RESUMO

CAPACIDADE DA MARCHA E TRATAMENTO FISIOTERAPÊUTICO DE IDOSOS COM DOENÇA DE PARKINSON. Introdução: Pacientes com doença de Parkinson (DP) apresentam manifestações clínicas motoras como instabilidade postural e alterações da marcha que contribuem para a inatividade física. A diminuição da capacidade da marcha é uma das principais complicações da inatividade física e pode ser tratada pela fisioterapia. Objetivos: o primeiro objetivo específico foi descrever a capacidade de marcha de idosos com DP e comparar com controles saudáveis. O segundo foi verificar os efeitos do *exergame* Nintendo Wii (NW) sobre o equilíbrio postural e mobilidade de idosos com DP e o terceiro foi comparar os efeitos de três modalidades de exercício físico na capacidade e velocidade da marcha, habilidade de levantar e sentar, funcionalidade, qualidade de vida e sintomas depressivos de idosos com DP. Desenho do estudo: Foi realizado um estudo transversal para responder ao primeiro objetivo, uma revisão sistemática para responder ao segundo objetivo e um ensaio clínico randomizado para responder ao terceiro objetivo específico. Material e Métodos: Participaram do estudo transversal idosos com DP e controles saudáveis. Para avaliar a capacidade da marcha foi utilizado o Teste de caminhada de 6 minutos (TC6M). Para realizar a revisão sistemática foram utilizadas as seguintes bases de dados eletrônicas: MEDLINE, Biblioteca Cochrane, PEDro, Periódico CAPES, BIREME e bases de dados Lilacs. Foi utilizada a Escala PEDro para avaliar a qualidade metodológica dos estudos selecionados. No ensaio clínico randomizado, os participantes foram divididos de forma aleatória em três grupos, G1 (treino funcional), G2 (exercício em bicicleta estacionária) e G3 (*exergame*). Como desfecho primário foi utilizado o TC6M. Entre os desfechos secundários encontram-se o teste de levantar e sentar (TLS), o teste de 10 metros (T10M), o *World Health Organization Disability Assessment Schedule 2.0* (WHODAS 2.0), o *Parkinson Disease Questionnaire-39* (PDQ39), o EuroQol-5D e a *Geriatric Depression Scale* (GDS15). Foi verificada a normalidade da distribuição das variáveis de estudo através do teste Kolmogorov Smirnov. As variáveis com distribuição normal foram sumarizadas em média e desvio padrão e comparadas com testes paramétricos e as variáveis com distribuição não normal foram sumarizadas em mediana e intervalo interquartil e comparadas através de testes não paramétricos. Resultados: No artigo 1 houve diferença significativa entre a distância percorrida no TC6M de idosos com DP (322±55 metros) e controles saudáveis (374±51 metros). No artigo 2 os estudos selecionados apresentaram uma baixa qualidade metodológica e mostraram efeitos

positivos do treino com NW sobre a instabilidade postural de indivíduos com DP. No artigo 3, todos os grupos melhoraram significativamente a distância percorrida no TC6M (G1=37 metros; G2=35 metros; G3=36 metros), o tempo no TLS (G1=3 segundos; G2=2 segundos; G3=4 segundos) e a pontuação no WHODAS 2.0 (G1=9 pontos; G2=4 pontos; G3=7 pontos). O G1 e o G3 melhoraram a pontuação no EuroQol-5D e PDQ39 respectivamente e apenas o G3 melhorou significativamente a velocidade da marcha no T10M (0,12±0,2 metros/s). Nenhum dos grupos melhorou significativamente a pontuação da GDS15. Não foram encontradas diferenças significativas entre os grupos. Conclusões: Idosos com DP apresentam uma menor capacidade de marcha em relação aos controles saudáveis. Os três ensaios clínicos randomizados selecionados na revisão sistemática encontraram melhora do equilíbrio postural e da mobilidade dos participantes com DP submetidos ao treino com o *exergame* NW. As três modalidades de exercício apresentaram melhoras significativas sobre a capacidade de marcha, habilidade de levantar e sentar e funcionalidade dos participantes idosos com DP.
Palavras chave: 1. Doença de Parkinson; 2. Idoso; 3. Jogos de vídeo; 4. Marcha.

Tabela 1. Características epidemiológicas e clínicas do GC e GP, Salvador, 2016.

GRUPOS	**GC (Média ± DP)**	**GP (Média ± DP)**	**p**
Variável	**n=24**	**n=24**	
Idade (anos)	68,79 (± 6,63)	69,88 (± 5,49)	0,39
Altura (m)	1,51 (± 0,06)	1,58 (± 0,07)	0,002
Peso (Kg)	69,66 (± 14,27)	68 (± 10,2)	0,45
IMC (Kg/m^2)	30,17 (± 5,22)	26,97 (± 3,54)	0,013
UPDRS		30,58 (± 12,57)	
Hoehn e Yahr		2,77 (± 0,25)	

IMC: índice de massa corporal; m: metros; Kg: quilograma; UPDRS: Escala Unificada de Avaliação da Doença de Parkinson; N: número de participantes; DP: desvio padrão.

Tabela 2. Distância percorrida no TC6M do GC e GP, Salvador, 2016.

TC6M	n	Média (± DP)	p
Grupo Controle	24	373,87 (± 51,11)	0,06
Grupo Parkinson	24	322,02 (± 55,05)	
Idosas Saudáveis	22	373,19 (± 53,08)	0,01
Idosas com Doença de Parkinson	13	302,22 (± 53,47)	

TC6M: Teste de caminhada de 6 minutos; DP: desvio padrão; p: nível de significância.

Table 3. Characteristics of the variables and the outcome of treatment with Nintendo Wii in experimental studies included in this review

Author/year/study	Sample / Age mean / Level of PD	Instruments of evaluation	Results / Conclusions
Zettergren et al, 2011[28] (Case Study)	n=1 69 years	TUG BERG Self selected gait speed Fall history GDS	After 8 weeks, the subject's BBS score and the gait speed have increased, the TUG decreased and and GDS scores remained unchanged. The Nintendo Wii Fit may be a viable alternative to independent exercise programs for people diagnosed with idiopathic PD.
Esculier et al, 2012[21] (Clinical Trial)	n=20 n=9 Health people 63,5 years n=11 People with PD 61,9 years 18,4 – UPDRS	STST TUG POMA 10-m walk test CBM ABC Unipodal stance duration Force platform	The PD group significantly improved their results in TUG, STST, unipodal stance, 10-m walk test, CBM, POMA and force platform after the training programme. The healthy subjects group significantly improved in TUG, STST, unipodal stance and CBM. This study suggests that a home-based balance programme using Wii Fit could improve static and dynamic balance, mobility and functional abilities of people with PD.
Pompeu et al, 2012[23] (Randomised clinical trial)	n=32 67,4 years Hoehn and Yahr stages 1 and 2	UPDRS-II BERG Unipedal Stance Test Montreal Cognitive Assessment	Both groups showed a significant improvement on the UPDRS-II, BBS, Unipedal Stance Test and Montreal Cognitive Assessment after training that was maintained at follow-up. Wii Fit could be used as a new tool in association with physical therapy in order to improve motivation, and consequently adherence.
Loureiro et al, 2012[29] (Quasi-experimental design)	n=6 65 years Hoehn and Yahr stages 2 and 3	Borg's Scale BERG Notthingham's Scale TUG Functional Reach	Statistically significant differences were found in the following tests: Borg's Scale and BERG. The TUG and Notthingham's Scale was not statistically significant when comparing the initial and final values. It is believed that exercises with virtual reality therapy can be a useful tool to improve the balance in PD patients.
Mhatre et al, 2013[30] (Quasi-experimental	n=10 67,1 years Hoehn and Yahr	BERG DGI Sharpened Romberg	The BBS and DGI improved significantly, as did postural sway measured with the balance board. The Sharpened

design)	stages 2,5 and 3	with eyes open and closed Postural sway using the Wii balance board ABC GDS	Romberg improvements neared significance only for eyes closed. There were no significant changes on patient ratings for the Activities-specific Balance Confidence. An exercise training class by using the Wii Fit balance board improved selective measures of balance and gait in adults with PD. However, no significant changes were seen in mood or confidence regarding balance.
Herz et al, 2013[19] (Quasi-experimental design)	n=20 66,7 years Hoehn & Yahr Stage 2	9-hole peg test POMA Purdue Pegboard Test Timed tapping test TUG Hamilton Depression Scale Nottingham Extended Activities of Daily Living Test PDQ-39 NEADL UPDRS	There was a significant improvement in the right-sided 9-hole peg test score and TUG score between pre- and post-intervention. This study demonstrates that the Nintendo Wii gaming system can be an effective treatment modality for patients with PD. However further studies are needed to determine if there are long-term benefits of this therapy in PD.
Zalecki et al, 2013[22] (Quasi-experimental design)	n=24 68,8 years	BERG POMA TUG Sit-to-stand test 10-Meter Walk test ABC	There was a significantly improvement in BERG, POMA, TUG, Sit-to-stand test, 10-Meter Walk test and Activities-specific Balance Confidence scale at the end of the programme.
da Silva et al, 2013[27] (Quasi-experimental design)	n=6	Goniometry Trunk Mobility Scale BERG PDQ-39	It was observed that treatment using Wii Sports (Nintendo Wii®) games was able to increase, range of movement, trunk mobility, balance and quality of life of individuals with PD.
Liao et al, 2015[32] (Randomized controlled trial)	n=36 Hoehn and Yahr score ranging 1 to 3 Wii Fit exercise (n=12) Traditional exercise (n=12) No structured exercise program (n=12)	Obstacle crossing performance Dynamic balance SOT PDQ-39 FES-I TUG	The Wii Fit group showed greater improvement in obstacle crossing velocity, crossing stride length, dynamic balance, SOT, TUG, FES-I, and PDQ39 than the control group. Wii Fit training also resulted in greater improvement in movement velocity of limits-of-stability test than Traditional Exercise training.
Pompeu et al, 2014[31] (Case series)	n=4 67 years Hoehn and Yahr stages 2 and 3	BESTest	There was an improvement of 9.19% in the BESTest score. This improvement may be related to the motor and cognitive demands of the games.
Lee, Lee and Song, 2015[26]	n=20 68,4 years	BBS Modified Barthel	There was significantly differences between before and after

(Randomized controlled trial)	Experimental group (n=10) Control group (n=10)	Index Beck Depression Inventory	treatment in the experimental group, and significantly differed between the experimental and control group in the balance, activities of daily living, and depressive disorder status. Virtual reality dance exercise has a positive effect on balance, activities of daily living, and depressive disorder status of PD patients.

Abbreviations: TUG, Timed up and go; BBS, Berg Balance scale; GDS, Geriatric Depression Scale; STST, Sit-to-Stand test; POMA, Tinetti Performance Oriented Mobility Assessment; CBM, Community Balance and Mobility assessment; ABC, Activities-specific Balance and Confidence scale; UPDRS, Unified Parkinson's Disease Rating Scale; UPDRS-II, Section II of the Unified Parkinson's Disease Rating Scale; DGI, Dynamic Gait Index; BESTest, Balance Evaluation Systems Test; SOT, sensory organization test; PDQ39, Parkinson's Disease Questionnaire; FES-I, fall efficacy scale.

Table 3. Baseline experimental group characteristics in individuals with Parkinson disease.

Variable	**G1** (n=22)	**G2** (n=20)	**G3** (n=20)	
	n (%) Median (IR) / Mean (±SD)	n (%) Median (IR) / Mean (±SD)	n (%) Median (IR) / Mean (±SD)	
Sex (female)	6 (27.3)	9 (45.0)	10 (50.0)	.358
Fallers	10 (45.5)	9 (45.0)	10 (50.0)	.861
Weight (Kg)	68.57 (±9.92)	64.66 (±13.10)	67.76 (±14.45)	.577
Height (m)	1.61 (±0.09)	1.62 (±0.09)	1.60 (±0.09)	.630
BMI (Kg/m^2)	26.62 (±4.17)	24.36 (±3.97)	26.61 (±5.83)	.222
UPDRS	29.86 (±12.95)	28.65 (±12.86)	32.30 (±15.48)	.696
AC (cm)	94.70 (±11.76)	90.62 (±19.04)	95.27 (±13.07)	.559
Age (years)	71 (66-75)	67 (64-71)	67 (66-68)	.063
Illness duration (years)	4 (3-7)	6 (4-9)	4 (4-7)	.461
Mini Mental Test	27.00 (24.75-28.00)	27.00 (25.00-29.00)	27.00 (25.00-28.00)	.723
Hoehn and Yahr Stage	2.50 (2.50-3.00)	2.50 (2.00-3.00)	2.50 (2.00-2.50)	.108
Education (years)	8.00 (4.75-11.00)	9.50 (5.00-11.00)	8.00 (4.00-11.00)	.457

Variables with not normal distribution was expressed as median and interquartile range and compared with Kruskal Wallis test; Variables with normal distribution was expressed as mean and standard deviation and compared with ANOVA test; n: number of participants; cm: centimeters; m: meters; IR: interquartile range; Kg: kilogram; BMI: body mass index; AC: abdominal circumference; UPDRS: Unified Parkinson's Disease Rating Scale.

Table 4. Primary and secondary outcome measures comparing before and after intervention for each study group in patients with Parkinson disease (p-values refer to Wilcoxon signed-rank test / T-test).

	Variable	**G1** (n = 22) Baseline median (IR) Baseline mean (±SD) 8 weeks median (IR) 8 weeks mean (±SD)		**G2** (n = 20) Baseline median (IR) Baseline mean (±SD) 8 weeks median (IR) 8 weeks mean (±SD)		**G3** (n = 20) Baseline median (IR) Baseline mean (±SD) 8 weeks median (IR) 8 weeks mean (±SD)	
	6MWT	354.9 (±98.9)		405.2 (±97.3)		365.4 (±81.1)	
(m)		391.7 (±107.5)	.008	440.2 (±90.2)	.001	401.2 (±77.9)	.005
	10MWT	1.3 (±0.3)		1.3 (±0.3)		1.2 (±0.3)	
(s)		1.4 (±0.4)	.068	1.4 (±0.3)	.101	1.4 (±0.3)	.011
	PDQ39	47.0 (±25.1)		38.1 (±19.8)		44.7 (±26.7)	
		41.7 (±21.7)	.069	32.9 (±19.1)	.185	33.9 (±25.2)	.004
	BMI	26.6 (±4.2)		24.4 (±4.0)		26.6 (±5.8)	
(Kg/m^2)		26.5 (±4.1)	.562	24.1 (±3.8)	.105	26.3 (±5.7)	.126
	AC (cm)	95.0 (±11.8)		90.6 (±19.0)		95.3 (±13.1)	
		94.4 (±11.5)	.691	88.4 (±15.6)	.069	92.9 (±13.5)	.011
	WHOD	73.3 (±22.0)		66.2 (±17.7)		70.75 (±19.6)	
AS 2.0		63.91 (±14.0)	.018	61.9 (±16.2)	.019	64.3 (±19.2)	.041
	SRT (s)	16.6 (12.0-21.3)		13.2 (11.4-17.1)		14.5 (11.4-16.1)	
		11.8 (9.6-15.9)	0.001	11.1 (9.8-13.7)	.001	10.5 (7.4-13.4)	.003
	Euroqol-	7.0 (6.0-9.0)		6.0 (5.0-7.0)		6.5 (5.0-7.0)	
5D		6.0 (5.0-7.0)	.014	5.0 (5.0-6.8)	.399	6.0 (5.0-7.0)	.311
	GDS-15	5.0 (3.8-7.3)		3.0 (2.0-6.0)		5.0 (3.0-7.8)	
		5.0 (1.8-7.0)	.099	4.0 (2.0-5.0)	.962	3.5 (2.8-8.3)	.115

Variables with not normal distribution was expressed as median and interquartile range and compared with Wilcoxon signed-rank test; Variables with normal distribution was expressed as mean and standard deviation and compared with T-test; n: number of participants; s: seconds; cm: centimeters; m: meters; IR: interquartile range; Kg: kilogram; BMI: body mass index; AC: abdominal circumference; 6MWT: 6-minute walk test; SRT: Sitting-rising test; 10MWT: 10-meters walk test; PDQ39: Parkinson Disease Questionnaire-39; Whodas 2.0: World Health Organization Disability Assessment Schedule 2.0; GDS-15: 15-item Geriatric Depression Scale.

Table 5. Primary and secondary outcome measures compared between the three experimental groups.

Variable		G1 (n=22)	G2 (n=20)	G3 (n=20)	G1 vs G2	G1 vs G3
		Median (IQR) Mean (±SD)	Median (IQR) Mean (±SD)	Median (IQR) Mean (±SD)	Mean difference (95% CI)	
6MWT (m)	6M	36.73 (±59.15)	34.98 (±38.71)	35.77 (±49.84)	1.7 (-29.8 to 33.3)	1.0 (-33.3 to 35.3)
10MWT (s)	10	0.12 (±0.30)	0.07 (±0.19)	0.12 (±0.20)	0.0 (-0.1 to 0.2)	-0.0 (-0.2 to 0.1)
PDQ39	PD	5.36 (±13.13)	5.15 (±16.74)	10.85 (±14.67)	0.2 (-9.1 to 9.5)	-5.5 (-14.2 to 3.2)
BMI (Kg/m^2)	B	0.09 (±0.69)	0.26 (±0.69)	0.34 (±0.94)	-0.2 (-0.6 to 0.3)	-0.3 (-0.8 to 0.3)
AC (cm)	AC	0.34 (±4.00)	2.20 (±5.10)	2.40 (±3.82)	-1.9 (-4.7 to 1.0)	-2.1 (-4.5 to 0.4)
Whodas 2.0	Wh	9.36 (±17.11)	4.30 (±7.52)	6.45 (±13.18)	5.1 (-3.3 to 13.5)	3.0 (-6.7 to 12.5)
SRT (s)	SR	2.95 (1.03-7.72)	2.11 (0.34-3.53)	4.48 (0.61-6.27)	1.8 (-1.2 to 4.8)	1.1 (-2.0 to 4.1)
Eurqol-5D	Eur	1.00 (0.00-2.00)	0.00 (0.00-1.00)	0.00 (-1.00-1.75)	0.6 (-0.3 to 1.5)	0.5 (-0.6 to 1.5)
GDS-15	GD	0.50 (-0.25-1.25)	0.00 (-1.75-1.75)	1.00 (0.00-2.00)	0.6 (-0.8 to 1.9)	0.1 (-1.3 to 1.5)

Variables with non-normal distribution were expressed as median and interquartile range (IQR); Variables with normal distribution was expressed as mean and standard; n: number of participants; s: seconds; cm: centimeters; m: meters; Kg: kilogram; BMI: body mass index; AC: abdominal circumference; 6MWT: 6-minute walk test; SRT: Sitting-rising test; 10MWT: 10-meters walk test; PDQ39: Parkinson Disease Questionnaire-39; Whodas 2.0: World Health Organization Disability Assessment Schedule 2.0; GDS-15: 15-item Geriatric Depression Scale.

ABSTRACT

GAIT CAPACITY AND PHYSIOTHERAPEUTIC TREATMENT OF ELDERLY PEOPLE WITH PARKINSON DISEASE. Introduction: Patients with Parkinson's disease (PD) present clinical motor manifestations such as postural instability and gait changes that contribute to physical inactivity. Decreased gait capacity is one of the main complications of physical inactivity, but can be treated by physiotherapy. Objectives: The first specific objective was to describe gait ability of elderly with PD and to compare it with healthy controls. The second was to verify the effects of exergame Nintendo Wii (NW) on postural balance and mobility of elderly with PD, and the third was to compare the effects of three modalities of physical exercise on gait capacity and speed, ability to raise and sit, functionality, quality of life and depressive symptoms of elderly people with PD. Study design: A cross-sectional study was performed to respond to the first objective, a systematic review to respond to the second objective, and a randomized clinical trial to respond to the third specific objective. Material and Methods: Elderly patients with PD and healthy controls participated in cross-sectional study. The 6-minute walk test (6MWT) was used to assess gait capacity. To perform the systematic review, following electronic databases were used: MEDLINE, Cochrane Library, PEDro, CAPES Journal, BIREME and Lilacs databases. The PEDro Scale was used to evaluate the methodological quality of the selected studies. In randomized clinical trial, participants were randomly divided into three groups, G1 (functional training), G2 (exercise on stationary bicycle) and G3 (exergame). As primary endpoint, 6MWT was used. Among the secondary outcomes are the sit-up test (TLS), the 10-meter test (T10M), the World Health Organization Disability Assessment Schedule 2.0

(WHODAS 2.0), the Parkinson Disease Questionnaire-39 (PDQ39), the EuroQol-5D and the Geriatric Depression Scale (GDS15). Variables distribution normality was verified through the Kolmogorov Smirnov test. Variables with normal distribution were summarized in mean and standard deviation and compared with parametric tests, however variables with nonnormal distribution were summarized in median and interquartile range and compared by non-parametric tests. Results: In article 1 there was a significant difference between distance covered in 6MWT of elderly with PD (322 ± 55 meters) and healthy controls (374 ± 51 meters). In article 2 selected studies presented a low methodological quality and showed positive effects of NW training on the postural instability of individuals with PD. In group 3, all groups significantly improved the distance covered in 6MWT (G1=37 meters, G2=35 meters, G3=36 meters), the time in TLS (G1=3 seconds, G2=2 seconds, G3=4 seconds) and the score in WHODAS 2.0 (G=9 points, G2=4 points, G3=7 points). G1 and G3 improved scores on EuroQol-5D and PDQ39 respectively, and only G3 significantly improved walking speed on T10M (0.12 ± 0.2 meters / s). None of the groups significantly improved the GDS-15. No significant differences were found between groups. Conclusions: Elderly patients with PD have a lower gait capacity compared to healthy controls. The three randomized clinical trials selected in the systematic review found improvement in postural balance and mobility of participants with PD undergoing training with the exergame NW. The three modalities of exercise presented significant improvements on gait ability, ability to stand and sit and functionality of the elderly participants with PD.
Key words: 1. Parkinson's disease; 2. Aged; 3. Video games; 4. Gait.