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Effects of Exercise on Parkinson's Symptom Relief

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Abstract

In this review of twenty research articles, the effects of moderate exercise therapy on the symptoms of Parkinson's Disease will be explored. Appropriate literature was located using the research question, "In older adults with a Parkinson's Disease Diagnosis, how does moderate exercise influence the symptoms of this disease?" Twenty peer-reviewed research articles were examined for the impact of different forms of exercise on various symptoms associated with Parkinson's. Nineteen of the articles reviewed provide substantial evidence in support of exercise therapy as a treatment option for people with Parkinson's, and one of the articles found inconclusive evidence neither in support nor against exercise therapy. The purpose of reviewing this research is to explore the options that people with a Parkinson's diagnosis have to achieve the best quality of life while managing the symptoms of their disease.

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Parkinson's Disease is a neurodegenerative disorder that can cause tremors, bradykinesia, limb rigidity, and gait and balance problems. There is no cure for Parkinson's, and even though the disease itself is not fatal, the complications of the disease can be. The complications associated with Parkinson's Disease are rated as the 14th leading cause of death in the United States according to the Center for Disease Control and Prevention. Approximately 60,000 American's are diagnosed with Parkinson's Disease each year, and approximately ten million people live with this disease worldwide. The Parkinson's Foundation Prevalence Project estimates that 1.2 million people in the United States will be living with Parkinson's by the year 2030. As this disease continues to grow among the population it is becoming increasingly important to find ways to alleviate the complications and symptoms of the disease.

It is necessary for research to be conducted to discover best evidence for managing Parkinson's Disease symptoms. It is the responsibility of health care providers to be educated on the best treatment options that are available for their patients. While pharmaceuticals can be helpful in relieving some of the symptoms associated with Parkinson's Disease, it is imperative that other options be explored. The older adult population, which is typically affected by Parkinson's is already at risk for polypharmacy, and it is the responsibility of health care providers to do everything they can to mitigate this risk. Patients with Parkinson's should be provided with individualized care options to help increase their quality of life. The more research is explored, the more care options are discovered, leading to a decreased risk of polypharmacy among people with Parkinson's Disease.

Exercise has been thought of as being a benefit to people with Parkinson's because of the many health benefits that it provides. There are several research studies that test this theory. If

exercise therapy can be clinically proven to provide benefits for Parkinson's, then a new regimen could be implemented in the care administered for these patients.

In this review of literature, the effects of exercise therapy on the symptoms of Parkinson's Disease will be explored. Analyzing studies is an important factor in discovering the benefits or lack of benefits of different therapies on diseases. The purpose of this review is to discover the impact that different types of exercise can have on the various complications that can arise with Parkinson's Disease.

Methods

Study Design

A systematic review of twenty research articles was conducted related to the PICOT question, "In older adults with a Parkinson's Disease diagnosis, how does moderate exercise influence the symptoms of this disease?" Articles were selected from CINAHL and PubMed, and PRISMA guidelines were used to create a flowchart. See Figure 1.

Search Strategy

CINAHL and PubMed databases were searched for articles that pertained to the research question. These sources were searched independently. A limiter was set within these databases to locate peer-reviewed journal articles within the last ten years, and the following MeSH terms were used; "Parkinson's Disease", "exercise or physical activity", and "symptom relief".

Inclusion/Exclusion Criteria

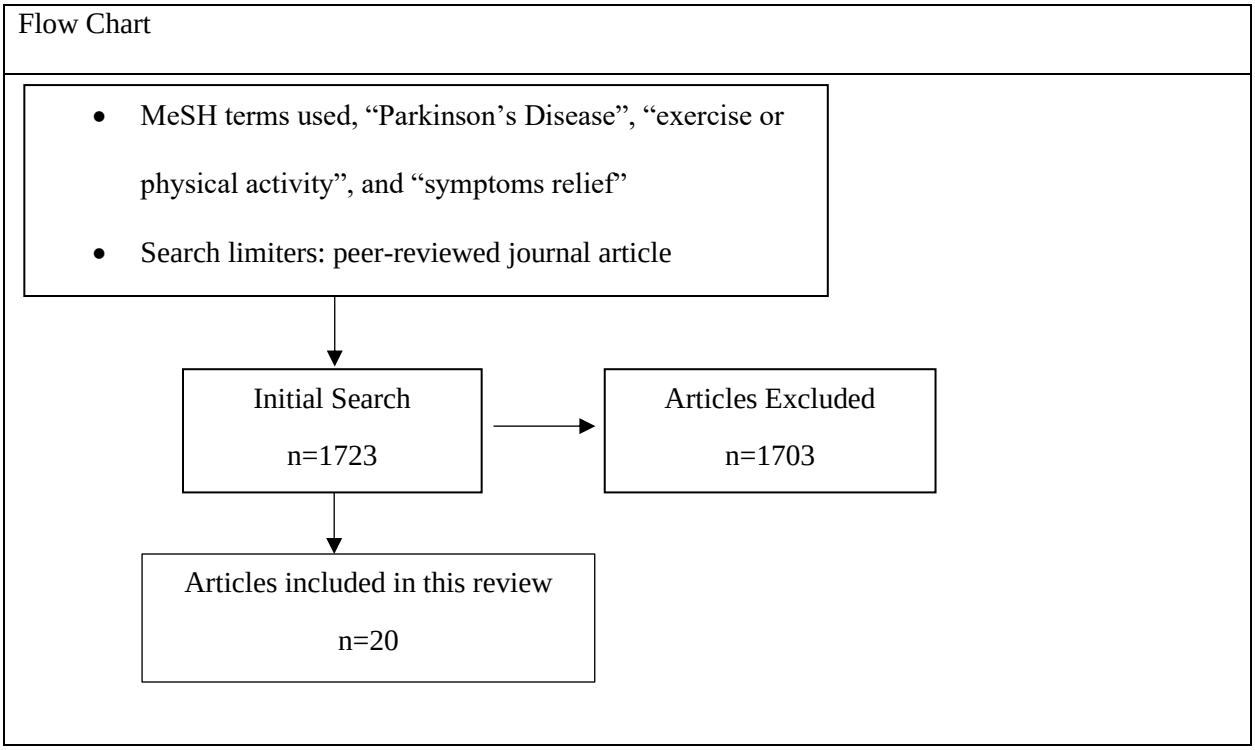
Articles excluded were missing key elements of the PICOT question. Elements of the PICOT question include the study was conducted in older adults with a Parkinson's Disease diagnosis and the study looked at the effects moderate exercise has on the symptoms of

Parkinson's. The twenty articles that are included in this review compared the effects of exercise on different symptoms related to this disease in regard to the research question.

Search Results

The initial search of the databases yielded 198 articles from CINAHL and 1510 from PubMed. After the selection process, twenty articles were chosen to be a part of this review. The process of selection is presented in Figure 1.

Figure 1



Results

Characteristics of Studies

The studies included a combined total of 1,014 participants from the older adult population with a Parkinson's Disease diagnosis. One of the studies is a qualitive study and 19 are randomized clinical trials. One study looked at the effects of exercise on quality of sleep

(Coe, et al. 2018). Three studies looked at the effects that low resistance interval training has on symptoms associated with Parkinson's (Uygur, et al. 2017), one specifically at resistance training effects on depressive symptoms (Lima, et al. 2019), and another at the effects on psychological distress and health related quality of life (Kwok, et al. 2019). Three studies examined the effects of Tai Chi exercise, one on gait initiation and gait performance (Amano, et al. 2013), one on functional balance and motility (Khuzema, et al. 2020), and one on the general motor and non-motor symptoms (Zhu, et al. 2020). One study (Goodwin, et al. 2011) compared the effectiveness of an exercise program with usual care in people with Parkinson's who have a history of falls. Two studies examined the effectiveness of physiotherapy (Frisaldi, et al. 2021), one which specifically looked at the effects on gait speed and range of motion (Medijainen, et al. 2019). Two studies evaluated the effects of aquatic therapy on symptoms of PD (Perez-de la Cruz, 2019; Silva & Israel, 2019). Two studies examined the effects of cycling on mobility and motor function (Ridgel & Ault, 2019; Tollar, et al. 2019). One study compared the effects of multidisciplinary care and multidisciplinary rehabilitation on the symptoms and quality of life of patients with PD (Marumoto, et al. 2019). Two studies examined the effects of video game-based exercise on balance and functional mobility (Santos, et al. 2019; Yuan, et al. 2020). One study evaluated the effectiveness of aerobic exercise done at home on relieving motor symptoms (van Der Kolk, et al. 2019). One study examined the effects of dance movement therapy on balance and cognition in people with Parkinson's Disease (Fisher, et al. 2020). And the last study compared gait and balance before and after a four-week treadmill exercise program (Rigby, et al. 2019). 19 of the studies provide significant evidence towards the benefits that exercise has for Parkinson's Disease, and one of the studies (Amano, et al. 2017) requires further testing. See Table 1.

Summary of Studies

Table 1

Synthesis Table								
Author, Year	Conceptual Framework	Design/ Method	Sample & Setting	Major Variables Studied	Measurement	Data Analysis	Findings	Appraisal: Worth to practice
Amano, et al. 2013	none	Randomized clinical trial	45 participants with Parkinson's Disease	16-week Tai Chi exercise session; the control groups was a non-exercise group	Unified Parkinson's Disease Rating Scale Part III score	Post intervention ratings=before ratings	Tai Chi was ineffective in improving gait initiation, gait performance, and reducing parkinsonian disability	Tai Chi exercise requires further study before being considered a valuable therapeutic intervention
Coe, et al. 2018	none	Randomized clinical trial	Older adult population; people with Parkinson's	Sleep and Fatigue; Sedentary and light activities overnight; physical activity levels	Self-reported measures; Wilcoxon's test; Accelerometers	P-value; over time (0.32 and 0.37-0.38, resp.).	Significant increase in time spent in sedentary and light activities during the overnight period postintervention	Suggests an improvement in sleep patterns for individuals participating in both exercise and handwriting interventions
Fisher, et al. 2020	none	Randomized clinical trial	10 community dwelling adults with mid-severe stage Parkinson's Disease	Evaluate the effects of a 10-week dance movement therapy class on cognition and balance	BESTest measure of balance and SCOPA-Cog measure of cognition	$p = <0.0001$ and $p = 0.0299$	Significant increase in total score on the BESTest measure of balance and in the total score on the SCOPA-Cog measure of cognition	Supports the use of dance movement therapy for people with Parkinson's

Kwok, et al. 2019	Khuzema, et al. 2020	Goodwin, et al. 2011	Frisaldi, et al. 2021
none	none	none	none
Randomized clinical trial	Randomized clinical trial	Randomized clinical trial	Randomized clinical trial
187 adults with a clinical diagnosis of idiopathic Parkinson’ s Disease	27 individuals with idiopathic PD	123 participants with Parkinson’ s and a history of falls	38 individuals with mild PD
Mindfulness yoga was delivered in 90-minute groups and SRTE were delivered in 60-minute groups for 8 weeks	Pre and post intervention evaluation of functional mobility and balance	10-week strength and balance training program; the control group continued with their usual care	New dance-physiotherapy combined intervention, called DArT method
Hospital Anxiety, Depression Scale, and Movement Disorder Society Unified Parkinson's Disease Rating Scale Part III motor score	Berg Balance Test, timed 10-minute walk test, and Timed Up and Go test	Number of falls during the 10-week intervention period and the 10-week follow-up period, Berg balance, Falls Efficacy Scale	Unified Parkinson's Disease Rating Scale Part III score
P = 0.001	Berg balance scale (p=0), timed up and go test (p=0.008), and 10-minute walk test (p=0.001)	incidence rate ratio for falls was 0.68 (95% CI 0.43 to 1.07, p=0.10) during the intervention period and 0.74 (95% CI 0.41 to 1.33, p=0.31)	p = 0.003 and p = 0.038
The yoga group had significantly better improvement in outcomes than the SRTE group	Significant effects on balance and mobility	Statistically significant improvement for the group that participated in the intervention	DArT method was safe and effective in improving motor impairment in mild PD
Mindfulness yoga is beneficial for reduction in anxiety and depressive symptoms as well as improving mobility	Suggests that Tai Chi as well as Yoga are well adhered and are attractive options for a home-based setting	Suggests a decrease in falls for individuals who participate in an exercise program	Supports the use of dance physiotherapy for individuals with mild Parkinson’ s Disease

Perez-de la Cruz, 2019	Medijainen, et al. 2019	Marumoto, et al. 2019	Lima, et al. 2019
none	none	none	none
Randomized clinical trial	Randomized clinical trial	Quasi-randomized clinical trial	Randomized clinical trial
Individuals with Parkinson’ s Disease	24 individuals with idiopathic Parkinson’ s Disease	80 patients with idiopathic Parkinson’ s Disease	33 individuals 60 years or older with PD
The control group received dry land physiotherapy and the experimental group participated in aquatic Ai Chi sessions	8-week physiotherapy program; participants were evaluated twice with 10 weeks between assessments	8-week program of either multidisciplinary rehabilitation or enhanced multidisciplinary care	Control group and resistance training group that participated in a 20-week training program
VAS pain scale, the Geriatric Depression Scale, and the SF-36 quality of life scale	Gait test of Short Physical Performance Battery, freezing of gait questionnaire, and dominant side hip flexion and abduction range of motion	Parkinson's Disease Questionnaire-39 and Unified Parkinson's Disease Rating Scale	Unified Parkinson's Disease Rating Scale
$p < 0.001$	Versatile intervention in groups resulted in increase of GS (ES -0.9), and HFLEX (ES-0.6), FOG was reduced (ES -0.41)	EMC improved quality of life	$P < .05$
Significant differences in pain, depression, and quality of life for the experimental group	Significant improvement for the group that participated in the intervention	Significant improvements in quality of life for individuals in the EMC group	Significant reduction of depressive symptoms, improved quality of life, and improved UPDRS score
Supports the use of Ai Chi aquatic therapy for people with Parkinson’ s	Sufficient to improve GS and range of motion, and reduce FOG	Beneficial to improve motor and nonmotor symptoms associated with Parkinson’ s	Supports the use of resistance training to improve functionality of elderly people with PD

Santos, et al. 2019	Rigby, et al. 2019	Ridgel & Ault, 2019
none	none	none
Randomized clinical trial	Randomized clinical trial	Randomized clinical trial
45 patients with PD	Clinical study of 10 older adults, ages 64-80, with Parkinson's Disease.	16 subjects with mild-moderate idiopathic PD
Compared the effects on balance, gait, functional mobility, and improvement of the quality of life	Evaluate the effectiveness of treadmill exercise on gait, balance, and postural sway	15-day program of high cadence cycling and stretching
Evaluate gait, functional mobility, and balance	Tinetti Performance-Oriented Mobility Assessment, Limits of Stability Test, Purdue Pegboard Test	Movement Disorder Society Unified Parkinson's Disease Rating Scale Part III, Kinesia ONE, and Timed up and Go
Statistically significant improvements in gait, balance, and functional mobility	p = .028	UPDRS scores (P=0.002), hand movement amplitude (P=0.013), rapid alternating hand movement speed (P=0.003), gait (P=0.012), and TUG time (P=0.002).
Significant differences were found in the pre, and post intervention analyzes	Significant increase after the land treadmill exercise intervention versus scores immediately pre-intervention	Significant improvements for all measured symptoms associated with Parkinson’ s
Supports the use of Nintendo Wii exercise gaming along with conventional exercises for rehabilitation	Supports the use of treadmills as an exercise option for people with Parkinson’ s	Supports the practice of high cadence cycling for people with Parkinson’ s

Uygur, et al. 2017	Tollar, et al. 2019	Silva & Israel, 2019
none	none	none
Qualitative evidence	Randomized clinical trial	Randomized clinical trial
14 individuals with Parkinson’ s Disease	74 nondemented Parkinson’ s Disease patients	28 individuals with Parkinson's
twelve 30-min sessions of low-resistance interval training on a stationary recumbent bicycle	Agility exergaming and stationary cycling groups exercised 5×/week for 5 weeks	10-week aquatic exercise program
Unified Parkinson’ s Disease Rating Scale- 10-meter walk, timed up and go, functional reach, 4 square step test, nine hole peg test, simple reaction time	Movement Disorders Society Unified Parkinson's Disease Rating Scale II score, Parkinson's Disease Quastionnaire-39, and Beck Depression Inventory	Timed up and go test, five times sit to stand test, berg balance test, and dynamic gait index
$P < 0.05$	UPDRS-II scores improved, PDQ, 13 and 17%, and BDI -2.5 and -2.1 points,	TUG ($p=0.03$), FTSST ($p=0.001$), BBS ($p=0.002$), and DGI ($p=0.001$)
Scores all exhibited significant improvements	Both interventions resulted in improvements of motor and clinical symptoms in PD patients	Significant improvements for gait, balance, and mobility
Supports the practice of speedwork for people with Parkinson’ s Disease	Supports the use of two highly different exercise programs for people with Parkinson’ s	Suggested dual-task aquatic exercise program was able to improve functional mobility, balance, and gait of individuals with PD

Zhu, et al. 2020	Yuan, et al. 2020	van Der Kolk, et al. 2019
none	none	none
Randomized clinical trial	Randomized clinical trial	Randomized clinical trial
41 patients with Parkinson's Disease	24 Parkinson's patients 65 years or older	130 individuals with PD
12 weeks of intervention in either a Tai chi exercise experimental group or routine exercise control group	Customized interactive video game based (IVGB) training on balance	Aerobic intervention group and control group
Unified Parkinson's Disease Rating Scale part III, Berg Balance Scale, Parkinson's Disease Questionnaire-39, Parkinson's Disease Sleep Scale, and Montreal Cognitive Assessment	Modified fall efficacy scale, Multidirectional reach test, and Berg Balance Scale	Movement Disorders Society Unified Parkinson's Disease Rating Scale Motor score
P=0.029 and P=0.024	6-week IVGB exercise intervention significantly improved functional outcomes	P=0.002
Significant improvements from baseline for both groups in the PDSS and MOCA	Significant improvement in balance, postural stability, and confidence in preventing falls	Significant difference between the post score for the experimental group compared to the control
Supports the use of Tai Chi along with a routine exercise regimen to improve sleep quality and cognitive function	Suggests that interactive video game-based exercise is beneficial for people with Parkinson's	Supports the practice of at home aerobic exercise

Discussion

Nineteen of the studies presented in this review provide an example of how exercise can be beneficial to relieve the symptoms associated with Parkinson's Disease. These studies provide statistically significant data in support of the theory that exercise is an effective therapy option for people with Parkinson's. One study had inconclusive evidence.

The exercise therapy examined in Amano, et al., (2013) did not provide evidence for or against Tai Chi as a valuable therapeutic intervention for people with Parkinson's Disease. The before intervention ratings on the Unified Parkinson's Disease Rating Scale Part III equaled the post intervention ratings indicating no change. Further research is required to determine the effectiveness of Tai Chi on complications that result from Parkinson's.

The nineteen studies that provide support of exercise therapy for people with Parkinson's have devices of measurement that provide analysis of the effects of the therapy on certain symptoms. The Unified Parkinson's Disease Rating Scale, UPDRS, is just one of the many objective measurements used by these researchers to determine outcomes in these studies (Amano, et al. 2013; Lima, et al. 2019; Frisaldi, et al. 2021; Marumoto, et al. 2019; Uygur, et al. 2017; Zhu, et al. 2020). There are four parts of the UPDRS: part I about mentation, behavior, and mood, part II about activities of daily living, part III about motor examination, and part IV about complications of therapy. Parts I-III are rated on a scale from 0-4 and higher ratings indicate increased severity. Part IV uses yes and no answers. The complications associated with Parkinson's Disease that the studies worked with were nonmotor symptoms, such as fatigue and sleep, motor function, and falls. The use of moderate exercise and strength and balance training decreased a person's risk of falls, enhanced their motor function, and improved quality of sleep in the individuals who participated in these projects.

There were six studies that looked specifically at how nonmotor symptoms associated with Parkinson's Disease were affected by exercise and balance training (Coe, et al. 2018; Zhu, et al. 2020; lima, et al. 2019; Kwok, et al. 2019; Perez-de la Cruz, et al. 2019; Marumoto, et al. 2019). The results from these studies give insight and support for the use of this type of therapy being normalized as a treatment option for people diagnosed with Parkinson's. The six studies

discuss the benefits of various exercise therapies on nonmotor symptoms such as quality of sleep, quality of life, depression, anxiety, pain, and psychological distress. Participants in these studies had scores that improved post intervention on the Geriatric Depression Scale, UPDRS, Hospital Anxiety and Depression Scale, Parkinson's Disease Sleep Scale, Montreal Cognitive Assessment, and the Parkinson's Disease Questionnaire.

Falls, problems with gait, decreased range of motion, and balance and stability problems are typically identified as a significant issue for people with Parkinson's Disease. Falls are a major cause of hospitalizations among the older adult population, especially those with a Parkinson's Disease diagnosis. According to Paul, et al., (2017) people with Parkinson's Disease face a higher rate of hospital admissions due to falls and have a longer median stay than those without Parkinson's. Studies examining the effects of exercise on motor function problems express full support of exercise therapy as a treatment option for people with Parkinson's. The studies proved to be beneficial in reducing risk of falls and improving gait, balance, and mobility (Goodwin, et al. 2011; Medijainen, et al. 2019; Silva & Israel, 2019; Yuan, et al. 2020; Tollar, et al. 2019; Santos, et al. 2019; Rigby, et al. 2019; Khuzema, et al. 2020). Participants in these eight studies had improved scores on the UPDRS, Timed Up and Go, Simple Reaction Test, Four Square Step Test, Berg Balance Test, Falls Efficacy Scale, and the Freezing of Gait Questionnaire. If exercise therapy can improve motor function and decrease the risk of falls for people with a Parkinson's Disease diagnosis, then implementing this therapy in a treatment regimen could reduce the incidence of hospitalizations among this population.

There were limitations in a few of the studies. There were limitations in the actual timings of sleep or sleep patterns in Coe, et al., (2018). A few of the studies only examined the effects of exercise therapy in the moderately ill, therefore their findings cannot be generalized for

all patients in different stages of severity of Parkinson's Disease (Marumoto, et al. 2019; Rigby, et al. 2019, Uygur, et al. 2017; Yuan, et al. 2020). Authors suggest that a long-term follow-up and larger sample size would be beneficial in determining the outcomes of interventions in the future (Goodwin, et al. 2019; Khuzema, et al. 2020; Medijainen, et al. 2019; Perez-de la Cruz, 2019; Ridgel, et al. 2019; Yuan, et al. 2020).

Having evidence of support for clinically significant therapies offers the opportunity for improvement of care for patients that are diagnosed with Parkinson's Disease. Instead of relying on pharmaceuticals doctors and nurses can explore therapies that will be beneficial and improve the quality of life of their patients with Parkinson's. The results of these studies provide insight into the future interventions that could be applied as treatment options for those that face a Parkinson's Disease diagnosis. Exploring research on this topic is important in order to find evidence of effective therapies that could allow patients to receive the best possible care.

Conclusion

Exercise therapy is beneficial in relieving the motor and nonmotor symptoms associated with Parkinson's Disease. There are several different exercise therapies that individuals with a Parkinson's Disease diagnosis can utilize to improve things like gait, balance, sleep, and overall quality of life. This literature review offers examples of the types of exercise therapy that have shown significant benefits to those with Parkinson's and highlights the importance of this research on the healthcare profession. With knowledge about exercise therapy healthcare professionals can enhance the quality of life in their patients.

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