



## Senior Fitness Test in assessing the effectiveness of physical rehabilitation in the context of Parkinson's disease patients' quality of life

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### Abstract

Parkinson's disease (PD) is a degenerative disorder of the central nervous system. The main problems associated with losses at the motor level are: tremor, rigidity, postural instability and bradykinesia. Many publications related to rehabilitation in PD refers to methods which are used to rehabilitate patients, but there is lack of significant amount of publications concerning tools to examine the effectiveness of these programs. The purpose of the work was to determine the suitability of Senior Fitness Test (SFT) in the assessment of the effectiveness of physical rehabilitation of people with PD. The research was conducted in a group of 52 people (age  $64.52 \pm 7.56$  years) with idiopathic PD disease (duration of the disease was  $6.69 \pm 4.93$  years) in II stage in Hoehn & Yahr scale. Unified Parkinson's Disease Rating Scale (UPDRS) was used to determine the clinical status of patients. Parkinson's Disease Quality of Life Questionnaire (PDQL) was applied to determine the quality of life. The patients were divided into a group of participants and non-participants in the process of physical rehabilitation. Obtained results in the tests showed statistically significant differences between the groups in all the tests. The biggest absolute difference was observed in the Back Scratch test (308,33%). In order to achieve the main goal of the work, the correlation coefficients between the quality of life and the results of the SFT were calculated. The obtained results show that correlation between all the tests in both groups is at least moderate. The highest correlation was recorded in the "2-minute walk" test in both groups. It was found that there is a relationship between SFT results and the quality of life of people with PD. SFT is a helpful tool in assessing the effectiveness of physical rehabilitation of people with PD.

**Keywords:** Parkinson's disease, Senior Fitness test, Quality of life, physical rehabilitation

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## INTRODUCTION

Parkinson's disease (PD) is a degenerative disorder of the central nervous system, characterized by the disappearance of neurons of the substantia nigra and consequently, the deficiency of dopamine in the nigrostriatal system [1,2]. Parkinson's disease is usually clinically manifested by the loss of the substantia nigra neurons exceeding 50% and the decrease by about 80% of dopamine content in the striatum [3]. The treatment involves pharmacological methods and the possibility of operational action that enables, among others, to reduce the complications of pharmacological treatment. The physical rehabilitation plays an essential role in Parkinson's disease patients' treatment [4,5,6].

The main problems associated with losses at the motor level are: tremor, rigidity, bradykinesia, postural instability and gait impairment, which often leads to falls and, as a consequence, to body injury [1,7]. The priority in physiotherapy tasks is to maintain the level of patients' physical fitness, which allows them to continue their career and to remain independent. Moreover, maintaining functional independence which concerns the limitations of the ability to perform simple everyday activities such as managing their personal hygiene, eating or dressing. The inability to perform these tasks, which once would seem to be something automatic and simple, leads to deterioration of the patient's emotional state, which in turn leads to isolation from the society. Therefore, another important aspect of rehabilitation is improving the quality of life of people with PD [5,8].

As far as the duties of physiotherapists in the context of specific motor tasks are concerned, the main goal concerns proper gait speed and good posture. The specialists have to incorporate balance exercises and use coordination exercises for upper and lower limbs, as well as stretching. In addition, maintaining the current lifestyle and activities prevents the formation of secondary complications mainly in the nervous, circulatory and locomotor systems [9,10]. Rehabilitation should begin in the period before the full clinical manifestation of the disease, before pharmacotherapy and must be an integral part of the patient's treatment throughout his life. The research carried out among patients with PD allows to see the positive effects of therapy on the improvement of their mobility [8,11]. Many publications related to rehabilitation in Parkinson's disease refer only to methods which are used to rehabilitate patients, but there is lack of significant amount of publications concerning tools to examine the effectiveness of these programs, as well as their impact on the quality of patients' life. In order to evaluate the efficiency of training programs for PD patients, the authors used, among others the following tests - "Chair stand", "8-foot up and go" or "Stand up and go"[12], which are components of the SFT. Nieuwboer et al. [13] used in her work the measurement of step length, the frequency of the "freezing" episodes and the gait speed which she measured in the third, sixth and twelfth week of training with people suffering from PD. In her publication investigating the assessment of the impact of kinesitherapy on the motor skills of patients with Parkinson's disease, she used the UPDRS test to measure the clinical condition of the subjects. The results obtained before and after the treatment were compared with each other. In nearly all subscales, the scores given after the therapy were lower than at the beginning [13].

One of the methods of measuring physical fitness constitutes SFT [12,14]. Its usefulness was found in population studies of older people, however there are few publications referring to the possibilities of its use in the group of people with PD. One of the few publications is the work of Cancela et. al. [12] who studied a group of 30 people with PD. The participants were able to perform the test, but only with the modification of one task. The results of the study showed that the control group obtained worse results than their healthy peers, especially in terms of flexibility. The measurement showed lower level of functional capabilities and weaker muscle function that is characteristic of people with Parkinson's disease.

The obtained SFT results were analyzed using Spearman's correlation with the UPDRS results and the PDQ-39 questionnaire evaluating the quality of life, and a statistically significant correlation between these values was observed. This suggests the existence of a link between the results obtained in the tests, and the severity of the disease. However, the authors suggest further research aimed at measuring the effectiveness of SFT in assessing the physical fitness of people with Parkinson's disease [8].

The purpose of this work was to determine the suitability of Senior Fitness Test in the assessment of the effectiveness of physical rehabilitation of people with Parkinson's disease. Specific research questions were posed at the work:

What is the relationship between the level of physical fitness measured by the Senior Fitness Test and the quality of life in people with PD?

Does participation in the rehabilitation process differentiate the relationship between physical fitness and quality of life?

## MATERIAL AND METHODS

The research was conducted in a group of 52 people (age  $64.52 \pm 7.56$  years), who have been treated in the Department of Neurology in the Medical University of Silesia in Katowice, and have been members of the Silesian Association for People with Parkinson's disease. Those people were diagnosed with idiopathic PD disease (duration of the disease was  $6.69 \pm 4.93$  years). The Bioethical Commission of the Academy of Physical Education in Katowice approved the research. All subjects were informed about the purpose and course of study and gave their written consent to participate in them.

PD diagnosis was based on United Kingdom Parkinson's Disease Society Brain Bank criteria. The study included patients with stage II of the disease according to the Hoehn & Yahr scale [15]. The subjects did not suffer from other coexisting neurodegenerative diseases. The purpose selection technique was applied. The patients were divided into a group of participants (A) and non-participants in the process of physical rehabilitation (B).

To determine the clinical status of patients, the Unified Parkinson's Disease Rating Scale (UPDRS) was implemented- Part I (intellectual status), part II (everyday activities and symptoms of Parkinson's disease), part III (assessing physical fitness) [16]. The characteristics of the subjects are presented in Table 1.

To determine the level of physical fitness, the Senior Fitness Test was implemented [17]. It is used as a tool to assess the motor skills of elderly people. It includes the following tests:

1. The Chair Stand Test. It requires people to repeatedly stand up from a chair and sit down for 30 seconds. The number of stands is recorded. This test covers lower-body strength.
2. The Arm Curl Test. This test requires people to repeatedly lift 2kg weight (for women) and 3kg weight (for men) for 30 seconds. The number of lifts is recorded. The test covers upper-body strength.
3. The Back Scratch Test. This is measured in distance (cm) and reflects upper-body flexibility.
4. The Chair Sit and Reach Test. This is measured in distance (cm) and reflects lower-body flexibility.
5. The 8-foot (2,45m) Up and Go test. This is measured in time (seconds) and reflects agility and dynamic balance.
6. The 2-minute Walk Test which covers aerobic endurance. The test requires people to walk on a rectangular course but more recent versions use a straight line. The number of full steps completed in 2 minutes is recorded.

To determine the quality of life of the subjects, Parkinson's Disease Quality of Life Questionnaire (PDQL) was applied [18]. It consists of 37 items covering 4 domains. They comprise parkinsonian symptoms (14 items), systemic symptoms (difficulty walking, malaise, sleep disorder, exhaustion, constipation, urinary incontinence (7-items), emotions (9 items) and social functions (hobby, sex, recreation, leisure trips, public speaking, transport difficulties, low mood and intimidation) - 7 items. The respondent has the opportunity to choose one out of five responses regarding the prevalence of disorders mentioned above: 1- permanent, 2-most of the time, 3-quite often, 4- sometimes, 5-never. The total score obtained in all subscales was used in the paper.

Table 1. Characteristics of subjects.

Characteristic	Group A (n=24)	Group B (n=28)	t-test	
	X ± SD	X ± SD	t	p
Age [years]	63.27±5.86	64.42±6.45	2.42	0.45
Disease duration [years]	5.93±1.34	6.73±1.97	3.67	0.56
UPDRS [pts]	part I	2.39±0.81	2.42	0.19
	part II	14.96±1.84	1.56	0.43
	part III	20.46±3.11	3.53	0.45
	part I, II, III	37.81±5.12	2.45	0.24

UPDRS – Unified Parkinson's Disease Rating Scale, X - arithmetic mean, SD – standard deviation, t - value of t-test, p – probability degree.

Patients involved in the process of rehabilitation (group A), participated regularly in rehabilitation classes in the gym twice a week for 45 minutes. They had begun at least 3 months prior to the study. Rehabilitation program was focused on individual symptoms. In case of the slow movement and inflexibility of postural reflexes attention was paid to the optimal use of the retained patterns for acquired and automatic movements. The procedure included: frequent repetition of movements, combining the movements with the special acoustic step initiator, repetition of movements with different frequency, introduction of arbitrary movements with stimulating mechanisms: visual, auditory and sensory cues, imaginative stimulation of the movement before its performance, cognitive strategies of the equivalent reflexes induction, awareness of postural abnormalities and their correction. In case of stiffness, rehabilitation treatment did not concern coping with stiffness itself but minimizing its negative impact. While in case of tremors, a strategy for reducing them was implemented. The subjects were taught ways to control tremors through purposeful movements. During the course, each exercise was useful in terms of coping with everyday activities.

The results obtained in the research were statistically measured by calculating basic descriptive statistics. The homogeneity of variance in the compared groups was measured using the Levene's test and the normal distribution of features using the Kolmogorov-Smirnov test. T-test was applied in order to determine the relationship between groups in the analyzed parameters. Pearson's correlation coefficient was used to specify the differences between the results of the tests concerning social bonds and the patients' quality of life.

## RESULTS

Before analyzing the results of tests evaluating the quality of life of the respondents and SFT, both groups were compared with respect to age, duration of disease and clinical condition. The conducted analyses did not reveal any statistically significant differences between the studied groups at the assumed significance level of  $p < 0.05$  (Table 1).

Through the use of statistical methods the comparisons could be made and the results obtained in the tests completed by both groups showed that statistically significant differences between the groups occurred in all the tests. The largest absolute difference was observed in the Back Scratch test (308,33%), while the smallest difference in the Up and Go test (Table 2). The group of people participating in physical rehabilitation was characterized by a higher level of fitness (Table 2).

In order to achieve the main goal of the work the correlation coefficients between the quality of life of the respondents and the results of the Senior Fitness Test were calculated. The obtained results show that correlation between all the tests in both groups is at least moderate. The highest correlation was recorded in the "2-minute walk" test in both groups.

Table 2. Results in Senior Fitness Test in both group.

Test	Group A	Group B	Absolute difference	Relative difference	t-test	
	X1± S	X2± S	X2-X1	X2-X1 (%)	t	p
The Chair Stand Test [repeat]	12.60±4.31	11.36±3.64	-1.24	-10.92	4.68	0.02
The Arm Curl Test [repeat]	19.34±6.61	17.00±5.68	-2.34	-13.76	6.48	0.01
The Back Scratch Test [cm]	-6±3.54	-24.5±9.85	18.50	-308.33	4.38	0.01
The Chair Sit and Reach Test [cm]	1.37±5.11	-0.33±1.21	-1.70	515.15	2.82	0.03
Up and Go test [s]	7.743±3.21	8.03±2.68	0.29	3.75	1.79	0.04
The 2-minute Walk [repeat]	38±11.53	23.75±10.89	-14.25	-37.50	6.21	0.01
PDQL [point]	151.28±12.64	129.26±13.46	-22.02±6.15	-17.30±4.52	4.65	0.001

PDQL – Parkinson's Disease Quality of Life Questionnaire, X - arithmetic mean, SD – standard deviation, t - value of t-test, p – probability degree.

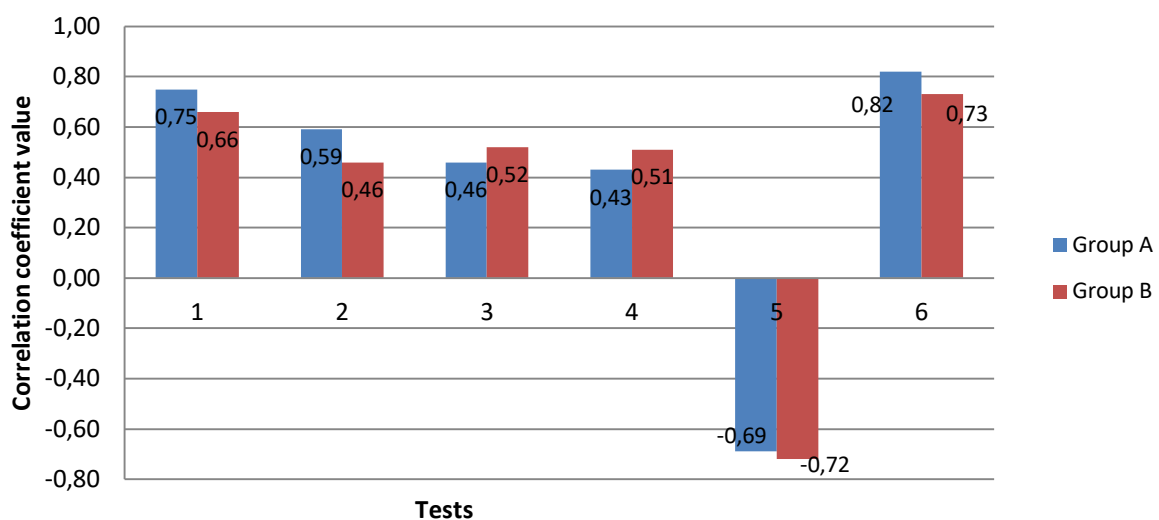


Figure 1. Correlation between the assessment of the quality of life and SFT results.

## DISCUSSION

Better level of physical fitness guarantees greater psychological comfort and increases the quality of life of elderly people. Self-reliance in performing daily activities is particularly important in their case. Doing the housework and active participation in social life helps to maintain good health and well-being for as long as possible [19,20]. The conducted research has shown that participation in the process of physical rehabilitation significantly differentiates the results obtained by the respondents in SFT tests. There were statistically significant differences between the groups in all 6 tests. People who participated in physical rehabilitation were characterized by a higher level of fitness. The biggest difference was observed in the "Back Scratch" test. The assessment of quality of life also showed higher scores in the PDQL test among PD patients.

Similar results were obtained by Konstantinidis et al. [21] who used the FFA platform (Fit For All) in their study, from which 116 seniors used it for 8 weeks, 5 times a week. The exercisers improved their strength, flexibility, endurance and balance by using FFA. Their physical attributes

were measured before and after the exercise programs using SFT. Furthermore, a subjective assessment of the quality of life was made using the WHOQoL-BREF questionnaire. The results of all SFT tests were better after the end of the program. The respondents also stated that their quality of life improved significantly, therefore they granted themselves more points in each of the subgroups in the questionnaire. Taking these studies into consideration, it can be concluded that even a short improvement program has a positive effect on the seniors' physical attributes. There is a visible relationship that the better results in the SFT tests, the higher values obtained in quality of life questionnaires.

In the other studies, Ćwirlej-Sozańska et al. [22] analyzed the usefulness of selected scales in the assessment of physical fitness and balance in seniors. According to the authors, the balance disorders in the elderly population limits their ability to participate fully in social life. In the conducted studies, they assessed the usefulness of various scales in the assessment of seniors' skills. From the selected tests, they showed that the most reliable test is "8-foot up and go", which belongs to the SFT. Thus, the better results obtained in the test, the greater opportunities for independent functioning and better quality of life. However, the authors admit that further research on a larger group of people is needed in order to determine the full usefulness of this test. The research conducted in this work confirms the great correlation between quality of life and the "8-foot up and go" test.

Zoran Milanović et al. [23] in their research observed the relationship between the level of efficiency measured by SFT and quality of life. They compared women and men in various age groups. The research of other authors indicates that SFT is applied to various questionnaires concerning quality of life, with different groups of respondents, in terms of age and dysfunctions. The better results obtained during the test, the better quality of life assessments. However the results lack in evaluation of the correlation between specific tests and the opinions gathered from the questionnaires. Therefore, it is difficult to explain what affects the most the actual health of the respondents. Multi-dimensional approach and clinical practice indicates that the improvement of an individual's psychophysical functioning encourages multiplying and strengthening positive therapeutic effects [24,25,26]. The authors focused so far in their works on comparing patients' results to the standards created by Rikli and Jones, or the results of the data before and after the exercise program were compiled [27,28,29].

As far as the studies carried out at this work are concerned, the greatest correlation between quality of life and fitness level was observed in the "2-minute walk" test in both groups. In half of the conducted tests, correlation coefficient was higher in the group of exercisers and in the second half of the tests in the group not participating in the physical rehabilitation. On this basis, it can be concluded that participation in the process of rehabilitation of PD patients does not unequivocally differentiate the correlation between quality of life and results obtained in SFT, which indicates the high reliability of this test. Due to the relatively small number of respondents as well as few publications on this topic, further research is necessary in order to confirm the suitability of SFT in assessing the effectiveness of physical rehabilitation of PD patients and to evaluate their efficiency and progress during the implementation of rehabilitation programs.

## CONCLUSIONS

Based on the tests carried out it can be stated that: there is a relationship between the results of the SFT and the level of quality of life of people with PD, SFT is a helpful tool in assessing the effectiveness of physical rehabilitation of people with PD.

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