Declared and real recreational physical activity with Parkinson's disease woman patients

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Abstract

Parkinson's disease (PD) is one of the most common causes of motor disability associated with neurodegenerative disease and the first symptoms appear most frequently between age 50 and 60 years. It is therefore recommended to use several methods of measurement in the assessment of physical activity, and it could be done with motion meters (pedometers) and acceleration meters (accelerometer) which record activity in a selected time interval. The purpose of the study is facing the real risk of PD and significantly physical activity, the aim of this work was to compare the level of the declared and real physical activity in women with PD.

The obtained results were compiled and prepared in accordance with statistics rules. Basic descriptive statistics were calculated and the normal distribution was examined by means of the Kolmogorov-Smirnov test. In order to evaluate the significance of differences, the Student's *t*-distribution test was applied for independent samples. Conclusion shows us regardless of the limits described above, it may be stated that the conducted research show that the declared and real volume of weekly physical activity of people with PD in the second stage of disease assessed by the IPAQ questionnaire and monitored by Caltrack Monitor was statistically significantly varied. Nevertheless, these discrepancies were, in individual cases, markedly differentiated.

Keywords: physical activity, Kolmogorov-Smirnov test, PD

Introduction

One of the most common causes of motor disability associated with neurodegenerative disease is Parkinson's disease (PD). The first symptoms appear most frequently between 50 and 60 years of age. It is estimated that more than 8.7 - 9.3 million people over the age of 50 suffering from this disease will live in 2030 in 10 most populated countries of Western Europe [von Campenhausen et al. 2005]. Taking into account aging of the population, Parkinson's disease creates more and more medical and social problems for patients and their families [Dorsey et al. 2007].

Gender is also among the determinants of incidence PD. The results of epidemiological studies indicate the superiority of men among patients with PD [Wooten et al. 2004]. It is likely that hormones can be a factor protecting against PD development in women. A large role is attributed to the importance of estrogen, as factors modulating the risk of PD, and as factors that have a protective effect on central nervous system cells [Li et al. 2008]. This would indicate the need to develop a separate programme for functional rehabilitation, improving the quality of life, but also tailored separately for women and men [Nawrocka et al. 2017].

The results of the research presented in the literature indicate the positive influence of various forms of physical activities. Taking physical activity by people with PD reduces neurological symptoms, improves quality of life, mood, executive functions, and last but not least, it improves self-reliance in performing daily activities. Regular physical activity leads also to an increase in the concentration of neurotransmitters (serotonin, dopamine, acetylcholine, noradrenaline) and has an impact on changes in the activity of some neurotransmitter receptor subtypes. In consequence, it leads to an alteration in the activity of whole cortical and subcortical structures [Sarbadhikari, Saha 2006]. Higher severity of the disease, gait disorders, lack of coordination and less autonomy in daily activities correlate with lower physical activity and can therefore intensify the progression of the disease [Cholewa et al. 2016].

Since previous studies have shown a positive role of physical activity in reducing the motor symptoms of Parkinson's disease, physical activity might be an indispensable component of rehabilitation and may differentiate patients in terms of their functioning [Lauze et al. 2016].

The classification of physical activity is most often based on a questionnaire survey. One of the most popular is the International Physical Activity Questionnaire (IPAQ) [Mader et al., 2006, DeCocker et al. 2007]. However, the questionnaire surveys of physical activity are often encumbered with significant errors resulting from *imperfect self-assessments* [Westertep 1999, Lachat et al. 2008]. It is therefore recommended to use several methods of measurement in the assessment of physical activity.

The acknowledged parameter describing physical activity is the measurement of energy expenditure [Neilson et al. 2009]. It could be done with motion meters (pedometers) and acceleration meters (accelerometer) which record activity in a selected time interval (a day, a week). These devices are used to evaluate the volume of exercise in health training, they are helpful in epidemiological studies [Vanhees 2005 et al.] and are also used to monitor the physical activity of patients [Gutin et al. 2005].

Purpose

Facing the real risk of PD and significantly physical activity, the aim of this work was to compare the level of the declared and real physical activity in women with PD.

Material and methods

The research was carried out on 29 women (aged $62,51 \pm 6,27$), with diagnosed idiopathic PD (disease duration $5,11 \pm 3,58$), with PD of IInd stage according to the Hoehn and Yahr [1967] classification were included in the research.

The surveyed people neither did not suffer from other diseases nor from mobility impairment. In addition, the study did not include those who were professionally active in order to assess only physical activity, rather than activity induced by employment.

The International Physical Activity Questionnaire (IPAQ) and single-axis accelerometer (Caltrac Monitor) were used to measure the weekly caloric costs of physical activity for women and men. Numerous studies have shown satisfactory reliability and usability of these research tools in assessing the volume of physical activity of adults [Rothney 2008].

In order to determine the actual level of physical activity, the surveyed women wore the accelerometer for 7 days and only before going to sleep they detached it without interrupting their record. After 7 days, the energy expenditure of physical activity in kilocalories was determined with the accelerometer, taking into account their gender, age, height and weight.

The respondents filled out a IPAQ questionnaire during the time of reading data from the accelerometer in order to determine the level of declared physical activity. They were supposed to assess their physical activity of the previous week, in which they wore the accelerometer. A short version of the IPAQ questionnaire was used and contained questions about the number of days of the week when they made efforts in the respective zones of intensity. Based on the responses of the surveyed people, the volume of physical activity was evaluated in the intensity zones as follows: low (walking), moderate and high (vigorous).

Based on questionnaire data, the weekly volume of physical activity in each intensity zone was calculated. The intensity of the effort was determined by multiplying the metabolic equivalent (MET). According to the IPAQ instructions, the following numbers were assumed: 8.0 MET for activity with vigorous intensity (PA1), 4.0 MET for moderate intensity (PA2) and 3.3 MET for low (walking) intensity (PA3). Total weekly physical volume (WPA-weekly physical activity) was determined by multiplying the duration of exercise in the respective zones by the related metabolic rate and then summed. This parameter was considered a measure of declared physical activity. In order to compare the declared physical activity with the real level of physical activity, the unit MET min/week was converted to kcal/week according to the formula:

$$CPA [\text{kcal/week}] = WPA [\text{MET min/week}] * BW [\text{kg}] / 60 [\text{min}]$$

where:

CPA - weekly caloric cost of physical activity (kcal/week)

WPA - weekly level of physical activity (MET min/week)

BW - body weight of respondents

The credibility of such a procedure is confirmed by previous studies [Neilson et al. 2008].

The obtained results were compiled and prepared in accordance with statistics rules. Basic descriptive statistics were calculated and the normal distribution was examined by means of the Kolmogorov-Smirnov test. In order to evaluate the significance of differences, the Student's *t*-distribution test was applied for independent samples.

Results

The results showed that in any everyday declared activities, the efforts of low intensity were strongly dominated (Tab.1). The respondents' total weekly volume of physical activity was 2428 MET min/week. The characteristics of declared physical activity are presented in Table 1.

Table 1. Frequency and value of daily physical activity in 3 zone of intensity.

Intensity	Tested
Frequency of daily physical activity (day/week)	
PA 1	0,78±0,97
PA 2	1,98±1,34
PA 3	5,87±5,87
Daily volume of physical activity (min)	
PA 1	1,28±0,58
PA 2	38,12±3,79
PA 3	50,28±3,89

PA 1 – Physical activity of high intensity,

PA 2 – Physical activity of moderate intensity,

PA 3 – Physical activity of low intensity,

The main purpose of the research was to compare the declared level (DPA) and the real level of physical activity (RPA). The caloric cost measured by accelerometer was significantly higher than the one estimated with the IPAQ questionnaire (on average 740kcal higher). Detailed results are presented in Table 2.

Table 2. Energy cost of real physical activity with the use of accelerometer related to level of declared physical activity.

	RPA [kcal/week]	DPA [kcal/week]	t	P
Tested	4035±1985	3295±1759	1,87±0,59	0,002

RPA - real physical activity,

DPA - declared physical activity,

t-value of the student's t test

p - probability degree.

Discussion

Studies have shown that tested women with Parkinson's disease (PD) who participate in the survey declare more physical activity compared to the actual state. Differences were statistically significant. In order to evaluate physical activity a homogeneous group of people in the second stage of the disease (according to Hoehn and Yahr scale) was chosen. At this stage, there is a slight movement disturbance affecting both sides of the body but balance problems do not occur. Impaired mobility is relatively low.

Moreover, people who are professionally active were not surveyed since the physical activity not forced by work was supposed to be taken into consideration. The selection of such a homogeneous group certainly affected the results. Due to the slow and insidious nature of the disease the progressive movement disturbances are felt much more slowly with respect to their actual occurrence.

The results indicate that the risk of error in the classification of the volume of physical activity in the survey is quite considerable. This is confirmed by the results of studies comparing the energy expenditure that was estimated from different questionnaires with the energy measured with Doubly Labeled Water laboratory method. Using **correlation coefficients of the results** of the parallel studies with the same tools within the limits of 0.5 to 0.7, a significant overestimation of physical activity in the survey was found in individual cases.

The main reason for this fact is the difficulty with proper assessment of the intensity of physical effort made by the respondents [Mahabir et. al. 2006, Neilson et. al. 2008]. Direct contact of an experienced interviewer with respondents during completing a questionnaire about physical activity seems to be necessary in this situation. This refers especially to sick persons, often reluctant to physical efforts, and consequently also to their self-esteem.

The results of author's own research have confirmed the usefulness of the Caltrac accelerometer to monitor (the measurement) the actual physical activity of people with PD. The undoubted advantage of accelerometers is the fact that the readings of these devices motivate the respondents to do regular physical activity. It plays a beneficial role both in the prevention and treatment of hypokinetic diseases [Chakrawarthy et al. 2002].

However, devices that measure proper acceleration do not record the frequency and intensity of physical activity, which constitute the important parameters of physical exercise that are beneficial to health. Data on this subject can be gained through the self-assessment of physical activity in the survey. Therefore, parallel application of the frequency, volume and intensity of physical effort of both healthy and sick persons, subjective and objective measurement techniques and tools is therefore fully reasonable and appropriate.

To summarize the analyses, it should be mentioned that due to the small number of the observed cases and the limited research group the conclusions ought to be formulated cautiously. Moreover, further studies concerning analysis of a bigger research group suffering from different stages of disease are necessary.

Conclusion

Regardless of the limits described above, it may be stated that the conducted research show that the declared and real volume of weekly physical activity of people with PD in the second stage of disease assessed by the IPAQ questionnaire and monitored by Caltrack Monitor was statistically significantly varied. Nevertheless, these discrepancies were, in individual cases, markedly differentiated.

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