Baltic Journal of Health and Physical Activity 2018; 10(1): 38-45
Journal of Gdansk University of Physical Education and Sport
e-ISSN 2080-9999

ORIGINAL

doi: 10.29359/BJHPA.10.1.04

The influence of dance on selected risk factors of falls in Parkinson's disease patients – A pilot study

Authors' Contribution:
A Study Design
B Data Collection
C Statistical Analysis
D Data Interpretation
E Manuscript Preparation
F Literature Search
G Funds Collection

Bogna Listewnik[1] **ABDEFG**, **Zbigniew Marcin Ossowski**[2] **ACDEFG**

[1] Master's Studies, Faculty of Public Health, Medical Univeristy of Gdansk, Poland
[2] Faculty of Tourism and Recreation,
Gdansk University of Physical Education and Sport in Gdansk, Poland

abstract

Background: Parkinson's disease (PD) patients may develop several motion control disorders leading to deterioration in body balance and general mobility, which in turn increases the risk of falls. The aim of this study was to examine the influence of therapeutic dancing classes on functional mobility, gait, body balance and endurance in Parkinson's disease patients.

Material/Methods: The study was conducted on a group of 10 participants (aged 69.9 ±6.47) suffering from PD. Testing was applied twice: at the beginning of the study and after 12 weeks of dance-based intervention training. Tests used for the purpose of the study included: Tinetti Performance Oriented Mobility Assessment (parts 1 and 2), timed up-and-go test and 6 min walk test.

Results: The study results indicate that therapeutic dancing classes significantly increased body balance (p = 0.002), gait (p = 0.047), functional mobility (p = 0.005) and endurance (p = 0.002) in PD patients.

Conclusions: The acquired results can be instrumental in devising future therapeutic programs aiming at prevention of falls in PD sufferers.

Key words: Parkinson's disease, tango, body balance, functional mobility, endurance.

article details

Article statistics: **Word count:** 2,270; **Tables:** 2; **Figures:** 2; **References:** 38
Received: November 2016; **Accepted:** December 2017; **Published:** March 2018
Full-text PDF: http://www.balticsportscience.com

Indexation: Celdes, Clarivate Analytics Emerging Sources Citation Index (ESCI), CNKI Scholar (China National Knowledge Infrastructure), CNPIEC, De Gruyter - IBR (International Bibliography of Reviews of Scholarly Literature in the Humanities and Social Sciences), De Gruyter - IBZ (International Bibliography of Periodical Literature in the Humanities and Social Sciences), DOAJ, EBSCO - Central & Eastern European Academic Source, EBSCO - SPORTDiscus, EBSCO Discovery Service, Google Scholar, Index Copernicus, J-Gate, Naviga (Softweco, Primo Central (ExLibris), ProQuest - Family Health, ProQuest - Health & Medical Complete, ProQuest - Illustrata: Health Sciences, ProQuest - Nursing & Allied Health Source, Summon (Serials Solutions/ProQuest, TDOne (TDNet), Ulrich's Periodicals Directory/ulrichsweb, WorldCat (OCLC)

Funding: This research has been financially supported by Foundation for the Development of the Education Sysyem, grant no. PL-12-358-2013-R2.

Conflict of interests: Authors have declared that no competing interest exists.

Corresponding author: Zbigniew Ossowski Ph.D., Gdańsk University of Physical Education and Sport, ul. Górskiego 1, 80-336 Gdańsk, Poland; e-mail: zbigniew.ossowski@awf.gda.pl.

INTRODUCTION

Idiopathic Parkinson's disease (PD) is a degenerative neurological disorder which causes limited mobility and falls [1]. The risk factor of falls in PD patients increases tenfold in comparison with elderly people [2] and in a group of those who did fall, 10.4% also suffered a hip fracture [3]. Hip fracture in elderly people should not be considered as a routine orthopaedic problem but as a challenge involving other branches of medicine including physical culture. It has been documented that physical activity is effective in preventing risk factors for falls of older people [4, 5, 6, 7]. This is important because the treatment of hip fractures requires long hospitalisation, physiotherapy, psychological and social care, and also – in many cases – institutionalisation, which leads to sizeable incremental costs. A broken hip also highly increases a risk of death: tenfold within first weeks after the injury and twofold within the first year [8]. If hip fracture happens to a Parkinson's disease patient, the above risk of death factor will be twice as high [9]. In a study by Eventov et al. [10], among Parkinson's disease patients who had suffered a femur fracture, 31% died within a year of the injury. If such patients are able to survive, prolonged immobilization during the recovery period causes further deterioration of their joints mobility, increasing inability to cope with everyday chores and triggering decrease in their cognitive skills [11].

Various studies indicate that handicapped gait and impaired body balance of PD patients constitute the main risk factors of falls, which, in turn, are often the cause of general disability [12, 13]. It seems clear, therefore, that improvement in speed and the quality of gait should be included among therapeutic intervention priorities.

Basic means of rehabilitation for Parkinson's disease patients are kinesiotherapy and practice of everyday chores. But research studies indicate numerous other beneficial therapeutic activities, such as: occupational therapy, speech therapy, hydrotherapy, heat therapy, relaxation training, dance therapy, music therapy, art therapy, walking, hiking, physical recreation in form of games, psychotherapy and Tai Chi [14].

There is a growing body of research indicating that dance is a beneficial activity conducive to social integration and that it may be an effective and pleasant form of physical activity for certain PD patients [15, 16, 17]. Initial study results strongly suggest that dance could be even more effective in improving patients' general mobility and body balance than other forms of exercises [18], including standard physiotherapy aimed specifically at improving patients' mobility [19]. Moreover, dancing benefits patients' wellbeing and facilitates their social integration [20]. Research also shows that among many various dance forms, tango seems to be the most effective as a motion rehabilitation exercise [21] and it is safe for PD patients ranging from mild to relatively severe stages of the disease [22]. Dancing tango can be also helpful in improving walking speed and pace length, as well as steady body turns, because the dance requires intense control of body motion, its speed and range. Moreover, dancing is also beneficial for general quality of life in PD patients [23, 24]. Tango steps can be especially effective for practicing walking backwards, which is an essential skill in prevention of falling backwards [25].

While the study concerning possible effects of dance on Parkinson's disease sufferers is quite rich, relatively few of these studies analyse relationship between dance activities and risk factors of falls in PD patients. Therefore, the main goal of the present study was to evaluate the influence of therapeutic dancing classes on gait, functional mobility, body balance and endurance of PD patients.

MATERIAL AND METHODS

PARTICIPANTS

Recruitment of participants was conducted via press and radio announcements, as well as informative posters put up in places such as: Association of Parkinson's disease patients and their families in Gdynia, Clinic of Extrapyramidal Disorders in Św. Wojciech (St. Adalbert) specialist hospital in Gdańsk and in Research Hospital of Medical University of Gdańsk. The group that was eventually established consisted of twenty Parkinson's disease patients who met all the recruitment criteria. Requirements for participants in the study were as follows: confirmed diagnosis of idiopathic Parkinson's disease (in an early or moderate stage), an ability to climb two flights of stairs, no persistent severe joints aches which would prevent a person from taking part in physical activities (intermittent moderate aches were not an obstacle).

Ten persons (out of the study group of twenty) did not complete the whole physical exercise training programme or their attendance was irregular. Eventually, ten people (five women and five men) met all the criteria and they were subsequently tested as part of the study. Participants officially agreed to take part in the study.

Characteristics of participants' age and their selected anthropometric parameters are presented in Table 1.

Table 1. Characteristics of study participants

Variables	M	SD
Age [years]	69.9	6.47
Body height [cm]	166.45	8.72
Body mass [kg]	75.9	14.26
BMI [kg/m^2]	27.29	3.75

METHODS

Tinetti Performance Oriented Mobility Assessment (Tinetti POMA test) was applied in the study and consisted of two parts. The first part of the test was aimed at body balance assessment in the course of nine tasks performed by a patient. Each task was graded on the scale of 0-2 points. The total result below 15 points indicates a low risk of falls, whereas the result below 12 points suggests that the risk factor of falls should be considered high in a tested person. The second part of the test was aimed at assessing gait in the course of seven tasks. The total result below 11 points indicates a low risk of falls, while the result below 7 points suggests that the risk factor of falls is high in a tested person [26]. Among other tests utilized in the present study were: TUG (timed up-and-go test) measuring functional mobility [27] and 6 min walk test evaluating the level of endurance [28].

PROTOCOL

The study participants attended a twelve weeks' pedagogic experiment, which consisted of systematic dance training sessions, taking place twice a week in seventy-minute training units. Dance classes were conducted by physiotherapists qualified in dance therapy and competent as tango instructors.

Each session (training unit) was commenced with a symbolic greeting with a group forming a circle. Next was a warm-up (lasting ten to fifteen minutes) performed in a stationary position and in walk. Then followed thirty minutes dedicated to learning new elements of dance (individually and in pairs). Preferably, if possible, PD patients were paired with healthy dance partners (a spouse or one of the physiotherapists). Patients were mostly practicing the tango techniques, which was the main form of activity during these training sessions. To make the activities more appealing for the participants and to reinforce the training effects, sessions were enhanced with elements of other dances such as: samba, polka and integration dances. There were also obstacle courses, exercises with props (balls, tapes and disks) and other recreational activities and games. Last part of the session (lasting ten to fifteen minutes) was devoted to some elements of Tai chi, Schultz's autogenic training, stretching and relaxation exercises to a calming soundtrack and finally a symbolic farewell with a group forming a circle.

The participants were tested twice: before the experiment (baseline or Test 1) and after the whole training programme (final assessment or Test 2). Each test was preceded by a standard five-minute warm-up aimed at big muscle groups and including stretching exercises.

STATISTICAL ANALYSIS

During the analysis, standard statistical methods were used to calculate means and standard deviations (mean ± standard deviation). The Shapiro-Wilk statistical analysis test was used to verify the normality of the data. The t-Student or the Wilcoxon test was used for within-group comparisons. In addition, Cohen's effect size (ES) was calculated to quantify the magnitude of statistical significance. All data were analysed using the statistical package Statistica 12 (StatSoft, 2012), and the level of significance was set to $p < 0.05$.

RESULTS

The influence of therapeutic dancing classes on body balance, gait, functional mobility and endurance in PD patients can be seen in Table 2 below.

Table 2. Changes in body balance, gait, functional mobility and endurance in study participants as an effect of the dance classes

Variables	Baseline				After 12 weeks				Difference [%]	p	ES
	M	SD	Q1	Q3	M	SD	Q1	Q3			
POMA 1	11.3	2.63	9	12	13.85	2.56	13	16	18.41*	0.002	-0.98
POMA 2	10.3	2.75	8	12	12.45	3.95	9	15	17.27*	0.047	-0.63
TOG (s)	8.96	3.1	7.3	8.7	7.24	2.73	5.42	7.3	-19.2*	0.005	0.59
6MWD (m)	361	91.69	300	432	446.2	119.72	396	492	23.6*	0.002	-0.8

Abbreviations: M = values are means, SD = standard deviation, Q = quartile, ES = effect size, POMA = Performance Oriented Mobility Assessment, TUG = Timed up-and-go test, 6MWD = 6 min walk distance, *p < 0.05

Test results of the study indicate that therapeutic dancing classes had a positive effect on body balance and gait in PD patients. The difference between the results of POMA tests (parts 1 and 2) was statistically significant at the level of $p = 0.002$ and $p = 0.047$, respectively.

The tests also showed a statistically significant improvement in functional mobility ($p = 0.005$) and an increase in endurance ($p = 0.002$) of the participants. Individual changes in the level of mobility and endurance as an effect of the therapeutic dancing classes can be seen in Figures 1 and 2.

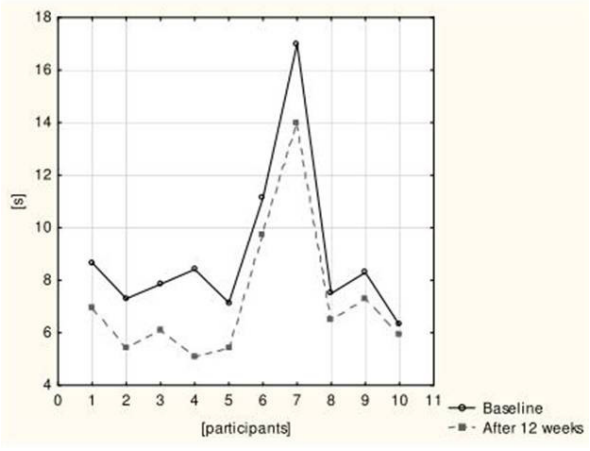

Fig. 1. Individual changes in functional mobility of PD patients as an effect of dancing classes

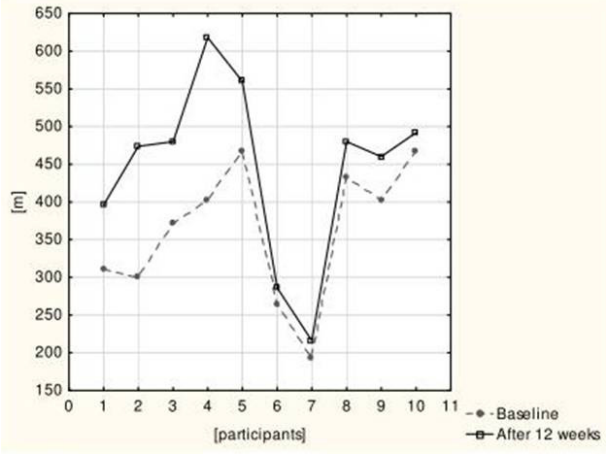

Fig. 2. Individual changes in endurance of PD patients as an effect of dancing classes

DISCUSSION

Results of the conducted study indicate that the therapeutic dancing classes programme with the tango as its focal point had a significant effect, improving body balance (18.41%), gait (17.27%), functional mobility (19.2%) and endurance (23.6%) in PD patients. The results concerning body balance improvement coincided with the observations made by Mckee and Hackney [29]. Authors of the present study can confirm that twelve-weeks' tango training is effective ($p = 0.038$) in improving body balance in PD patients. Such

a positive effect of the prescribed training programme on body balance was probably related to the dynamic pattern of dance steps: intermittent moving and stopping, turns, walking sideways and backwards [30].

Also Dreu et al. [31] confirm in their study that gait can be improved by dance training, because it naturally combines cognitive strategies of movement, body balance exercises and physical activity, but with a focus on pleasurable motion in accord with music (instead of pinpointing patient's limitations).

In the study by Dukan et al. [32], a group underwent a 24-month dance training programme, after which the participants showed an improvement in walking speed (forward and backward), while in a control group the same parameter deteriorated [30]. Another instance of improved walking speed (forward) parameter was observed in patients who participated in dancing sessions for 10 weeks (with 20 hours of training in total throughout the study). This increase did not dissipate even after a month since the end of the training. In patients taking part in an intensive dance training programme (lasting for two weeks), there was a percentage increase in a swing phase of their gait and a corresponding decrease in a stance phase. Additionally, their backward steps were noticeably lengthened [33]. Other studies indicate that non-invasive tDCS brain stimulation moderately improves gait in PD patients, although it seems to be more effective when combined with physical activity. The best of such effects were observed in patients participating in tango training [34].

The present study also indicates that the timed up-and-go (TUG) test results increased statistically, as was the case in the study conducted by Hashimoto et al. [35], where the authors observed a higher increase in functional mobility in patients taking part in dance training, in contrast to patients taking part in a standard exercises programme. After twelve weeks of training intervention, the results of TUG tests in the said study showed significant improvement (ES = 0.65; p = 0.006) and the number of steps taken during the test also increased (ES = 0.65; p = 0.006).

However, the results of certain other studies do not confirm a significant improvement in mobility in patients participating in dance training [18, 31]. Although it should be noted that even in that group, patients dancing the tango had better results in TUG test than patients dancing the waltz, foxtrot or American ballroom [25]. Yet, there are also studies indicating higher benefits of dance training over some other forms of exercises [36]. Such benefits could be explained by the fact that the tango incorporates movements that are also usually employed by physiotherapists in treatment of freezing walk in PD patients. Tango steps include moves such as: stepping over the partner's foot, tapping the partner's foot with one's own foot, crossing one's legs. Tango also entails rhythmic body swinging and shifting one's centre of gravity from one foot to the other.

It should also be emphasized that close contact between dance partners in upper parts of their bodies helps maintain mutual safety in motion. Moreover, dancing with a healthy partner gives a patient a measure of support, which in turn contributes to the overall efficiency of the training activity.

Yet, given the discrepancies of the TUG test results which are evident in the analysed body of research, dance training cannot be recommended as an

efficient method of improving functional mobility in PD patients. The results of a 6-min walk test (6MWT) taken by PD patients participating in the present study indicated an improvement, which is convergent with observations made by other authors [28,29]. Improvement in 6MWT was also shown in healthy elderly people who attended Turkish folk dance [37] and dance aerobics training programmes [38].

Admittedly, the present study is flawed by certain limitations, which were the consequence of a small number of participants and a lack of a control group. Despite a wide use of media in the recruitment process, encouraging PD patients to participate in systematic dance training proved a very difficult challenge. The underlying reason for that could be related to psychological changes in PD patients and their fear of a possible fall during training. The present research is, therefore, only a pilot study which hopefully can prove useful in planning further more extensive studies with a bigger research group.

CONCLUSIONS

The study indicates that 12 weeks of long therapeutic dancing classes proved effective as a therapeutic technique, improving body balance, gait, functional mobility and increasing endurance in patients participating in the intervention program. These results can be instrumental in devising future therapeutic programmes aimed at prevention of falls in PD sufferers.

ACKNOWLEDGMENTS

The authors of the present study would like to thank all participants for attending the project “Taniec z Parkinsonem” (Dance with Parkinson). The project was granted financial support from Fundacja Rozwoju Systemu Edukacji (Foundation for the Development of Educational System).

REFERENCES

[1] Morris ME, Martin CL, Schenkman ML. Striding out with Parkinson disease: evidence-based physical therapy for gait disorders. Phys Ther. 2010;90(2):280-8.

[2] Gray P. Hildebrand K. Fall risk factors in Parkinson’s disease. J Neurosci Nurs. 2000;32(4):222-8.

[3] Chen YY, Cheng PY, Wu SL, Lai CH. Parkinson’s disease and risk of hip fracture: an 8-year follow-up study in Taiwan. Parkinsonism Relat Disord. 2012;18(5):506-9.

[4] Cho YH, Mohamed O, White B, Singh-Carlson S, Krishnan V. The effects of a multicomponent intervention program on clinical outcomes associated with falls in healthy older adults. Aging Clin Exp Res. 2018 Jan 25.

[5] Ossowski ZM, Wawryniuk M, Česnaitienė VJ. Influence of Nordic walking training on static and dynamic body balance among the elderly. Balt J Health Phys Act. 2015;7(1):72-80.

[6] Wiech MA, Prusik K, Ossowski ZM, et al. Diversified health-related Nordic walking training programs and physical fitness of elderly women. Balt J Health Phys Act. 2016;8(4):147-156.

[7] Ossowski ZM, Skrobot WR, Aschenbrenner P, Česnaitienė VJ, Smaruj MA. Effects of short-term Nordic walking training on sarcopenia-related parameters in women with low bone mass: a preliminary study. Clin Interv Aging. 2016;11:1763-1771.

[8] Graham K. Parker M. Pryor G. Mortality and morbidity after hip fractures. BMJ. 1993;13;307(6914):1248-50.

[9] D’Amelio M, Ragonese P, Morgante L, et al. Long-term survival of Parkinson’s disease: a population-based study. J Neurol. 2006;253(1):33-7.

[10] Eventov I, Moreno M, Geller E, Tardiman R, Salama R. Hip fractures in patients with Parkinson’s syndrome. J Trauma. 1983;23(2):98-101.

[11] Mustafa M. Avraham G. Loss of autonomic postural reflexes, Gait abnormalities and „freezing walk” in severe Parkinson’s disease patients contributes to falls and hip fractures. Merit Res J Med Medic Sci. 2014;2(5):109-116.

[12] Ashburn A, Stack E, Pickering RM, Ward CD. A community-dwelling sample of people with Parkinson’s disease: characteristics of fallers and non-fallers. Age Ageing. 2001;30(1):47-52.

[13] Smithson F, Morris M, Iansek R. Performance on clinical tests of balance in Parkinson's disease. Phys Ther. 1998;78:577-92.

[14] Friedman A. Choroba Parkinsona: mechanizmy, rozpoznawanie, leczenie [Parkinson's disease: mechanisms, diagnosis, treatment]. Warszawa, Czelej, 2005. Polish.

[15] Shanahan J, Morris ME, Bhriain ON, Saunders J, Clifford AM. Dance for people with Parkinson disease: what is the evidence telling us? Arch Phys Med Rehabil. 2015; 96(1):141-53.

[16] Kunkel D, Fitton C, Roberts L, et al. A randomized controlled feasibility trial exploring partnered ballroom dancing for people with Parkinson's disease. Clin Rehabil. 2017;31(10):1340-1350.

[17] Rocha PA, Slade SC, McClelland J, Morris ME. Dance is more than therapy: Qualitative analysis on therapeutic dancing classes for Parkinson's. Complement Ther Med. 2017;34:1-9.

[18] Hackney ME, Kantorovich S, Levin R, Earhart GM. Effects of tango on functional mobility in Parkinson's disease: a preliminary study. J Neurol Phys Ther. 2007; 31(4):173-9.

[19] Volpe D, Signorini M, Marchetto A, Lynch T, Morris ME. A comparison of Irish set dancing and exercises for people with Parkinson's disease: a phase II feasibility study. BMC Geriatr. 2013;4,13:54.

[20] Haboush A, Floyd M, Caron J, LaSota M, Alvarez K. Ballroom dance lessons for geriatric depression: an exploratory study. Arts Psychother. 2006;33(2):89-97.

[21] Duncan RP, Earhart GM. Randomized controlled trial of community-based dancing to modify disease progression in Parkinson disease. Neurorehabil Neural Repair. 2012; 26(2):132–43.

[22] Blandy LM, Beevers WA, Fitzmaurice K, Morris ME. Therapeutic Argentine tango dancing for people with mild Parkinson's disease: A feasibility study. Front Neurol. 2015;27;6:122.

[23] Hackney ME, Earhart GM. Recommendations for implementing tango classes for persons with Parkinson disease. Am J Dance Ther. 2010;32(1):41–52.

[24] Holmes WM, Hackney ME. Adapted tango for adults with Parkinson's disease: A qualitative study. Adapt Phys Activ Q. 2017;34(3):256-275.

[25] Hackney ME, Earhart GM. Effects of dance on movement control in Parkinson's disease: a comparison of Argentine tango and American ballroom. J Rehabil Med. 2009; 41(6):475-81.

[26] Köpke S, Meyer G. The Tinetti test: Babylon in geriatric assessment. Z Gerontol Geriatr. 2006;39(4):288-91.

[27] Podsiadlo D, Richardson S. The timed „Up & Go": a test of basic functional mobility for frail elderly persons. J Am Geriatr Soc, 1991;39(2): 142-8.

[28] American Thoracic Society Statement. Guidelines for the six-minute walk test. Am J Resp Crit Care Med. 2002;166:111-117.

[29] Mckee K. Hackney M. The effects of adapted tango on spatial cognition and disease severity in Parkinson's disease. J Mot Behav. 2013;45(6):519-29.

[30] de Dreu MJ, van der Wilk AS, Poppe E, Kwakkel G, van Wegen EE. Rehabilitation, exercise therapy and music in patients with Parkinson's disease: a meta-analysis of the effects of music-based movement therapy on walking ability, balance and quality of life. Parkinsonism Relat Disord. 2012; 18 Suppl 1:114-9.

[31] Duncan RP, Earhart GM. Are the effects of community-based dance on Parkinson disease severity, balance, and functional mobility reduced with time? A 2-year prospective pilot study. J Altern Complement Med. 2014;20(10):757-63.

[32] Hackney ME, Earhart GM. Effects of dance on balance and gait in severe Parkinson disease: A case study. Disabil Rehabil. 2010;32(8):679-84.

[33] Marchant D, Sylvester JL, Earhart GM. Effects of a short duration, high dose contact improvisation dance workshop on Parkinson disease: A pilot study. Complement Ther Med. 2010;18(5):184-90.

[34] Kaski D, Allum JH, Bronstein AM, Dominguez RO. Applying anodal tDCS during tango dancing in a patient with Parkinson's disease. Neurosci Lett. 2014;7;568:39-43.

[35] Hashimoto H, Takabatake S, Miyaguchi H, Nakanishi H, Naitou Y. Effects of dance on motor functions, cognitive functions, and mental symptoms of Parkinson's disease: a quasi-randomized pilot trial. Complement Ther Med. 2015;23(2):210-9.

[36] Dos Santos Delabary M, Komeroski IG, Monteiro EP, Costa RR, Haas AN. Effects of dance practice on functional mobility, motor symptoms and quality of life in people with Parkinson's disease: a systematic review with meta-analysis. Aging Clin Exp Res. 2017 Oct 4.

[37] Eyigor S, Karapolat H, Durmaz B, Ibisoglu U, Cakir SA. Randomized controlled trial of Turkish folklore dance on the physical performance, balance, depression and quality of life in older women. Arch Gerontol Geriatr. 2009;48(1):84-8.

[38] Hui E, Chui BT, Woo J. Effects of dance on physical and psychological well-being in older persons. Arch Gerontol Geriatr. 2009;49(1):e45-50.

Cite this article as:
Listewnik B, Ossowski ZM. The influence of dance on selected risk factors of falls in Parkinson's disease patients - A pilot study. Balt J Health Phys Act. 2018;10(1):38-45.
doi: 10.29359/BJHPA.10.1.04