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REVIEW ARTICLE

Home-based therapeutic exercise as a treatment for Parkinson's Disease: an integrative review

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ABSTRACT

Home-based therapeutic exercise has been examined by a number of recent studies as a care strategy for the control of signs and symptoms of Parkinson's Disease (PD). This integrative review of literature aimed to collect studies published in the last five years (2010-2014) about the use of home-based therapeutic exercise as a physical therapy care strategy for PD. A survey of articles in the LILACS, PEDro, PubMed and Cochrane databases was carried out, using the combinations: Physiotherapy AND Parkinson's Disease or Home Exercise AND Parkinson's Disease. To analyze methodological quality, the adapted Critical Appraisal Skill Program (CASP) and the Agency for Healthcare and Research and Quality (AHRQ) were used. The benefits of conventional exercises were: stimulation of self-care; strength gain and increased range of movement; reduction in number of complaints and fear of falling; improvement in the motor symptoms of Parkinson's Disease and related quality of life. The benefits of rehabilitation with virtual reality were: improvement of gait, functional ability and balance, as well as positive findings for acceptance and motivation.

Keywords: Parkinson Disease; Physical Therapy Specialty; Home Care Services; Exercise Therapy.

INTRODUCTION

Parkinson's Disease (PD) is a common neurodegenerative illness among the elderly, affecting men more than women.[1] The classic diagnosis of the condition is based on clinical criteria such as the presence of bradykinesia, combined with one of the cardinal symptoms of the disease: stiffness, resting tremor or postural instability.[2-4] Patients may additionally display non-motor syndromes such as olfactory, gustative and cognition dysfunction and sleep disturbances.[5,6]

Due to demographic changes it is estimated that the number of cases of PD will double by 2030, reaching 12 million worldwide.[7] As a result, developing countries such as Brazil must plan effective and accessible methods of controlling the disease, based on quality of life, which is affected by the signs and symptoms of the illness.[8-10] The disease is controlled by pharmacological, non-pharmacological and/or surgical treatments,[11] with a multidisciplinary approach considered to be the best alternative.[12-15]

Physiotherapy, however can promote benefits for PD sufferers as an additional treatment strategy[16] by providing guidance and practice in therapeutic techniques such as stretching, muscle strengthening, gait, mobility, balance, transfer, relaxation and breathing exercises.[15,17,18] These physiotherapeutic strategies can be performed at home, an important factor considering the mobility and financial difficulties of patients, as well as the shortage of professionals to meet the demand of sufferers.[18-20]

Despite the importance of the subject, there are no published studies that compile scientific evidence about home-based therapeutic exercises as a physiotherapeutic care strategy for PD. The aim of the present study, therefore, was to survey studies published between 2010 and 2014 on the use of home-based therapeutic exercises as a physiotherapeutic care strategy for Parkinson's Disease.

METHOD

An integrative literature review was carried out. Such a study type incorporates a search, critical evaluation and synthesis of available evidence about a delimited theme or guiding question, contributing to medical practice based on health evidence.[21]

Six methodological stages were used: 1- identification of theme and selection of guiding question of the study; 2- establishing of inclusion and exclusion criteria of the studies; 3- definition of information to be extracted from the selected studies and categorization of the same; 4- evaluation of the studies included in the review; 5- interpretation of results; 6- presentation of review and synthesis of knowledge.[21]

For the first stage the following guiding question was elaborated - between 2010 and 2014 what scientific evidence was published about the use of home-based therapeutic exercises as a physiotherapeutic care strategy for PD? Next, eligibility criteria were established to allow articles to be obtained and selected through a search, performed between November and December 2014, of the LILACS (Literatura Latino-Americana e do Caribe em Ciências da Saúde (Latin American and Caribbean Literature in Health Sciences)), PEDro (Data Base in Evidence in Physiotherapy), PubMed (U.S. National Library of Medicine) and Cochrane (Cochrane Database of Systematic Reviews) databases.

The articles included dealt with home-based approaches used as a physiotherapeutic care strategy in individuals diagnosed with PD; were published between the years 2010 and 2014; and were available in Portuguese, English or Spanish. There were no restrictions based on study design. Studies duplicated in the databases, those in which subjects performed home-based exercises combined with other non-pharmacological treatments, and publications not available in their entirety or whose results had not yet been published were excluded from the study. Key-words indexed on the Health Science Descriptors (DeCS) - Physiotherapy and Parkinson's Disease - and the Medical Subject Headings (MESH) - Home Exercise and Parkinson's Disease - indexes were used to search for the articles. The Boolean operator of choice was "AND".

For the most effective critical analysis of the articles included, two instruments that allowed the evaluation of different types of study design were applied: 1- Critical Appraisal Skill Programme (CASP) (adapted)[22] and 2- Agency for Healthcare and Research and Quality (AHRQ).[23]

The original CASP [24] considered eight specific tools for the evaluation of different delineations of study such as reviews, cohort studies, clinical trials, and cross-sectional studies. In this review, an adapted version of CASP was used which included ten scored items including: 1) objective; 2) suitability of method; 3) presentation of theory and methodological procedures; 4) sample selection criteria; 5) sample details; 6) relationship between researchers and research subjects (randomization/blinding); 7) respect for ethical issues; 8) rigor in data analysis; 9) propriety when discussing results 10) contributions and limitations of study. For item 8, rigor in methodological analysis was considered to refer to the suitability of data analysis, such as intention to treat analysis. The studies were classified as level A (between 6 and 10 points), which is considered as of good methodological quality with low bias, or level B (up to 5 points) meaning satisfactory methodological quality but with a considerable risk of bias.[22]

The AHRQ classifies studies into six levels according to the level of evidence: (1) systematic review or meta-analysis; (2) randomized clinical trials; (3) non-randomized clinical trials; (4) cohort and case control studies; (5) systematic review of descriptive and qualitative studies and (6) unique descriptive or qualitative study. [23]

RESULTS

Of the 143 studies identified from the cross-referencing of the descriptors, 29 met the inclusion criteria. Of these, 13 were excluded (11 were duplicates, one was not available in its entirety and the results of one had not been published) leaving 16 articles to make up the final sample (table 1). The main information from the articles included in this review is shown in table 2.

Table 1 Databases consulted and number of articles comprising study sample. Recife-PE, 2014.

Database	Combination of key-words	Articles found	Articles which met the inclusion criteria	Articles rejected based on exclusion criteria	Sample
LILACS	Physiotherapy AND Parkinson's Disease	40	2	0	2
PubMed	Home Exercise AND Parkinson's Disease	81	16	2	14
PEDro	Home Exercise AND Parkinson's Disease	22	11	11	0
Cochrane	Home Exercise AND Parkinson's Disease	0	0	0	0
Total		143	29	13	16

Table 2 Description of each study included in study. Recife-PE, 2014.

Author/Year	Sample and diagnosis time (DT)	Objective	Study design	Main findings
Nakae & Tsushima,[25] 2014	10 patients with PD, who were 2 or 3 on Hoehn & Yahr[26] scale (HY) DT: 12.6 (±5.6) years	Identify effects of home-based exercises on physical function and activity of PD sufferers	Cohort	Stimulate self-care, improve range of movement and muscle strength, as well as reduce time spent lying down.
Barry et al.,[27] 2014	Seven complete articles published in English based on virtual reality rehabilitation among PD sufferers	Evaluate evidence of safety, viability, and efficacy of virtual reality games as a rehabilitation tool for PD	Systematic Review	Only one study evaluated the effects of home use, finding good results for balance, mobility and functional capacity. Further investigations are necessary to establish safety and clinical efficacy.
Ebersbach et al.,[28] 2014	58 patients with PD (HY 1 to 3) DT per group: LSVT®BIG[29,30] = 6.1 (±3.0) years, Nordic walking[31]= 7.8 (±4.4) years, Home-based= 7.4 (±5.9) years	Evaluate through reaction time whether physical activity can impact the cognitive performance of PD sufferers	Randomized-controlled blind evaluator clinical trial	LSVT®BIG[29,30] (use of 80% of maximum power, with intense motivation and feedback) or Nordic walk[31] (warm-up, walk and return to calm) outpatients were associated with an improvement in the cognitive aspects of preparation for movement when compared to those performing unsupervised home exercises.
Dowling et al.,[32] 2013	20 patients with PD (HY 2 to 3) DT: 0.67 to 28 years	Demonstrate the technical feasibility of the home use of a game-based gait and balance training program featuring a balance platform	Observational Cross-sectional	A program that incorporated therapeutic movements to improve gait and balance for PD was an appealing and viable option for home use.
Pickering et al.,[20] 2013	70 patients with PD (HY 2 to 4) DT: 7.7 (±5.8) years	Investigate the percentage of prescribed repetitions of home-based exercises concluded and the characteristics of those who adhered to the program	Observational Cross-sectional	79% of the prescribed repetitions were concluded. Good adhesion, however, was lower among more elderly patients and those with a poor state of health.

Author/Year	Sample and diagnosis time (DT)	Objective	Study design	Main findings
Canning et al.,[33] 2012	20 patients with PD (HY 1 to 2) DT by group: Intervention- 6.1 (±4) year, Control- 5.2 (±4.1) years	Investigate viability and efficacy of home-based training using treadmill on patients with mild PD	Randomized Controlled Clinical Trial With Pilot Study	The method was considered a feasible and safe form of exercise for people without cognitive impairment and mild PD. Further investigation into the effectiveness of home treadmill training is needed.
Esculier et al.,[34] 2012	18 patients: 10 with moderate PD and eight healthy elderly individuals TD: 8.5 (±3) years	Evaluate the effects of home-based balance training using Nintendo™ Wii Fit with a balance platform for PD sufferers and compare them with healthy individuals	Clinical Trial -Pilot Study	A home-based program using Nintendo™ Wii Fit with balance platform can improve static and dynamic balance, mobility and functional capacity for PD.
Stack et al.,[35] 2012	47 patients with PD (HY 1 to 4) median DT (min-max): 7	Evaluate the effects of home-based physiotherapy aimed at transfers among PD sufferers and	Randomized Controlled Clinical Trial	The home-based physiotherapy group displayed a tendency of improvement in transfers, mobility and balance that were not observed in the control

	(1–30) years	the viability of distance measuring of the results to preserve blindness	Blind evaluator	group. Evaluation by video was positive in terms of preserving blindness.
Schenkman et al.,[36] 2012	121 patients with PD (HY 1 to 3) DT by group: strength, balance and flexibility (SBF)- 4.5 (±3.8) years, aerobics (AE)- 3.9 (±4.2) years, Control- 4.9 (±3.7) years	Compare long and short term results of two supervised programs and a home-based control program	Randomized Controlled Clinical Trial Blind evaluator	Supervised outpatient SBF (strength, balance and flexibility) programs are recommended for improving overall functioning and AE (aerobic) exercises for long term aerobic conditioning. The lack of a significant decline in the control outcomes suggested that the home-based[37] program with monthly meetings also provided benefits, although these were less far-reaching.

Author/Year	Sample and diagnosis time (DT)	Objective	Study design	Main findings
Frazzitta et al.,[38] 2012	50 patients with PD (HY 2 and 3) DT per group: Intervention- 8 (±3) years, Control- 9 (±3) years	Analyze whether intensive rehabilitation (IRT) and outpatient rehabilitation has an effect on motor performance compared to control over 12 months and reapplied after a year; determine whether IRT reduces the need for an increase in the dosage of levodopa	Randomized Controlled Clinical Trial Blind evaluator	The addition of IRT (flexibility, strength, balance, transfer, track training with sensory input and guidance) to pharmacological training is important for the improvement of motor performance, autonomy and performance of ADLs, as well as slowing the increase in drug dosage compared to control (a neurologist recommended the performance of home and walking based exercises).
Santos et al.,[39] 2012	33 patients with PD (HY 1 to 3) Number of patients with DT≤ 5 years=25 and with DT ≥ 5 years=11	Evaluate effects of a self-supervised treatment program on PD sufferers using the Unified Parkinson's Disease Rating Scale (UPDRS) and HY	Case Series	While not all the patients displayed an improvement in mental function, ADLs and motor symptoms, the data recommends the home-based program as an alternative therapeutic method against PD
Santos et al.,[18] 2010	Articles indexed on PubMed, SciELO and LILACS	Perform a review and update of physiotherapy in PD	Literature Review	Self-supervised home-based exercises are the best form of exercise to be used against PD.
Dereli & Yaliman,[40] 2010	30 patients with PD (HY 1 to 3) DT by group: Supervised- 4 (2–18) years, Self-supervised- 7 (3–11) years	Compare effects of supervised outpatient physiotherapy with home-based self-supervised exercises on the quality of life of PD patients	Almost-Random Clinical Trial Blind evaluator	The exercise program supervised by a physiotherapist was more effective at improving ADL, motor, emotional, and mental symptoms and general health quality than the self-supervised home-based program. However, both had positive effects on quality of life.
Ebersbach et al.,[29] 2010	58 patients with PD (HY 1 to 3) DT per group: LSVT®BIG[29,30] – 6.1 (±3.0) years, Nordic walking[31] – 7.8 (±4.4) years and Home-based - 7,4 (±5.9) years	Compare effects of LSVT®BIG,[29,30] Nordic walking,[31] and supervised home-based exercises	Randomized Controlled Clinical Trial Blind evaluator	LSVT®BIG[29,30] is an effective technique for improving motor performance in PD compared to Nordic walking[31] and non-supervised home-based exercises.

Author/Year	Sample and diagnosis time (DT)	Objective	Study design	Main findings
De Bruin et al.,[41] 2010	22 individuals with PD (HY 2 to 3) DT by group: Intervention- 6.4 (±4.2) years, Control- 4.5 (±3.3) years	Investigate the viability and effectiveness of the integration of gait and music in a short home-based intervention on PD	Randomized Controlled Clinical Trial Blind evaluator	Listening to music as a home-based exercise can be implemented in a safe form for PD sufferers. There were improvements in gait speed, step time, cadence and severity of motor symptoms.
Espay et al.,[42] 2010	13 patients DT: 12.1(±4.2) years	Investigate effectiveness of sensory devices (visual and auditory) on the gait of PD sufferers.	Clinical Trial	Devices that used sensory feedback appeared to be effective at improving gait speed, stride length and reducing freezing episodes.

HY= Hoehn & Yahr Parkinson's Disease stage scale.[26]

Of the 16 articles, 15 (93.75%) were published in English and one (6.25%) in Portuguese. A total of 14 (87.5%) were non-Brazilian studies and two (12.5%) were Brazilian.

In terms of year of publication, six articles (37.5%) were from 2012, five (31.25%) were from 2010, three (18.75%) were from 2014 and two (12.5%) were from 2013. The study locations were: England and the USA, representing 18.75% of the total number of studies each, followed by Brazil, Canada and Germany (12,5% each) and Italy, Australia, Turkey and Japan (6.25% each).

Following a complete reading of the studies, 14 (87.5%) were classified as level A in methodological quality and only two (12.5%) as level B, based on the adapted CASP scale [22] (table 3).

Table 3 Description of home based interventions and evidence levels of articles, according to adapted CASP[22] and AHRQ.[23] Recife-PE, 2014.

Author/Year	Description of home-based intervention	Evidence (adapted CASP)	Evidence (AHRQ)
Nakae & Tsushima,[25] 2014	Eight weeks. Stretching, balance, strengthening and postural change exercises at least three times a week. These were carried out under the supervision of the patients, who were guided by a physiotherapist in the form of manual with photos. There were weekly home visits (30 minutes) with exercises for motivation.	B	4
Barry et al.,[27] 2014	NA	A	1
Ebersbach et al.,[28] 2014	16 weeks. Instruction (one hour) with practical demonstration of stretching, large range of movement, active muscle strength and posture exercises to be performed at home without supervision.	A	2
Dowling et al.,[32] 2013	Supervised (50 minutes). Virtual reality game with sitting and standing, trunk rotation and functional diagonal movements.	A	6
Pickering et al.,[20] 2013	Six weeks, with weekly control visits. A manual with written instructions and images of functional exercises and activities to reduce the risk of falling was prepared by physical and occupational therapists based on experience, two reviews of Cochrane[43,44] and focus groups with doctors. The manual included: strength, range of movement, balance and walking exercises. Each exercise was graded based on six levels of difficulty. The program also included guidance on falls and the use of walkers.	A	6
Canning et al.,[33] 2012	Six weeks, four times per week. Session (30-40 minutes): warm-up, sitting and standing movements, stretching, treadmill with 50% of average speed obtained during the six-minute pre-test and return to calm. Subsequently, treadmill training intensity increased to 60% and 80% of the average speed obtained during the pre-test. Additional tasks were introduced from the fourth week onwards. Seven sessions were supervised by a physiotherapist and the others carried out independently.	A	2

Author/Year	Description of home-based intervention	Evidence (adapted CASP)	Evidence (AHRQ)
Esculier et al.,[34] 2012	Six weeks. Programs of approximately 40 minutes, three times a week. Training included 30 minutes with Nintendo™ Wii Fit platform and ten minutes with Nintendo™ Wii Sports (golf or bowling). The balance games used were: Table Tilt, Ski Slalom, Balance Bubble, Ski Jump and Penguin Slide. These exercises featured either a marker on the screen that tracked the user's movement, with the challenge being to keep this marker within a certain area to win points, or a character or object that moved according to how the user's weight shifted on the platform. Only one yoga exercise was used (deep breathing), where the patient was asked to keep his or her center of pressure as still as possible. Only the Hula-Hoop was used in the aerobics category. There were weekly motivational phone calls.	B	3

Stack et al.,[35] 2012	Four weeks, three times a week, the program focused on transfer from a chair, in the form of supervised exercises to increase hip and knee extensor strength, trunk stability and flexibility. Guidance for movement strategies when getting up and sitting down and verbal stimulation was also provided. Only portable equipment such as shin guards were used. A physiotherapist decided on the need for progression based on clinical experience.	A	2
Schenkman et al.,[36] 2012	For 68 weeks, five to seven times per week. Use of illustrated manual [37] with exercises to be performed at home by the patient. There was a monthly supervised group meeting. The manual included breathing exercises; flexibility; stretching; mobility, suggesting aerobic exercises; strengthening; balance; transfers and posture changes.	A	2
Frazzitta et al.,[38] 2012	48 weeks and reapplication the following year. A neurologist recommended exercising at home and walking in a generic manner. There were no reports of the exercises or how to perform them.	A	2
Santos et al.,[39] 2012	12 weeks, three times a week, about 60 minutes. On the first visit, patients and their relatives received instructions about the exercises and an illustrative manual based on that recommended by the Parkinson Society of Canada.[11] It was composed of 13 strengthening exercises and six stretching and flexibility exercises. There were weekly phone controls.	A	6
Santos et al.,[18] 2010	NA	A	6

Author/Year	Description of home-based intervention	Evidence (adapted CASP)	Evidence (AHRQ)
Dereli & Yaliman,[40] 2010	Ten weeks with thrice weekly 45 minute sessions. An individual patient educational session was held and a manual created by the physiotherapist with unsupervised exercises to be carried out at home was delivered to the patient. The educational session contained information about disease, rehabilitation and exercise. The exercises were: stretching; range of movement; mobility; progressive relaxation; segmented, diaphragmatic and deep breathing; balance; coordination and gait training. Patients were motivated by calls from the physical therapist once a week.	A	3
Ebersbach et al.,[29] 2010	16 weeks. Instruction (one hour) with practical demonstration of stretching, range of movement, active muscle strength and posture exercises to be performed at home without supervision.	A	2
De Bruin et al.,[41] 2010	13 weeks, three times a week and at least 30 minutes per session. Patients listened to a customized playlist of songs through headphones on an iPod (Apple Inc., Cupertino, CA) along with their normal activities. They were also invited to walk on their own in the neighborhood and told to refrain from dual tasking (i.e. talking to colleagues or walking with pets), as they walked with music. There were fortnightly contacts for control.	A	2
	Two weeks, twice per week, 30 minutes. Use of a visual and		

Espay et al.,[42] 2010	auditory sensory stimulation device to walk and perform daily activities. The apparatus, operating in an adaptive closed-loop mode, displayed a life-size virtual checkerboard-tiled floor superimposed on the real world with specialized see-through glasses. The user regulated the gait pattern to create a constant optical flow and a rhythmic auditory cue. The virtual walking responded dynamically to the motion of the patient or the speed set by the user, measured by an accelerometer. Visual feedback encouraged long strides. The constant gait synchronized the steps to auditory signals to encourage the patient to try harder. Additional auditory feedback from the patient's own steps was provided through headphones in a continuous form and produced at a rate based on the patient's gait pattern.	A	3

NA= non-applicable.

AHRQ[23] evaluation found that one article (6.25%) was a systematic review - evidence level one; seven (43.75%) were randomized clinical trials - evidence level two; three (18.75%) were non-randomized clinical trials - evidence level three; one (6.25%) was a prospective cohort - evidence level four; two (12.5%) were observational cross-sections, one (6.25%) was a case series and one (6.25%) was a literature review - all evidence level six. None of the studies employed a qualitative approach (table 3).

Table 3 provides a description of the home-based interventions accompanied by the evidence level of the corresponding studies according to the adapted CASP[22] and AHRQ[23] instruments.

DISCUSSION

The studies included in this review[20,25,27,32-36,39-42] suggest that home-based therapeutic exercises are an important care strategy for PD, most notably kinesiotherapy[18,20,25,28,29,33,35,36,38-41] and virtual reality rehabilitation.[27,32,34,42] Kinesiotherapy includes exercises of flexibility; strengthening; mobility; balance; relaxation; breathing; strategies of movement and motion and guidance about activities of daily living (ADLs). Virtual reality rehabilitation uses commercial or adapted video based games and a device capable of simulating a superimposed reality.

Kinesiotherapy

Four studies in this review[20,25,35,39] analyzed home-based programs that featured various conventional combinations of therapeutic exercises. Nakae & Tsushima[25] found a significant reduction in number of complaints, fear of falling, and time spent lying down, as well as a significant increase in flexibility and muscle strength. The same study observed good adhesion to the program, corroborating Pickering et al.,[20] although the latter study reported lower adhesion among older people, with increased limitations in motor exams and cognitive-behavioral problems.

The aforementioned studies[20,25] have in common an evaluation of short duration home-based programs that feature educational support material and weekly visits. While it is considered that these programs can offer advantages such as convenience and low costs, care is required when reproducing their protocols, as the study by Pickering et al.[20] did not test the intervention, and that by Nakae & Tsushima[25] had a B level of evidence with a considerable risk of bias. In the latter study,[25] the methodology was not suitable for the response the study aimed to provide, the sample was small and not sufficiently detailed, and little rigor was shown in data analysis.

Santos et al.[39] evaluated a self-supervised program that used illustrative material for exercises, but also featured a longer intervention and weekly telephone follow-up calls by the physiotherapist. Benefits in the signs and symptoms described in the Unified Scale Unified Parkinson's Disease Rating Scale (UPDRS) were found,[39] although not in all the patients. According to the authors,[39] it is possible that the cognitive capacity of some patients and their relatives affected the correct performance of the exercises. The main limitations of this study[39] were the small sample size and the absence of a control group. On the other hand, it should be noted that the program is more accessible than its semi-supervised or supervised equivalents, as it does not depend on the presence of a physiotherapist during sessions. Therefore, it is more recommended for independent patients and those with a preserved cognitive state preserved. It is also relevant that this study was conducted in a city in Brazil where the phone is a common means of communication in the home, making distance monitoring feasible. However, studies

are needed to assess the long-term cost-effectiveness of such monitoring.

Stack et al.[35] opted for a supervised practice short-duration randomized controlled trial. A trend towards improvement was observed in transfer, mobility and balance, findings not repeated in the control group, which displayed declining results. According to the study,[35] home-based transfer training is important as the home represents a place where patients can implement the strategies learned. On the other hand, some participants reported extreme fatigue after the intervention, suggesting that the type and intensity of the prescribed exercises should be reviewed.

The randomized controlled trials by Ebersbach et al.[28,29] and Frazzitta et al.[38] advocated the beneficial effects of supervised outpatient rehabilitation, in comparison with a home-based control. Ebersbach et al.[28,29] reported a significant improvement in motor performance, mobility and auditory stimulus reaction time in the outpatient group, results that were not observed in the home control group, which displayed relatively stable performance. Frazzitta et al.[38], meanwhile, found an improvement in motor and ADL symptoms among the outpatient group, with a significant deterioration of outcomes and increased medication dosage in the home-based control group. In this study[38] the exercises recommended by the neurologist and how they should be performed were not described. The manner in which the patients were instructed and motivated may have influenced the negative results.

Contradicting previous studies, the randomized controlled trial by Schenkman et al.[36] and the almost-random study by Dereli & Yaliman[40] found that a home program can provide benefits, although to a lesser extent than an outpatient program. Schenkman et al.[36] used an illustrated manual[37] with self-supervised home exercises and a supervised group meeting every month. The positives were a lack of significant decline in motor symptoms and quality of life throughout the study, as well as the continuation of the exercises after the intervention. The study by Dereli & Yaliman[40] held a personalized education session with the patient, delivering a manual of exercises for self-supervised practice, in addition to weekly telephone monitoring. The authors found a significant improvement in quality of life, although to a lesser extent than among the supervised group. The main limitations of this study[40] were its small sample size and almost random structure.

A study by Canning et al.[33] investigated home-based semi-supervised gait training with a treadmill. This method was found to be viable and improvements in six-minute walk time, fatigue and quality of life were observed. However, it should be noted that the participants were in the early stages of PD and that their cognition was intact. Also, because this was a pilot study, further research is necessary to investigate methods of increasing the safety of the training in terms of the intensity and duration of the exercises. Furthermore, the large-scale feasibility of the program may be questionable because of the cost of a treadmill and the need for proper supervision.

Only the study by De Bruin et al.[41] evaluated the feasibility and effectiveness of the integration between motion and music, finding improvement in gait speed, step time, cadence and the severity of motor symptoms. The findings suggest that music can be safely integrated into home exercise for the treatment of motor symptoms in PD sufferers. It is thought that the main difficulty with putting the procedure into practice would be the problem of producing a list of songs on an individual basis with the arrangement adjusted to the cadence in question. Furthermore, further research to assess the effect of home therapy is suggested as the only clinical trial found here had a small sample size.

Finally, a literature review by Santos et al.[18] described the positive effects of using home exercises with a physiotherapist, considering that most sufferers cannot attend specific locations due to mobility problems and the cost of treatment.

The findings of this review highlight the benefits of home kinesiotherapy, such as the potential to stimulate self-care, gain strength and increase range of movement; to reduce the number of complaints and the fear of falling; to improve motor symptoms related to Parkinson's Disease and quality of life. However, the program must be accessible and tailored to the needs of patients, with proper guidance and face-to-face or distance monitoring by a physiotherapist.

Virtual reality rehabilitation

This review includes four studies[27,32,34,42] which dealt with rehabilitation through virtual reality as a strategy for dealing with home-based treatment of PD. Of these, three were originals[32,34,42] carried out in developing countries. It is probable that the cost of this treatment is the main limiting factor for studies in developing countries such as Brazil.

Esculier et al.[34] analyzed the effects of a home-based program that used commercial Nintendo(tm) Wii Fit games and a balance platform, and found a good response in terms of static and dynamic balance, mobility, and functional capacity among PD sufferers. According to the authors,[34] the benefits of using the Wii Fit were related to the visual, auditive and proprioceptive feedback the device offered, and the activation of users' reward circuitry by motivating them to overcome previous scores. The clinical trial achieved an evidence level of B, and the limitations of the study included poor suitability of method, no control group and a small sample. Care should therefore be taken when extrapolating the results of this study to the general population. Furthermore, this program is of limited use in Brazil due to the high cost of the equipment and the balance platform, which is beyond the reach of low-income individuals. In addition, there is a shortage of professionals that use this resource as a home-based

strategy.

A study by Dowling et al.[32] suggested that the home use of games adapted for therapeutic movements and a balance platform is an attractive and viable resource for training gait and balance. Patients reported a greater ease and preference for games featuring sitting and standing, functional diagonal and trunk rotation movements. At times, the instructions were not clear in the trunk rotation game, which affected motor performance. The motivating factors for playing the games were their graphic and audio effects and the support material available. It should be noted that this is a cross-sectional study, and randomized clinical trials are therefore required to evaluate the effects of the proposed intervention.

The study by Espay et al.[42] was the only one that proposed to investigate the effect of rehabilitation with immersive virtual reality on the gait of PD patients, noting benefits in walking speed, stride length and freezing episodes. Despite the benefits achieved, this is not a feasible or accessible resource, especially from a public service perspective. Moreover, the lack of detail regarding the sample and the absence of a control group may be considered methodological biases.

The systematic review by Barry et al.[27] on the effects of virtual reality games on PD found only one study with a home-based approach, that of Esculier et al.,[34] which has already been discussed in this review. According to the authors,[27] in general the main positive point is the provision of visual feedback which encourages motor learning. However, fast-moving and complex commercial games can decrease motivation, adherence and safety. Other complicating factors, due to tremor and dyskinesia, are the use of the hand controls and platform, which may be a risk factor for falls. Suggestions for improving adherence to the program were: games adapted for the clinical stage of PD without negative feedback and with clear instructions and goals, suitable cognitive demand, and an investigation into the use of games that do not require platforms such as Xbox Kinect. Further research into the safe home-based use of these tools are also required.

Finally, this review suggests that virtual reality rehabilitation provides benefits in gait, balance and functional capacity, as well as favorable acceptance and motivational factors. However, the main difficulty of home-based use with PD is the cost and availability of the equipment required for this therapeutic practice.

CONCLUSION

The studies included in this review describe scientific evidence relating to the use of home-based therapeutic exercises as an important physiotherapeutic care strategy for Parkinson's Disease, with kinesiotherapy and rehabilitation with virtual reality of particular significance. The main benefits of therapeutic exercise were: the stimulation of self-care; gains in strength and range of movement; a reduction in the number of complaints and fear of falling; an improvement in motor symptoms related to Parkinson's disease and quality of life. The benefits of rehabilitation with virtual reality were improved gait, functional ability and balance, and positive results were also found in terms of acceptance and motivation. Finally, kinesiotherapy has advantages when compared with rehabilitation with virtual reality, as it is more accessible and less costly.

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