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Functional fitness of people over 65 participating in physical activities organized by the Universities of the Third Age and Seniors' Clubs in South-Eastern Poland

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ABSTRACT: The subject of the research was to assess the level of functional physical fitness of people aged 65 and over, taking into account the sex of the respondents, and to estimate the direction of changes in the functional physical fitness of the respondents as a result of participation in programmed physical activities of a University of the Third Age. The research on the level of functional physical fitness was carried out both among men and women aged 65 and over (104 men – 29% of the respondents and 251 women – 71% of the respondents), in total 355 people who are members of the Universities of the Third Age in Rzeszów, Mielec, Jasło, Zamość, and Seniors' Clubs in Rzeszów, Stalowa Wola, Przemyśl, Krosno and Lubaczów. The Functional Senior Fitness Test by Rikli and Jones (1999) was used to objectively analyse the level of functional physical fitness in the study group. The individual tests of the Functional Senior Fitness Test give the opportunity to assess the muscle strength of the lower and upper body, flexibility in the upper and lower body areas, agility and dynamic balance as well as the aerobic endurance of the senior citizen.

The research procedure assumed two studies to assess the level of functional physical fitness of people over 65 using the Functional Senior Fitness Test among seniors who are members of Universities of the Third Age participating in physical activities. Study 2 was conducted 6 months after study 1. In order to obtain reliable and credible results of individual tests and to maintain similar conditions for all participants, study 1 was conducted at the University of the Third Age at the beginning of the winter semester, and study 2 at the end of the first half of the academic year. The number of respondents was n = 86.

Men showed statistically significantly higher results in muscle strength in upper and lower parts of the body and aerobic endurance, women in flexibility of upper and lower parts of the body. Regular participation in physical activities among people over 65 has a significant statistical impact on the achievement of higher results in individual motor skills.

Sex significantly differentiates the level of functional physical fitness in selected age groups. A significantly higher level of functional physical fitness was presented by men in the test of muscle strength in in upper and lower parts of the body, agility and dynamic balance, and aerobic endurance, while women showed higher results in flexibility of upper and lower parts of the body.

The analysis of the results of the preliminary (study 1) and repeated (study 2) functional fitness level allows us to find significant differences in the results of the Functional Senior Fitness Test. It is worth noting that the regular participation in programmed physical activities organized at U3A contributed to an improvement in individual motor skills, such as the strength of the lower and upper body and aerobic endurance.

KEY WORDS: physical fitness, seniors, ageing, population of third age, quality of life, physical health, agility, strength, aerobic endurance, dynamic balance

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Introduction

The ageing process is an important issue that is increasingly under discussion. In Poland, seniors are destined to constitute a significant part of the society that will be continually growing up to 2050. This is confirmed by, among others, quantitative data of the Demographic Yearbooks, which indicate the dynamic growth in numbers of people over 65, for example, the number of people aged 65–69 increased from 1,359,800 in 2010 to over 2,161,800 in 2015 (Demographic Yearbook 2014, 2015).

Poland has found itself at a time of demographic development, in which even an increase in the fertility rate to the level of simple generation replacement will not reverse the progressive ageing of the population structure in a short period of time.

As a result, according to a forecast by the Central Statistical Office, by 2050 the percentage of people aged 65 and over will exceed 30% (GUS 2014). Also, foreign reports leave no doubts about the ageing of society on a global scale (WHO 2015, European Commission and Economic Policy, 2014, United Nation DESA 2001).

Demographic changes resulting in a significant increase in numbers of older people and extension of life expectancy have resulted in the need for deeper analysis and research into various aspects of the living situation of older people and any actions taken by them to maintain and preserve fitness and independence, and physical activity appropriate for age and health condition is one of the ways of mitigating the ageing process and delaying the onset of ageing processes. Physical exercise is a tool to prevent many functional problems and is an important preventive factor in maintaining cognitive functions and preventing dementia. Above all, however, it allows people to maintain good physical condition, and thus greater independence in old age.

The general aim of the study was to assess the level of functional physical fitness of men and women aged 65 and over, as a result of participation in a physical activities program conducted by Universities of the Third Age.

A secondary aim was in estimating the direction of changes in functional physical fitness studied as a result of participating in a physical activities program Universities of the Third Age.

Methods and procedures

The Functional Senior Fitness Test by Rikli and Jones (1999) was used to objectively analyse the level of functional physical fitness in the study group. The presented physical fitness test for elderly people is recommended by the International Council for Sports Science and Physical Education as exceptionally useful in the multidimensional assessment of physical fitness of people over 60 (Osiński 2013).

In order to ensure the comfort of performing individual tests as part of the Functional Senior Fitness Test, the tests were carried out in gyms of municipal sports and recreation centres, training rooms in community centres and in fitness club rooms. The testing of the level of functional physical fitness of seniors was preceded by a 10-minute warm-up and a presentation of the individual tests in the Functional Senior Fitness Test. The task was carried out by a properly trained team of researchers from the Faculty of Physical Education at the University of Rzeszów. The course of the tests is presented in Figure 1.

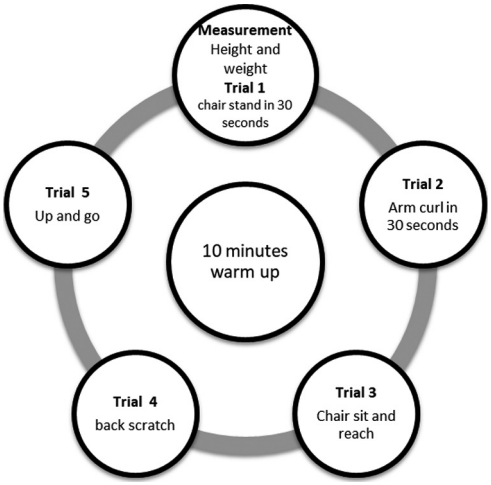

Fig. 1. Procedure for the course of examining individual tests in the Functional Senior Fitness Test (Rikli and Jones 2013). Test 6 – a 6-minute rectangle walk – was carried out by a senior after doing tests 1 to 5

The main condition for the inclusion of seniors in the study was an age of 65 and over, subjective good health and voluntary written consent to participate in the study. There was no risk to health during the tests, as they are non-invasive and conducted in accordance with the methodology adopted by the authors of the Functional Senior Fitness Test (Rikli and Jones 2013).

The research on the level of functional physical fitness was carried out both among men and women aged 65 and over (104 men – 29% of the respondents and 251 women – 71% of the respondents), in total 355 people who are members of the Universities of the Third Age in Rzeszów, Mielec, Jasło, Zamość, and Seniors' Clubs in Rzeszów, Stalowa Wola, Przemyśl, Krosno and Lubaczów (Table 1).

The average age in the study group is over 71 years. The youngest person under study was 65 years old and the oldest was 88 years old. More than half of the surveyed group was in the age group of 65–69 (52.7%), while only 10.4% were seniors in the age group of 80 and over.

Data analysis was carried out using the Statistica 12 program. The data processing and analysis consisted in appropriate grouping and presentation in tabular and graphic form. Data analysis was performed using selected methods of descriptive statistics. Measurable features were characterized by: arithmetic mean – the average level of the variable, the largest (maximum) and smallest (minimum) value, standard deviation (s) – a measure of the "average" deviation from the mean value.

The list of descriptive statistics was supplemented with an assessment of the significance of differences between women and men. Due to large deviations from the normal distribution of numerical results, the non-parametric

Table 1. Characteristics of the groups for fitness test by number of persons and the location of the tests

Group	Number	Percentage
Rzeszów (UTA Rzeszów, Church's Senior Club „Dominikanie")	102	28.7
UTA Jasło	67	18.9
UTA Mielec	59	16.6
UTA Zamość	46	13.0
SC Lubaczów	29	8.2
SC „Polanka" Krosno	22	6.2
Senior Community in Przemyśl	17	4.8
SC „Promyk" Stalowa Wola	13	3.7

Mann-Whitney test was used for most tests. The significance of the differences between the results for women and men was assessed separately for each age group.

Descriptive statistics were used for repeated studies on functional fitness, and the differences between studies I and II were assessed with the Wilcoxon test. Due to the large number of variables analysed, the results of 3 (out of 6) test were presented which showed a statistical significance in the test probability values calculated using the Mann-Whitney and Wilcoxon tests.

Results

Due to the lack of developed results for individual tests for the Polish population, the results of our own research and their analysis were compared to the values of the results of Rikli and Jones (2013) with a slight modification (units of length in the United States of America were converted to Polish units of length).

Because of the large number of analysed variables, the most important results from the Functional Senior Fitness Test performed were presented. Table 2 shows the results of the first test of the

Table 2. Statistical characteristics of lower body muscle strength taking into account the age and sex of the respondents

Age group	30-s chair stand (s)								*p*
	Sex								
	female				male				
	$\bar{x}$	*s*	min	max	$\bar{x}$	*s*	min	max	
65–69	14.4	3.9	4	27	17.1	5.7	8	33	0.0040**
70–74	13.9	3.2	6	22	14.7	5.8	7	30	0.7794
75–79	14.9	4.7	5	32	14.5	5.5	7	27	0.4733
80 and over	10.1	3.1	5	16	13.7	4.8	5	26	0.0078**

Table 3. Statistical characteristics of upper body flexibility taking into account the age and sex of the participants

Age group	Back scratch (cm)								*p*
	female				male				
	$\bar{x}$	*s*	min	max	$\bar{x}$	*s*	min	max	
65–69	−7.3	10.5	−50	10	−11.6	11.4	−36	13	0.0170*
70–74	−6.4	9.9	−31	10	−14.9	13.7	−36	8	0.0066**
75–79	−8.8	10.7	−35	7	−25.1	8.7	−47	−8	0.0000***
80 and over	−17.9	15.9	−52	4	−21.3	15.7	−50	1	0.5716

Table 4. Statistical characteristics of aerobic endurance, taking into account the age and sex of the participants

Age group	6-min walk (m)								*p*
	female				male				
	$\bar{x}$	*s*	min	max	$\bar{x}$	*s*	min	max	
65–69	477.8	97.6	214	818	537.4	94.7	360	750	0.0007***
70–74	464.1	81.2	291	620	533.9	104.2	280	700	0.0011**
75–79	471.4	83.7	300	625	421.6	108.1	235	620	0.1355
80 and over	364.4	95.8	210	540	483.9	157.0	160	800	0.0037**

Functional Senior Fitness Test. The differences between the results for women and men were found in the age group of 65–69 and 80 years and more. In both of these comparisons, men obtained higher scores.

The table below shows the distribution of the results for assessing upper body flexibility. Only in the oldest age group does sex not differentiate the result in the test in question. In the remaining age groups, men obtained lower results.

In the test of aerobic endurance (Table 4), women obtained significantly lower results in almost all age groups (only in the 75–79-year-old group were there no statistically significant differences).

This research included two studies to assess the level of functional physical fitness of people over 65 using the Functional Senior Fitness Test among seniors who are members of Universities of the Third Age and participating in physical activities.

Two charts present a graphic illustration of the results. Using a scatter plot, the results of the tests for the same participants in two different studies were compared. The box-whiskers chart shows the average performance test score in both studies, along with the typical range of variation and range of values (i.e. lowest and highest values).

The Lower Body Muscle Strength Test "30-second chair stand" showed different results in Studies 1 and 2 (Table 5; Figure 2a, 2b). Based on the Wilcoxon test (p = 0.0109*), it can be concluded that the effect of the classes conducted at U3A was statistically significant. On average, the results of this test increased by 0.6 repetitions.

Table 5. Comparative analysis of the preliminary test (study 1) and repeated test (study 2) – Lower Body Muscle Strength Test

30-second chair stand	$\bar{x}$	s	min	max
preliminary test (study 1)	15.5	4.5	8	30
repeated test (study 2)	16.1	4.5	9	30
significance of differences (p = 0.0109*)	0.6	2.0	−4	4

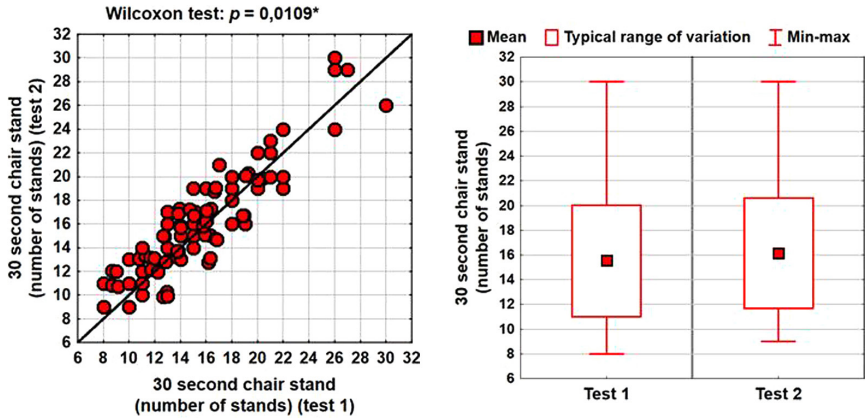

Fig. 2a–b. Comparative analysis of the preliminary test (study 1) and repeated test (study 2) – lower body muscle strength test, shown in scatter plot and box-whiskers chart

Table 6. Comparative analysis of the preliminary test (study 1) and repeated test (study 2) – Upper Body Muscle Strength Test

30-second arm curls	$\bar{x}$	s	min	max
preliminary test (study 1)	15.6	4.0	8	28
repeated test (study 2)	16.7	4.0	8	28
significance of differences (p = 0.0000***)	1.0	2.1	–4	9

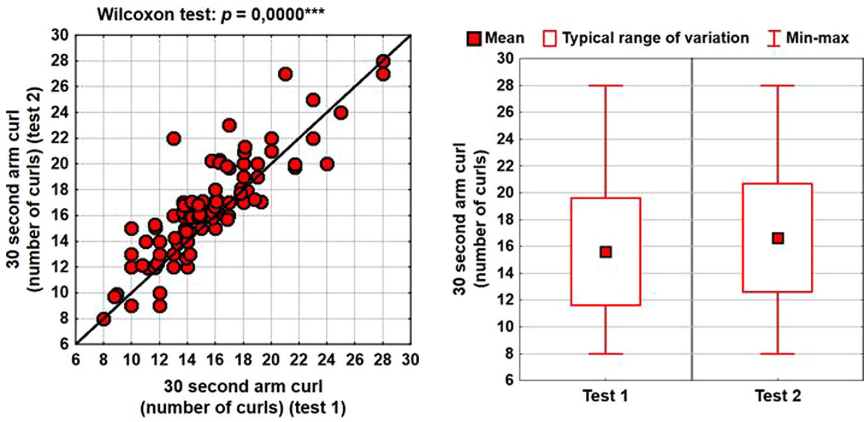

Fig. 3a–b. Comparative analysis of the preliminary test (study 1) and repeated test (study 2) – upper body muscle strength test, shown in scatter plot and box-whiskers chart

Table 7. Comparative analysis of the preliminary test (study 1) and the repeated test (study 2) – aerobic endurance test

6-minute walk [m]	$\bar{x}$	Me	s	min	max
preliminary test (study 1)	511.8	516	96.5	305	818
repeated test (study 2)	525.5	520	95.3	315	845
significance of differences (p = 0.0001***)	13.7	10	36.4	−113	150

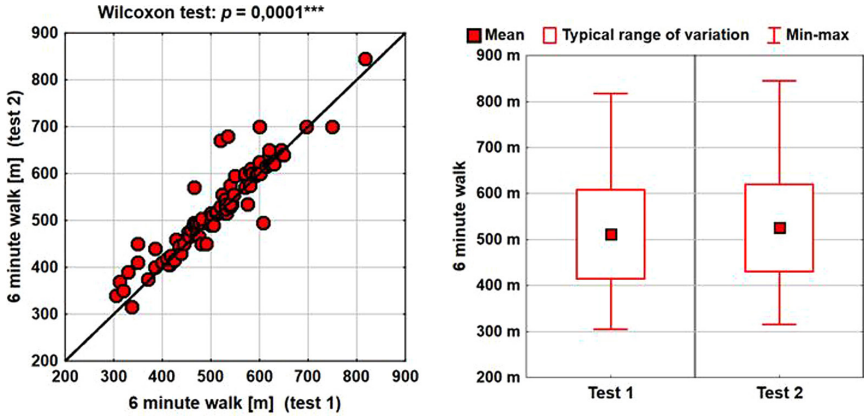

Fig. 4a–b. Comparative analysis of the preliminary test (study 1) and the repeated test (study 2) – aerobic endurance test, presented in shown in scatter plot and box-whiskers chart

Also, the Upper Body Strength Test "30-second arm curls" confirms the significant effect of participating in the movement classes conducted at the U3A ($p = 0.0000^{***}$). In study 2, the test result increases by approximately 1.0 repetition (Table 6). As presented in the chart, in the vast majority of people, a higher result was recorded in study 2 (Figure 3a, 3b).

A significant (test probability value $p = 0.0001^{***}$) difference in the repeated test was obtained for the 6-minute walk test. The average distance travelled increased by approx. 14 m, and the improvement concerned the vast majority of people (Table 7; Figure 4a, 4b).

In the remaining results of the Functional Senior Fitness Test, there are no grounds for concluding a significant impact of seniors' physical activity classes on the flexibility in upper and lower parts of the body, agility and dynamic balance.

Discussion

Demographic changes resulting in a significant increase in the numbers of older people, longer life expectancy and an increase in the number of professionally inactive people constitute a significant challenge for society. In the coming years in Poland, seniors will constitute a significant part of the society which will continually grow. Therefore, there is a need to tackle issues related to health, quality of life, and physical activity of the elderly in order to slow down ageing processes and senilism.

Kozdroń emphasizes that physical activity plays such an important role that it should be talked about as a human need. Physical exercise is a tool that prevents many functional problems and is an important preventive factor in maintaining cognitive functions and preventing dementia (Kozdroń 2014).

An optimal level of physical fitness of seniors is necessary in order to maintain self-reliance, and above all, independence in everyday activities on many levels of social life. Against the background of the progressive ageing of the population, determining the level of functional physical fitness becomes important in order to be able to assess it in a regional and global perspective and to apply the necessary measures to maintain or improve seniors' physical fitness. A suitable tool for assessing the level of physical fitness is the test battery developed by Jones and Rikli (1999) at California State University. The test proposed by these authors determines the properties necessary to maintain seniors' daily activity. Individual tests do not require specialized equipment and are easy for a senior to perform.

Functional activity has been examined in relation to various types of assessments in several European and non-European populations (Ignasiak et al. 2017; Kopkane – Plachy et al. 2012; Adamo et al. 2015; Chen et al. 2009; Król-Zielinska et al. 2006; Kuo 1990; Marques et al. 2014; Rikli and Jones 1999b; Rodrigues-Barbosa et al. 2011).

In analysis 677 people (355 people were analysed for this study) took part in tests of the functional performance of seniors in the territory of South-eastern Poland. Such a large study cohort provided the basis for assessing the functional fitness of senior citizens from South-eastern Poland, and for comparing this research with other parts of Poland.

It should be noted that physical fitness levels and state of health are informed by several factors, such as the education, lifestyle and social conditions of the seniors. It can be argued that seniors voluntarily

taking part in social and socio-intellectual activities proposed by Universities of the Third Age and Seniors' Clubs, as a rule, are still active in many areas of social life. However, it should be noted that Universities of the Third Age or Seniors' Clubs are not representative of Polish seniors over 65 years of age. Older people from other social backgrounds should also be taken into account. The authors' studies presented in this article may generate further analysis for fostering a reliable and multidimensional assessment of seniors' physical performance, and in selecting appropriate methods for optimizing healthy ageing in seniors.

Wiącek and Zubrzycki conducted functional physical fitness tests using the Functional Senior Fitness Test among women from south-eastern Poland (mean age 78.6). Comparing the individual results of our own research tests, it can be concluded that the average values of the results of muscle strength in the upper and lower parts of the body are higher for seniors in the age range of 65–79 years compared to the research conducted by the authors mentioned. However, the seniors in our own research showed lower mean values of the results in flexibility of upper and lower parts of the body (excluding the 70–74 age group in the "back scratch" test) (Wiącek and Zubrzycki 2006).

Zielińska-Król et al. applied the Functional Senior Fitness Test among 274 seniors from Poznań and compared the results obtained with values obtained by American seniors in particular age groups. The authors of the study did not find any significant differences between the seniors in terms of muscle strength, aerobic endurance and body flexibility. Moreover, in the older age categories (80 years and older), the muscle strength scores for the upper and lower body are higher than that of their American peers. Among men, no significant differences were found in individual tests, except for upper body flexibility (in the age group 70–79 years) and agility and dynamic balance (in the age group 60–69 and 70–79). Comparing the mean values of individual test trials obtained by seniors from Poznań with the values presented in this article, we can draw the following conclusions: higher mean values of muscle strength in the lower and upper body, aerobic endurance, agility and dynamic balance were obtained by seniors in our own research in the age group 70–79. In terms of upper and lower body flexibility, the seniors from our own research showed lower results in each age group. It is noteworthy that among the surveyed seniors from each age group, the results of the mean values of individual tests were higher or close to the mean values obtained by the seniors from Poznań. The exceptions are the values obtained for the upper body flexibility among men, where the seniors from Poznań obtained much better results (Zielińska-Król et al. 2006).

The results of studies by Ignasiak et al. carried out among 31 women (mean age 67) indicate that the seniors obtained by far the lowest results in the test of aerobic endurance. More than half of the seniors obtained results below the assumed values of Rikli and Jones. Our own research showed that results below the value of Rikli and Jones were recorded in the following tests: "back scratch", "8-foot up-and-go" and "6-minute walk" indicating the level of aerobic endurance of seniors (Ignasiak et al. 2011).

The assessment of the functional physical fitness of seniors aged 60 – 70 who participated in the classes offered

by the U3A at the University of Physical Education in Wrocław and the Art Academy of the Third Age (ASTW) showed in most of the respondents parameters consistent with the values of the Rikli and Jones results with the exclusion of aerobic endurance in the ASTW group (only 25% of the seniors exceeded the minimum values). The conducted analysis of the results of our own research showed parameters lower in individual tests (in the age group 65–69) compared to senior women from the above-mentioned institutions (Prystupa et al. 2012).

Also among the students of the Almamer U3A in Warsaw (in the age group 65–69), the individual values of the arithmetic mean obtained in the tests of upper body muscle strength, flexibility, agility and dynamic balance turned out to be higher than the results of the seniors participating in our own research (only the average values in lower body strength test are similar – U3A Warsaw: 15.3 repetitions; senior women of the presented dissertation: 14.4). The analysis of the research conducted among Warsaw seniors did not show any significant statistical influence of age on individual tests of the level of physical fitness. In the presented study, statistically significant differences were found in relation to the age of the seniors in the test of physical fitness concerning upper body muscle strength. Upper body muscle strength decreases with the age of the respondents (Zdrodowska et al. 2012).

A comparative analysis of the results of the Functional Senior Fitness Test for the students of the U3A and the Seniors' Club conducted at the Functional Research Laboratory of the Faculty of Physiotherapy of the University of Physical Education in Wrocław showed no statistically significant differences between the study groups (mean age 69.5 years). U3A students showed better flexibility and muscle strength in the lower body, agility and dynamic balance, and greater endurance, while Seniors' Club members showed the opposite: better flexibility and strength in the upper body muscles. This may indicate a different level of functional physical fitness of seniors and the need for research on a national scale (Dziubek et al. 2014).

Jones and Rikli conducted a study on a group of seniors, which consisted of 7183 participants (aged 60–94). The results showed that in all tests and most age groups, there was a gradual decline in body performance between the ages of 60 and 94 (Jones and Rikli 2000). Males performed better than females in measures of muscle strength, aerobic endurance, and agility and dynamic balance tests. Females showed higher scores than males in upper and lower body flexibility tests (Jones and Rikli 1999).

Comparative analysis of our own research with the results of American seniors showed similar mean values of lower body muscle strength both among women and men, and in the age group 75–79 in women and in the age group 65–69 in men the Polish seniors achieved higher results. In the age group 65–69 and 75–79 in both sexes, the values obtained by seniors from our own research on the strength of the muscles of the upper body are also similar to the values presented in the results of the research conducted by the authors of the test. The seniors in our own research obtained significantly lower values in flexibility of the upper and lower body in all age groups of both sexes. As among American seniors, women showed better flexibility in upper and lower parts of the body (Jones and Rikli 1999).

Research by Adamo et al. also confirms the fact that the results of muscle strength in upper and lower parts of the body among elderly women from the American population are similar to the results of our own research. However, senior women in the American population showed higher results in flexibility of upper and lower parts of the body (Adamo et al. 2015).

Also the analysis of Zieliński's results among 1017 women (mean age 73.19) and 779 men (mean age 72.15) over 64 years of age from all over Poland showed significantly lower results in the lower and upper body flexibility test in both sexes than in their American peers. In the assessment of the strength of the muscles of the lower body, as in the analysis of our own research, the differences in relation to American seniors are smaller. In the assessment of agility and dynamic balance as well as aerobic endurance, Poles also obtained lower results (Zieliński 2005).

The analysis of the results of individual Functional Senior Fitness Test trials among seniors in Wrocław: 125 men (age 60 – 85.5) and 431 women (age 60 – 87.1) showed that Poles of both sexes are on average fitter in the upper and lower muscle strength tests in all age groups compared to the American population. The differences in aerobic endurance among women are slight, and men from Poland walk the greater distance in 6 minutes (except for a small group aged 80 and over). Polish and American seniors of both sexes do not differ in agility and dynamic balance. Similarly, there are no differences in the flexibility tests of upper and lower parts of the body among women. A comparative analysis of our own research confirms a lower level of functional physical fitness compared to Wrocław seniors in all tests and age groups (Ignasiak et al. 2017).

The level of physical fitness of the respondents was differentiated between age and sex. A higher level of physical fitness was more often presented by men compared to women, and younger over older. This regularity is conditioned by sociometric factors.

In the presented article, an analysis of the impact of the physical activities offered by the U3A (where the dominant form was gymnastics, Nordic walking and swimming pool sessions) on the level of functional physical fitness among seniors regularly participating in various forms of physical activity was carried out. Seniors participating in the repeated study of functional physical fitness were selected in cooperation with sports (or recreation) instructors conducting gymnastics classes at Universities of the Third Age. Seniors regularly participating in the above activities took part in the study.

The analysis of the preliminary (study 1) and repeated tests (study 2) allows us to conclude that participation in physical activities at the U3A contributed to the improvement of individual motor skills, such as muscle strength in the lower and upper body and aerobic endurance (excluding body flexibility tests and agility and dynamic balance, both of which were similar).

The results of the conducted research are consistent with the results presented by Rutkowska et al., as exemplified by the students of U3A Warsaw, who take part in a physical activity program 2–3 times a week (mainly Nordic walking and gymnastics classes, also with the possibility of participating additionally in tai chi classes, swimming and dancing). The Wilcoxon test was also used to compare

the results of functional physical fitness tests. The mean values of the functional physical fitness tests at the beginning and at the end of the 4-month cycle of classes showed significant differences (excluding the results of the "30-s chair stand" test) (Rutkowska et al. 2011). Among seniors from U3A Biała Podlaska (age group 66 – 72), statistically significant differences were also noticed after participating in a 6-month program of physical activity in a test of muscle strength and flexibility of the lower and upper body (Niżnikowska 2014). A study by Kopkane-Plachy et al. among Hungarian seniors (mean age 67.1 years) also showed statistically significant differences in a test of aerobic endurance and lower body flexibility as a result of six months of participation in physical activities, especially among people participating in Pilates classes (Kopkane-Plachy et al. 2012). A seven-month participation in water gymnastic classes by seniors from the U3A in Jelenia Góra also confirms significant differences and improvement of selected motor skills under the influence of physical activity classes, such as aerobic endurance, muscle strength and flexibility of the lower body (Ignasiak et al. 2016). Functional physical fitness was also assessed by Kozdroń and Leś among women aged 65–75 participating in a Program for Movement Recreation for Elderly People. The analysis of the results of 4 tests with the Functional Senior Fitness Test battery before and after the program showed an improvement in the value of all the tests used and allowed the researchers to draw a conclusion about the effectiveness of the proposed program to improve the functional fitness of seniors (Kozdroń and Leś 2010).

Rikli and Jones presented a model that leads to disability. They emphasize that not only disease or pathology lead to many limitations. but also sedentary lifestyle and the lack of physical activity may be responsible for the loss of functional fitness, which can lead to disability (Jones and Rikli 1999).

In connection with the above, the assessment of the functional physical fitness of seniors, taking into account the socio-economic conditions, is the basis for further analysis and development of appropriate health promotion programs in order to slow down ageing changes, maintain functional fitness and counteract the process of senilism.

Conclusions

1. The level of functional physical fitness in selected age groups is significantly differentiated by sex. A significantly higher level of functional physical fitness was presented by men in the test of muscle strength in upper and lower parts of the body, agility and dynamic balance, and aerobic endurance, while women showed higher results in flexibility of upper and lower parts of the body.
   The test probability value calculated using the Mann-Whitney test indicated that higher results were achieved in lower body muscle strength assessment among men in the youngest age group of subjects (65–69 years) and the oldest (80 years and older). In assessing upper body muscle strength relative to sex, men also achieved highly statistically significant results in the lower age group (65–69 years). An analysis of the lower body flexibility test showed significant differences between the results of both sexes in the 70 – 74 years age group ($p<0.001$). The upper body flexibility

assessment indicated that only in the oldest age group were the results not differentiated by sex (as they were in the age groups 65–69 years, 70–74 years, 75–79 years). In the oldest age group women achieved higher results. Only the oldest age group, 80 years and older, varied in a statistically significant way by sex in the test of agility and dynamic equilibrium test. In relation to the assessment of sex-related aerobic strength, in which women led in almost all age groups (65–69 years, 70–74 years, 80 years and above), in the 75–79 year age group the women achieved significantly lower scores.

2. The analysis of the results of the preliminary (study 1) and repeated (study 2) functional fitness level allows us to find significant differences in the results of the Functional Senior Fitness Test. It is worth noting that regular participation in programmed physical activities organized at the U3A contributed to an improvement of individual motor skills, such as lower and upper body strength and aerobic endurance.

   Based on the result of Wilcoxon's test, it can be concluded that the effect of Universities of the Third Age classes was statistically significant in lower body strength test results. The results of this test showed an increase of 0.6 repetitions. Also, the upper body strength test enabled the researchers to determine the significant effect of participating in exercise classes conducted at Universities of the Third Age. In study 2, the result of the test increased by approximately 1.0 repetition. A significant difference in the repeated test was obtained for the 6-minute walk test. On average, the distance travelled increased by about 14 m and the improvement affected a majority of people.

The Authors' contribution

KS, RG, WC designed the research, developed the project concept research plan for the South-east of Poland. KS developed the data collection plan and provided study oversight of the trial in the field. KS, RG analysed data, wrote the paper and had responsibility for the final content. All authors read and approved the final manuscript.

Conflict of interest

The authors declare that there is no conflict of interest.

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