

Analysis of physical therapy in elderly patients with Parkinson's disease

Analiza postępowania fizykalnego w chorobie Parkinsona u osób w wieku podeszłym

Włodzisław Kuliński^{1,2}, Paulina Stachurek¹

¹ Division of Physical Medicine, Jan Kochanowski University, Kielce

² Department of Rehabilitation, Military Medical Institute, Warsaw

Abstract

Introduction. Parkinson's disease is considered to be one of the most severe neurodegenerative disorders. It is caused by the progressive loss of dopaminergic neurons in the substantia nigra and striatal dopamine deficiency. The disease leads to progressive gradual limitation of the motor, cognitive, and physical function of the patient. **Aim.** To determine the effect of physiotherapy on the objective and subjective assessment of the condition of patients with Parkinson's disease undergoing rehabilitation. **Material and methods.** The study group consisted of 42 patients aged 59-75 years with Parkinson's disease, staying at a care and treatment facility. The study was conducted using a diagnostic survey questionnaire and evaluated patient functioning and the severity of depression before and after rehabilitation. The assessment was conducted with the international Barthel index and the Geriatric Depression Scale (GDS). **Results.** The analysis conducted shows that rehabilitation has a positive impact on the level of depression in the patients and on their functioning. Duration and stage of the disease and the age of the patients all influence their functioning. The research also shows that the therapeutic effect of physical therapy and rehabilitation does not depend on the patient's gender, place of residence, level of education, marital status, and length of stay at the care and treatment facility. **Conclusions.** 1. Parkinson's disease is a very difficult therapeutic problem. 2. Rehabilitation has a positive impact on the level of depression in the patients and on their functioning. 3. Duration and stage of the disease and the age of the patients all influence their functioning. 4. The therapeutic effect of physical therapy and rehabilitation does not depend on the patient's gender, place of residence, level of education, marital status, and length of stay at the care and treatment facility. (Gerontol Pol 2017; 25; 88-94)

Key words: Parkinson's disease, physiotherapy

Streszczenie

Wstęp. Choroba Parkinsona uznawana jest za jedno z najcięższych schorzeń neurozwyrodnieniowych, spowodowane postępującym zanikiem neuronów dopaminergicznych w istocie czarnej oraz niedoborem dopaminy w prążkowie. Choroba prowadzi do stopniowo postępującego ograniczenia w zakresie czynności ruchowych, poznawczych, a także funkcjonalnych pacjenta. **Cel.** Określenie wpływu fizjoterapii na stan podmiotowy i przedmiotowy pacjentów z chorobą Parkinsona poddanych programowi rehabilitacji. **Materiał i metody.** Badanie przeprowadzono w grupie 42 pacjentów, w wieku od 59 do 75 lat z chorobą Parkinsona przebywających w Zakładzie Opiekuńczo-Lecznym. Badania przeprowadzono metodą sondażu diagnostycznego. Oceniono funkcjonowanie pacjentów oraz stopień depresji przed i po rehabilitacji. Do oceny zastosowano międzynarodową skalę Barthel oraz użyto Geriatrycznej Skali Oceny Depresji (GSD). **Wyniki.** Z przeprowadzonej analizy, wynika, że rehabilitacja ma korzystny wpływ na poziom depresji pacjentów oraz na ich funkcjonowanie. Czas trwania oraz stadium choroby, a także wiek, w jakim znajdują się pacjenci, mają wpływ na stopień ich funkcjonowania. Z badań wynika również, iż efekt terapeutyczny postępowania fizykalno-usprawniającego nie jest zależny od płci pacjenta, miejsca zamieszkania, stopnia wykształcenia, stanu cywilnego oraz czasu pobytu pacjentów w Zakładzie Opiekuńczo Lecznym. **Wnioski.** 1. Choroba Parkinsona jest bardzo trudnym problemem leczniczym. 2. Rehabilitacja ma korzystny wpływ na poziom depresji chorych oraz na ich funkcjonowanie. 3. Czas trwania choroby oraz stadium choroby, a także wiek, w jakim znajdują się pacjenci, mają wpływ na stopień ich funkcjonowania. 4. Efekt terapeutyczny postępowania fizykalno-usprawniającego nie jest zależny od płci pacjenta, miejsca zamieszkania, stopnia wykształcenia, stanu cywilnego oraz czasu pobytu pacjentów w Zakładzie Opiekuńczo Lecznym. (Gerontol Pol 2017; 25; 88-94)

Słowa kluczowe: choroba Parkinsona, fizjoterapia

Introduction

Parkinson's disease is one of the most common degenerative disorders of the central nervous system. According to the data of the World Health Organisation (WHO), there are approximately 5 million patients with Parkinson's disease in the world, including approx. 1.2 million in Europe and approx. 70,000 in Poland. The mean age of the patients at onset is 59 years. The disorder is characterised by slow movements, muscle stiffness and resting tremors. Its aetiology consists in extrapyramidal motor system insufficiency [1-5]. Clinical symptoms occur once approximately 50% of the substantia nigra cells have been damaged and the release of dopamine has decreased. One hypothesis assumes that Parkinson's disease may be caused by premature aging of the human body. In patients approaching 60 years of age, which is when symptoms of the disease usually appear, striatal dopamine decreases by 40-50%. Symptoms of the disorder first occur when the level of dopamine has decreased and is approximately 20% of the normal value. Consequently, specialists began to wonder whether changes in the substantia nigra may result from premature aging. Another hypothesis assumes that Parkinson's disease may result from accumulation of pathological proteins in certain structures of the central nervous system. There is also a theory that Parkinson's disease involves neuron damage and death caused by impairment of the ubiquitin-proteasome system. Another hypothesis is associated with genetic disorders suggesting a role of oxidative stress in nerve cell damage [3-5].

Clinical presentation

This disorder may be idiopathic or develop in the form of so-called parkinsonian syndrome, also referred to as secondary parkinsonism. The most typical main symptoms are: resting tremor, slow movements, muscle tremor, muscle stiffness, and impaired postural stability. Tremor is found in 70% of the patients. Stiffness hinders limb and trunk movements [3-5].

Abnormal muscle tone persisting for prolonged periods of time may result in pain and spasms. It may also cause inclination of the body and increase the severity of degenerative changes of the spine. The lack of postural stability leads to loss of balance and causes falls. The patients' posture becomes stiff and immobile; both automatic (reactive) movements and voluntary movements become gradually impaired (hypokinesia). Disturbed postural stability is often accompanied by gait disturbances and cognitive and mental disorders. Patients may experience changes concerning emotional, motivational and

social areas. Studies show that 40-60% of patients with Parkinson's disease have depression and often suffer from anxiety disorders and lowered mood [3-5].

Progression of Parkinson's disease is usually assessed with the use of a 5-point scale introduced by American neurologists Hoehn and Yahr [5].

An important part of the treatment consists in physical therapy and rehabilitation [6-15]. They are aimed at influencing motor function and physical capacity, preventing immobilisation and maintaining a normal body posture. Rehabilitation should contribute to an improvement in the general condition of the patient, thus allowing for self-care (without the need for assistance) and active participation in everyday, family, professional and social life. The rehabilitation is based on kinesiotherapy. Patients with Parkinson's disease are recommended to perform the following exercise: breathing, gait, strengthening, balance, postural, and coordination exercises, relaxing stretching exercises, facial muscle exercises, water exercises, music therapy, dance and physical games and activities [10,16-20]. The following physical therapy procedures are used: classic massage, whirlpool massage, underwater massage, brine baths, electrical stimulation with low frequency currents (Hufschmidt's method), magnetic field therapy, and whole-body cryotherapy [6,7].

Aim

The aim of this study was to evaluate the influence of physical therapy on the objective and subjective assessment of the condition of patients with Parkinson's disease undergoing rehabilitation.

Material and methods

In order to tackle the main research problem, consisting in the assessment of the effects of physical therapy on functioning of patients with Parkinson's disease undergoing rehabilitation at a care and treatment facility (ZOL), the following detailed questions were posed:

1. What is the influence of rehabilitation conducted at a care and treatment facility on the level of depression and functioning of patients with Parkinson's disease?
2. What correlations exist between selected demographic and medical factors and the functional status of patients with Parkinson's disease?

The study was conducted in a group of 42 patients with Parkinson's disease who were residents of the Świętokrzyskie voivodeship staying at the care and treat-

ment facility in Pińczów. The patients consented to participate in the study.

A rehabilitation programme conducted in the patients at the care and treatment facility takes place every day and consists in the following: gait exercises, exercises with respect to changing the position of the body, fine motor training, facial expression exercises, motor exercises to reduce stiffness, balance and motor coordination exercises, group general fitness exercises, physical therapy, and massage.

The patients' functioning was evaluated with the international Barthel index, which is commonly used to assess fitness. The Barthel index encompasses 10 activities of daily living such as eating meals, walking, getting dressed and undressed, personal hygiene, using the toilet or bowel and bladder control. The highest Barthel index score is 100. Patients who score 0-20 points are completely dependent on others, those with scores ranging from 20 to 80 points require some degree of assistance, and those with scores of 80-100 points may function independently with little help from another person.

Severity of depression was assessed with a 15-point version of the Geriatric Depression Scale (GDS). According to the standard GDS, scores of 0-5 points mean no depression, 6-10 points reflect moderate depression, and a result between 11 and 15 points indicates severe depression.

Both tests were conducted twice 5 months apart.

Statistical analysis

The Barthel index and GDS results are presented in the form of the following distribution parameters: mean – arithmetic mean, SD – standard deviation, min – minimum value, Me – median (“middle value”), max – maximum value.

The functional status of the patients according to the Barthel index was compared on two occasions with Student's t-test for dependent tests. A chi-square test for independence was used to compare the results of functional status assessment from two subsequent tests.

The results were analysed with respect to the influence of selected factors and on the functional status of the patients with Parkinson's disease.

Student's t-test for independent tests was used to compare the functional status depending on the presence of choreiform dyskinesia. Moreover, Pearson's linear correlation was analysed by studying the relationship between quantitatively described factors (e.g. age, disease duration and stage, length of stay at the care and

treatment facility) and the functional status measured with the Barthel index.

The results were deemed statistically significant at a significance level of less than or equal to 0.05 ($p \leq 0.05$). The lack of statistical significance was marked with the abbreviation NS (non-significant).

The statistical calculations were performed with the Statistica 10 software.

Results

Of the 42 patients with Parkinson's disease studied, 19 subjects (45.24%) were female and 23 (54.76%) were male. The patients' age ranged from 59 to 75 years. The largest age group (35.71%) consisted of those aged 71-75 years, and the second largest group (23.81%) was that of patients between the age of 66 and 70 years. All patients were staying at a care and treatment facility.

23 patients (54.76%) had choreiform dyskinesia and 19 (45.24) did not.

Parkinson's disease duration in the study group ranged from 5 to 20 years, with a mean duration of 11.2 years. The majority of the patients (52.38%) had suffered from the disease for 5-10 years.

Figure 1 shows stages of the disease according to the Hoehn and Yahr scale. Most subjects (61.9%) had moderately advanced stage 3 disease with balance disturbances and impaired postural reflexes.

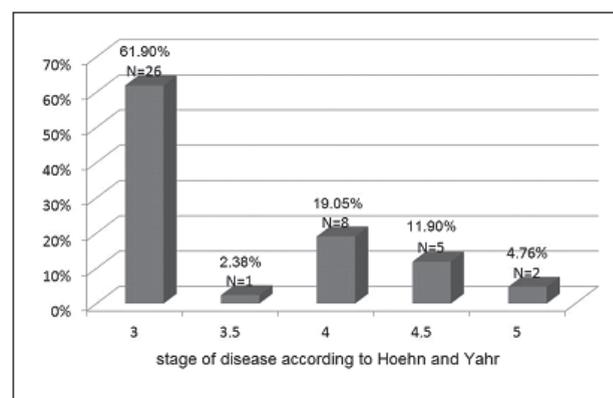


Figure 1. Stage of the disease according to HOEHN and YAHR

All the study patients had been staying at the care and treatment facility for 1 to 5 years (3.4 years on average).

The patients had the following concomitant diseases: atherosclerosis (37 patients, 88%), ischaemic heart disease (13 patients, 30.9%), hypertension (12 patients, 28.5%), diabetes (8 patients, 19%), obesity (8 patients, 19%), arthrosis (7 patient, 16.6%), a history of myocardial infarction (6 patients, 14.2%), a history of stroke (1 patient, 2.38%).

Table I presents GDS scores obtained in the study group of patients with Parkinson's disease.

The mean GDS score was 10 points in Test I and 10.7 points in Test II. The mean difference between the tests was 0.7 points and was statistically significant at $p < 0.001$. The number of patients with symptoms of depression was 27 (64.3%) in Test I and 17 (40.5%) in Test II; the number of patients with depression in Test II was statistically significantly lower ($p = 0.049$).

Table I. GDS scores in two subsequent tests

Test	GDS score (points)					Significance
	Mean	SD	Me	min	max	
I	10.0	2.2	10.0	5	15	$p < 0.001$
II	10.7	2.1	11.0	6	15	

The mean Barthel index score was 54 points in Test I and 52 points in Test II, which means the functional status of the patients with Parkinson's disease was moderately severe.

Table II. Mean Barthel index scores in subsequent tests

Test	Barthel index (scores converted into %)					Significance
	Mean	SD	Me	min	max	
I	54.0	17.1	57.5	20	80	NS
II	52.0	17.5	55.0	20	80	

In Test II, the disease was stable in 54.76% of the study patients, improved in 35.71%, and slightly worsened in 9.52%.

There was a statistically significant inversely proportional correlation between the functional status of the patients with Parkinson's disease and the duration of the disease ($r = -0.512$; $p = 0.001$) as well as the stage of the disease ($r = -0.8411$; $p < 0.001$). There was no correlation between the patients' functional status, age, and the length of stay at the care and treatment facility (Table III).

Table III. Correlation between patient functional status and selected factors

Pearson's linear correlation r		
	Barthel index (converted scores)	
age	$r = -0.2752$	NS
disease duration	$r = -0.512$	$p = 0.001$
stage of disease according to Hoehn and Yahr	$r = -0.8411$	$p < 0.001$
length of stay at care and treatment facility	$r = -0.2381$	NS

The longer the duration of the disease, the lower the Barthel index score, which translates to a worse functional status (Fig. 2).

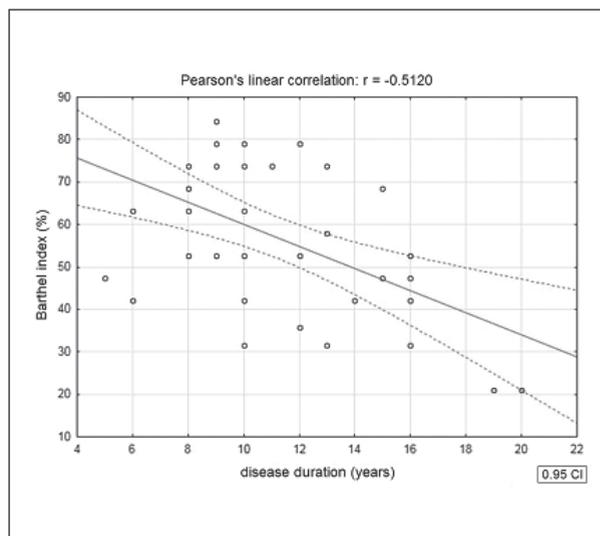


Figure 2. Correlation between functional status measured by converted Barthel index scores and disease duration

The more advanced the stage of the disease, the lower the Barthel index score, which means the patients have a worse functional status (Fig. 3).

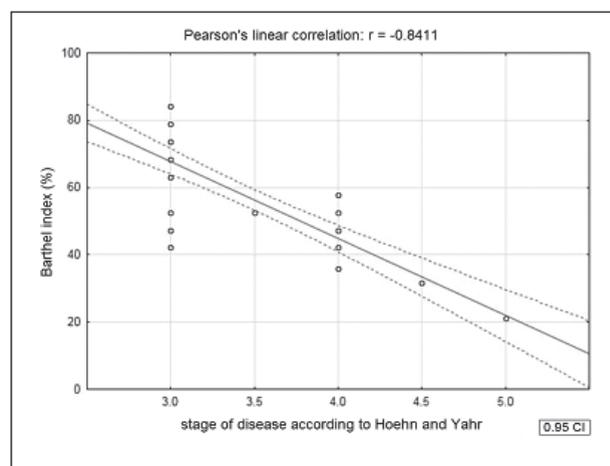


Figure 3. Correlation between functional status measured by converted Barthel index scores and stage of the disease according to Hoehn and Yahr

Choreiform dyskinesia causes a statistically significant ($p = 0.004$) decrease in the functional status as measured according to the Barthel index (Fig. 4).

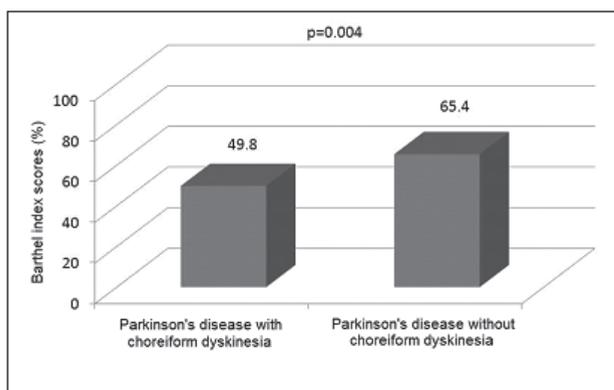


Figure 4. Functional status in converted Barthel index scores and the presence of choreiform dyskinesia

Discussion

Parkinson's disease is a slowly progressive, degenerative, untreatable disease of the central nervous system. Its clinical manifestations include slow movements, muscle stiffness and resting tremors. It is caused by extrapyramidal motor system insufficiency [3-5].

The process of rehabilitation plays an important role in the treatment of patients with Parkinson's disease and produces measurable benefits, as confirmed by this study and numerous literature reports [12-15].

Regular physical activity is important and should be present in everyday life of patients with Parkinson's disease as it helps prevent cardiovascular disease, diabetes and obesity [16-18].

A study by Rudzińska M. showed that rehabilitation has an established practical role in the treatment process and regular and appropriately selected physical exercise may positively influence the patients' general health status both in early and advanced stages of the disease.

This study in patients with Parkinson's disease, conducted with the use of the Geriatric Depression Scale (GDS), showed an improved health status in subjects with depression. Test I, performed before rehabilitation, indicated depression in 64.3% of the patients. The result significantly improved in Test II, which took place 5 months later and showed depression in 40.5% of the patients. The analysis conducted as part of the study indicates that rehabilitation had a positive influence on the level of depression in the patients and improved their functional status.

The literature shows that kinesiotherapy visibly improves physical fitness of the patients, helping them with everyday functioning and significantly contributing to an improvement in the quality of their lives [2,4].

According to Struensee M. et al., pharmacological treatment is more effective when combined with physical exercise than on its own.

Kozak-Putowska D. et al. [11] studied the efficacy of a therapeutic programme that included kinesiotherapeutic exercise, analysing improvements in general physical fitness and performance of the activities of daily living in patients with Parkinson's disease. The results of their study suggest that a considerable improvement was achieved in the overall motor performance, resulting from the treatment's effects on main symptoms of the disease.

This study used the Barthel index to assess the functional status of patients with Parkinson's disease with respect to the activities of daily living, such as eating meals, walking, getting dressed and undressed, personal hygiene, using the toilet or bowel and bladder control, and showed improvements in 35.71% of the patients, while no pronounced deterioration was found in the other subjects, which indicates a positive influence of the rehabilitation process.

According to the literature, patients who actively participate in rehabilitation enjoy a normal and better functional status for a longer time.

According to Pasek J. et al., rehabilitation introduced at an early stage of the disease helps delay disease progression and debility.

The study described in this paper showed a correlation between disease duration, stage of the disease, and the patients' age. These factors influence the functional status of the patients.

Kinesiotherapy is very important in the process of rehabilitation of patients with Parkinson's disease. It prevents permanent disability and allows for maintaining independence and good physical fitness for as long as possible [15-18].

The results presented in this paper confirm that kinesiotherapy improves the health status of patients with Parkinson's disease. It can be concluded that the use of physical therapy and rehabilitation (consisting of general fitness exercises) results in an improvement in the overall functional status of the patients. Rehabilitation contributed to a decrease in the severity of some symptoms and helped prevent significant progression of the disease despite the patients' old age and the fact that they had advanced disease.

The type of exercise and appropriate physical activity are selected based on assessments of the patients' functional status, particularly the stage of Parkinson's disease. Kinesiotherapy contributes to a reduction in symptoms of the disease, helps the patients maintain a level of activity that allows them to perform everyday tasks, and makes it easier to adjust to progressive disability in advanced stages of the disease. Rehabilitation should be introduced as early as at diagnosis and continue for

the rest of the patient's life. Nowadays, more and more methods of rehabilitation are available for patients with Parkinson's disease. Each method is aimed at improving physical fitness and the overall health status of the patients, which significantly increases their quality of life [12]. The efficacy of rehabilitation depends on systematic exercise and on the patients working closely with the physiotherapist and continuing the exercise programme every day.

Conclusions

1. Parkinson's disease is a very difficult clinical and social problem.
2. Physical therapy has a positive impact on the level of depression in the patients and on their functioning.
3. Duration and stage of the disease and the age of the patients all influence their functioning.
4. The therapeutic effect of physical therapy and rehabilitation does not depend on the patient's gender, place of residence, level of education, marital status, and length of stay at a care and treatment facility.

Conflict of interest

None

References

1. Pal R, Tiwani PC, Nath R, Pant KK. Role of neuroinflammation and latent transcription factors in pathogenesis of Parkinson's disease. *Neurol Res.* 2016;38(12):1111-22.
2. Davis AA, Racette B. Parkinson disease and cognitive impairment: Five new things. *Neurol Clin Pract.* 2016;10(6/5):452-8.
3. Dietrichs E, Odin P. Algorithms for the treatment of motor problems in Parkinson's disease. *Acta Neurol Scand.* 2017;10:1111-73.
4. Wei W, Chen HY, Fan W, et al. Chinese medicine for idiopathic Parkinson's disease: *Chin J Integr Med.* 2017;23(1):55-611.
5. Kuliński W, Pakszys W, Obrzydowska A, Koczorowski R. Monitorowane klinimetrycznie postępowanie fizykalne w leczeniu choroby Parkinsona. *Aktual Neurol.* 2003;3(1):73.
6. Kuliński W. Fizykoterapia. W: *Rehabilitacja Medyczna*, T1. Wrocław: Wydawnictwo Medyczne Urban & Partner; 2003. s. 321-372.
7. Kuliński W. Balneoterapia. W: *Rehabilitacja Medyczna*. T 1. Wrocław: Wydawnictwo Medyczne Urban & Partner 2003. s. 469-493.
8. van der Kolk NM, King LA. Effects of exercise on mobility in people with Parkinson's disease. *Mov Disord.* 2013;28(11):1587-96.
9. Wójcik S, Sienkiewicz-Wilowska J. Wizerunek starości w oczach osób chorych na chorobę Parkinsona a zapotrzebowanie na wsparcie. The image of elderly age among people suffering from Parkinson's disease and demand from support. *Now Lek.* 2013;82(1):31-8.
10. Sharp K, Hewitt J. Dance as an intervention for people with Parkinson's disease: a systematic review and meta-analysis. *Neurosci Biobehav Rev.* 2014;11(47):445-56.
11. Kozak-Putowska D, Hłzeczka J, Piskorz J, et al. Kinezyterapia w chorobie Parkinsona. *Med Og Nauki Zdrow.* 2015;21(1):19-23.
12. Adamson BC, Ensari I, Motl RV. Effect of exercise on depressive symptoms in adults with neurologic disorders; a systematic review and meta-analysis. *Arch Phys Med Rehabil.* 2015;96(7):1329-38.
13. Alves Da Rocha P, McClelland J, Morris ME. Complementary physical therapies for movement disorders in Parkinson's disease: a systematic review. *Eur J Phys Rehabil Med.* 2015;51(6):693-704.
14. Abbruzzese G, Marchese R, Avanzino L, et al. Rehabilitation for Parkinson's disease: Current outlook and future challenges. *Parkinsonism Relat Disord.* 2016;22 Suppl 1:60-4.
15. Ekker MS, Janssen S, Nonnekes J, et al. Neurorehabilitation for Parkinson's disease: Future perspectives for behavioural adaptation. *Parkinsonism Relat Disord.* 2016;22 Suppl 1:73-7.

16. Moller JC, Meniq A, Oechsner M. Neurorehabilitation in Parkinson's disease. Praxis (Bern 1994). 2016;105(7):377-82.
17. Lauze M, Daneault JF, Duval C. The effects of physical activity in Parkinson's disease: a review. J Parkinsons Dis. 2016;6(4):685-698.
18. Radder DL, Sturkenboom IH, van Nimwegen M, et al. Physical therapy and occupational therapy in Parkinson's disease. Int J Neurosci. 2017;4:1-14.
19. Rafferty MR, Prodoehl J, Robichaud JA et al. Effects of 2 years of exercise on gait impairment in people with Parkinson disease: The PRET-PD Randomized Trial. J Neurol Phys Ther. 2017;41(1):21-30.
20. Khalil H, Busse M, Quinn M, et al. A pilot study of a minimally supervised home exercise and walking program for people with Parkinson's disease in Jordan. Neurodegener Dis Manag. 2017;7(1):73-84.