up from a seated position (GSP) getting up from the prone position (GPP), getting up from a chair and movement around the house (GCMH), and putting on and taking off a shirt (PTS). All tests were individually conducted and repeated two different times with a minimum of 5 min intervals, the lowest time of the two trials was recorded; These tests make it possible establishing the Functional Autonomy and General GDLAM index (GI) calculated as follows: $GI = [10\text{ mW} + GPP + GSP + PTS] * 2 + GCMH / 4$

Measurements were performed at the baseline pretest and immediately upon posttest of the 16-week of the aquatic exercise program, only those completing 95% of training adherence were included in the statistical analysis.

Procedures

The aquatic exercise was conducted and supervised by specialist with Ph. D. in sport medicine also, was performed in accordance with physical exercise prescription established by the American College of Sports Medicine and the American Heart Association (American College of Sports et al., 2009; Nelson et al., 2007).

The participants completed 16-week of periodized aquatic exercise program five times a week, with 50 minutes per session which was comprised by 10 minutes of warm-up, 30 minutes of aquatic exercise with work heart rate reserve of 40-50% (1-8th week) increasing the load to 50-60% (9-16th week); monitored by Polar FT1® (Finland) heart rate monitor, heart rate reserve was estimated with the equation $MaxHR = 208 - 0.7x \text{ age}$ (Tanaka et al., 2001) followed by 10 minute of cool down.

Analysis

Descriptive statistical procedures are presented as mean \pm standard deviation; Shapiro-Wilk Test was used in order to confirm the normality of the data and T test for paired samples was applied for the values comparison of functional autonomy before and after the periodized aquatic exercise program, the statistical analysis were performed at significant level of $p < 0.05$. Also, percent changes ($\Delta\%$) were calculated $[(\text{Media post} - \text{Media pre}) / \text{Media pre}] \times 100$ (Vincent, 1999). Statistical analyses were performed using the statistical software (SPSS for Windows version 21, IBM Corporation, New York, USA).

Results

Descriptive statistical (Mean \pm SD) of the five tests to determine the functional autonomy and General GDLAM index (GI) are presented in Table I, the values showed lower means in post-test than baseline of the 16-week of aquatic exercise program, and Shapiro-Wilk Test confirm the normality of the data; also table I. Provides the data of the T test for paired samples analysis showed significant values ($p < 0.05$) comparing baseline and after 16-week of aquatic exercise program in post-menopausal women with Parkinson's disease ($p = 0.001$), of 10 mW (s), also General GDLAM index (GI) showed significant values ($p < 0.05$) comparing the measurements before of 16-week of aquatic exercise program ($p = 0.003$), No significance differences were observed between the exercising and control group for the variables of GSP ($p = 0.006$), GPP ($p = 0.020$), PTS ($p = 0.186$), and GCMH ($p = 0.020$).

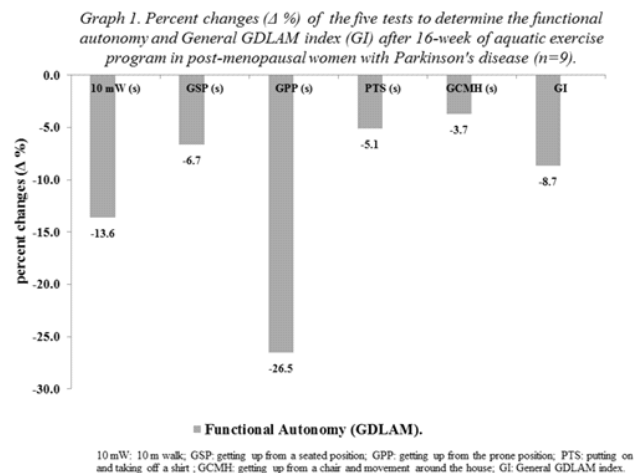
Table I. Mean and standard deviation (M \pm SD), Shapiro-Wilk test and T test for paired samples analysis values for the five tests to determine the functional autonomy and general GDLAM index (GI) baseline and after 16-week of aquatic exercise in post-menopausal women with Parkinson disease (n=9).

Variables	Pre-test		Post-test		T test for paired samples analysis
	M \pm SD	Shapiro Wilk test	M \pm SD	Shapiro Wilk test	
^a 10 mW (s)	6.6 \pm 0.9	0.614	5.7 \pm 0.6*	0.512	p=0.001*
^b GSP (s)	10.5 \pm 2.5	0.818	9.8 \pm 2.2	0.682	p=0.006
^c GPP (s)	4.9 \pm 1.4	0.837	3.6 \pm 0.8	0.96	p=0.020
^d PTS (s)	31.2 \pm 4.0	0.373	29.6 \pm 4.8	0.789	p=0.186
^e GCMH (s)	10.7 \pm 3.5	0.17	10.3 \pm 3.3	0.199	p=0.020
^f GI	24.2 \pm 3.5	0.991	22.1 \pm 3.2*	0.909	p=0.003*

Note: 10 mW: 10 m walk^a; GSP: getting up from a seated position^b; GPP: getting up from the prone position^c; PTS: putting on and taking off a shirt^d; GCMH: getting up from a chair and movement around the house^e; GI: General GDLAM index^f. *Statistically significant difference compared before of 16-week of aquatic exercise program (n=9), ($p < 0.05$).

Graph 1. Percent changes ($\Delta\%$) of the five tests to determine the functional autonomy and General GDLAM index (GI) after 16-week of aquatic exercise program in post-menopausal women with Parkinson's disease (n=9).

As shown in Graph 1, the percent changes ($\Delta\%$) of the five tests to determine the functional autonomy and General GDLAM index (GI) attained lower values after 16-week of aquatic exercise program.



Discussion

In accordance with the established hypothesis, the main findings of the present study were that four months of periodized aquatic exercise training program improve significant reductions in the (10 mW) of the battery tests of functional autonomy and in the (GI) in post-menopausal women diagnosed with idiopathic Parkinson's disease with stage I-III according to Hoehn and Yahr scale.

To the best of our knowledge there is a lack of information than show the effects of exercise on functional autonomy in post-menopausal women with Parkinson's disease. The most related references that have been study the incidence of exercise on functional autonomy is in elderly population (Borges et al., 2012; Goncalves et al., 2011; Pernambuco et al., 2013). In this context, the (10 mW) test was validated in elderly justifying the distance at which an elderly can cross the street

in an urban perimeter the test also reflects in elderly the security to walk without aid or assistance from people or equipment (Sipila, Multanen, Kallinen, Era, & Suominen, 1996). These findings are corroborated elderly women who participate in a 4 months walking program (Fraga, Cader, Ferreira, Giani, & Dantas, 2011). Other findings showed significant changes with less time in 10 m walk test of functional autonomy in elderly women practitioners of ballroom dance, this suggests that elderly women who engage systematic physical exercise may have more velocity to walk 10 meter distance.

The results of (GI) on this study was consistent with other controlled trials in elderly women has been considered exercise modalities as aquatic exercise, dance, yoga, or walking (Borges et al., 2012; Fraga et al., 2011; Goncalves et al., 2011; Pernambuco et al., 2013). The data showed improvements of percent changes ($\Delta\%$) on the tests getting up from a seated position (GSP) getting up from the prone position (GPP), getting up from a chair and movement around the house (GCMH), and putting on and taking off a shirt (PTS) but no significant difference compared with before of 16-week of aquatic exercise program, these results partial contradict those than found significant improvements in as aquatic exercise (Borges et al., 2012; Goncalves et al., 2011). In spite of the aquatic exercise training program was designed five times a week with periodization in order to produce greater adaptations, as is referred in exercise prescription (Romo et al., 2011; Stanley et al., 2013). Our aquatic exercise training program, it was increased the load heart rate reserve of 40-50% (1-8th week) to 50-60% heart rate reserve (9-16th week), by other hand some of these programs where attendance in strength modalities than may have influence the improvements in functional autonomy tests and in the (GI).

Regarding the assessment of physical fitness in the population with Parkinson's disease several batteries have been used to determine the effects of exercise physical exercise (Murray et al., 2014). In the present research the (GDLAM) protocol assessment of functional autonomy was chosen for inexpensive, validated, easy to apply, replicable and the tests simulate activities of daily living calculating the time done in general index of functional autonomy than provides information of certain freedom of action (Dantas & Vale, 2004; Dantas, 2014). In neurology and gerontology areas physical exercise, has been proposed during the rehabilitation of Parkinson's disease in order to minimize physical disability and fall accidents (Alkhuja, 2013; Benzinger et al., 2014), due the deterioration of neuromuscular functions should be monitored functional autonomy to avoid the occurrence of bone fractures and injuries for accidental falls in these population (Gazewood, Richards, & Clebak, 2013), moreover than presence of hip bone mineral density in post-menopausal women with Parkinson's disease is associated with leg muscle strength (Alkhuja, 2013).

The present study has some limitations, first than there is a single arm with no baseline to establish stability in the measures, the sample size is relatively small and we don't evaluate co variables in the group. However, despite these limitations, we used validated measurement instruments of functional autonomy and appropriate physical exercise prescription to conduct the aquatic exercise.

Conclusions

These results highlight the importance to include the periodized aquatic exercise training program as a non-pharmacological intervention for post-menopausal women diagnosed with idiopathic Parkinson's disease; However in the future, it will be appropriated more studies to better clarify the underlying mechanism between aquatic exercise and functional autonomy.

Acknowledgment

The research was funded by the Santander Scholarship Programme 2014 for Young Professors and Researchers from Latin American Universities favoring short-term research mobility and academic exchange to complete the research between the Faculty of Sport, Autonomous

University of Baja California, Mexico; Laboratory of Human Motricity Biosciences (LABIMH), Federal University of State of Rio de Janeiro, Brazil and Laboratory of Exercise Physiology, Estácio de Sá University, Cabo Frio, Brazil.

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