e-ISSN 2544-1620

Medical Science Pulse 2019 (13) 3

Original papers

DOI: 10.5604/01.3001.0013.5540

PHYSICAL ACTIVITY, PHYSICAL FITNESS AND QUALITY OF LIFE OF THE UNIVERSITY OF THE THIRD AGE STUDENTS

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A – study design, **B** – data collection, **C** – statistical analysis, **D** – interpretation of data, **E** – manuscript preparation, **F** – literature review, **G** – sourcing of funding

ABSTRACT

Background: Physical activity (PA) has a positive effect on human health at all ages and it is especially important in older people. When insufficient, it may lead to the deterioration of a person's health status.

Aim of the study: The aim of the study was to assess the declared PA of the Universities of the Third Age (U3A) students and to examine the relationship between the level of PA, physical performance, and quality of life in this population.

Material and methods: The study included 99 subjects, aged ≥60 years, with a Mini Mental State Examination score ≥24. Participants were examined using the International Physical Activity Questionnaire (IPAQ), the Short Form Health Survey (SF-36) questionnaire, the Short Physical Performance Battery (SPPB), the Activities of Daily Living scale (ADL), the Lawton Instrumental Activities of Daily Living scale (IADL), and the short form of the geriatric depression scale (GDS). Handgrip strength (HS) was measured using the baseline hydraulic dynamometer.

Results: Statistically significant differences in the results of women and men were demonstrated in 5 variables: the level of PA measured with the IPAQ, physical component summary of the SF-36 questionnaire, the total SPPB score, HS of the dominant hand and the non-dominant hand. In all examinations, men obtained higher scores than women. Positive correlations between PA and the result of the ADL, IADL, SPPB, HS and physical component summary of the SF-36 questionnaire were shown.

Conclusions: The study confirmed that the participants of the U3A classes mostly meet the recommendations regarding minimum PA and they willingly undertake regular PA. It translates into high functional and physical fitness, stronger muscles and a good QoL.

KEYWORDS: physical activity, University of the Third Age, quality of life, elderly people, physical fitness

Background

Physical activity (PA) has a positive effect on human health at all ages [1,2], and it is especially important in older people. Regular PA improves quality of life (QoL) [3], helps maintain normal body weight, reduces the risk of cardiovascular diseases, type II diabetes [4], sarcopenia [5], protects against the onset of depression [6] and positively affects cognitive function [7]. It is also considered as a factor that reduces the risk of death in older people [8].

Nowadays, older people want to remain active after having retired. They wish to perform social functions, develop their interests and knowledge, and, above all, maintain their independence for as long as possible. Intellectual and physical activity, adapted to the current state of health, is crucial to achieve these goals. Thanks to Universities of the Third Age (U3A), such goals are possible to attain and people who have retired can further develop their passion, interests and meet new people. U3A offer classes that allow to shape intellectual and motor skills. Participants can individually

choose the class that interests them as the range of offered physical activities is wide and includes gymnastics, water exercises, pilates, yoga, dancing and nordic walking [9–11].

According to the World Health Organization (WHO) [12] people aged ≥65 years should undertake 75 minutes of vigorous-intensity aerobic PA throughout a week, or 150 minutes of moderate-intensity aerobic PA throughout a week, or an equivalent of a combination of both types of activities. The WHO also recommends muscle-strengthening activities twice a week and balance exercises at least 3 times a week for people with reduced mobility. If, however, a person's health poses some limitations, this physical activity should be adjusted individually but kept at the highest level possible for a given person.

According to a Eurobarometer survey published in 2018, more than 50% of Europeans aged ≥15 years do not undertake any vigorous-intensity PA, and 47% do not engage in any moderate-intensity PA. Only 30% of Europeans aged ≥ 55 years declare taking PA with a certain regularity, and as many as 61% do not engage in any form of PA [13]. In the surveys carried out in Poland by the Public Opinion Research Centre, CBOS, less than 50% of Polish residents aged ≥55 years declare doing some PA [14]. The 2017 Kantar Public survey shows that the percentage of Polish people who meet WHO standards regarding PA decreases with age and amounts to 8% for a group of 60-69 year olds [15].

Aim of the study

Insufficient PA of older people may be a reason for deteriorating health status. The aim of the study was to assess the PA of older people attending classes at U3A and to examine the relationship between the level of PA, physical performance, and quality of life in this population.

Material and methods

The study was carried out from December 2017 to December 2018 and included a total of 99 students of the U3A from Wielkopolska Region. The inclusion criteria were age ≥60 years (the retirement age for Polish women), functional capability of at least one hand and cessation of professional activity. The only exclusion criteria was a score ≤23 in the Mini Mental State Examination (MMSE) adjusted for age and education. The study was carried out once for each subject by the same researcher. Written informed consent was obtained from all participants.

To assess the level of PA of respondents, a short Polish version of the International Physical Activity Questionnaire (IPAQ) was used [16]. The tool contains 7 questions regarding all types of PA lasting at least 10 minutes at a time and the time spent in a sitting position. The respondents say how many days during the last 7 days they did PA and how much time a day they spent on those activities. The PA in the questionnaire are divided into two types: moderate-intensity activities described as the ones causing slightly faster breathing and increased heart rate, vigorous-intensity activities (causing very fast breathing and a very fast heart rate), and activity related to walking. IPAQ scores are expressed in MET/minute/week (Metabolic Equivalent of Work). Different types of PA are assigned a different value of MET: for walking activity it is 3.3, for moderate effort 4 and for vigorous activity 8. When expressing a given activity in MET/minute /week, the value of the coefficient is multiplied by the number of days in which it is performed and by its average duration. The weekly score for a given patient is presented by summing the results of each type of activity. On this basis the respondents can be classified into three groups according to their level of PA, as shown in Table 1.

To assess the QoL, a Polish version of the SF-36 (Short Form Health Survey) questionnaire was used (license: QM039604). This tool assesses a person's health in a subjective way in a physical dimension (Physical Component Summary, PCS) and a mental one (Mental Component Summary, MCS) [17]. It contains 36 questions that evaluate 8 components: physical functioning, role physical, bodily pain, general health, vitality, social functioning, role emotional and mental health. Each answer provided by a patient is evaluated according to the key, and the results are interpreted as follows: the higher the total score, the higher the QoL assessment [18].

Physical performance of participants was assessed using the Short Physical Performance Battery (SPPB). The SPPB consists of three tasks: standing up from a chair five times consecutively, a hierarchical test of balance and a short walk at a normal pace. Each SPPB component test is scored from 0 to 4 with a score of 0 representing inability to perform the test and a score of 4 representing the highest category of performance.

Table 1. Classification physical activity intensity. Based on the weekly scores of the International Physical Activity Assessment Questionnaire expressed in MET/min/week

High	Moderate	Low
3 or more days of vigorous-intensity physical activity, 1500 MET / min / week or 7 days of physical activity, combining all types, with a value of over 3000 MET/ min/week	3 or more days of vigorous-intensity physical activity, minimum 20 min a day or 5 or more days of moderate-intensity physical activity or walking minimum 30 min a day or 5 or more days of any activities combined, exceeding 600MET / min / week	lack of any activity or failure to meet other criteria

Abbreviations: MET, Metabolic Equivalent of Work.

The maximum number of points is 12 and indicates the best body function [19].

The handgrip strength was tested using the Baseline hydraulic dynamometer. The results were collected in a digital form using Hercules software (CRI Jolanta) and they were expressed in kilograms. The measurement was performed in accordance with the recommendations of the American Society of Hand Therapists (ASHT) [20]. During the measurements, the subject was sitting in a chair without a back or armrests, with feet resting on the floor, parallel to each other, hip and knee joints set at right angles, arms adducted and touching the torso, elbow joint bent to 90°, forearm in a neutral position, and wrist straightened in the range of 0° to 30°. The subject performed their strongest handgrip and held it for 6 seconds. Each of the hands was tested three times, with a one-minute break between each measurement. The mean result from those three measurements was used for further analysis.

The Activities of Daily Living scale (ADL) was used to measure independence of activities of daily living such as bathing, dressing, toileting, transferring, continence, and feeding. Patients receive 1 or 0 points for independence in each function [21]. More complex skills were assessed using the Lawton Instrumental Activities of Daily Living scale (IADL), which consists of 8 domains. The subject receives 3 points when he performs the activity independently, 2 with a little help and 1 when he is unable to perform the given activity [22].

The short form of the geriatric depression scale (GDS) was used to identify the risk of depression. It consists of 15 questions and assesses the mood and motivation of the subject in relation to the last 2 weeks. A threshold score of 5 points indicates an increased risk for depression [23]. MMSE was used as the screening test for cognitive impairment [24].

The Body Mass Index (BMI) value was calculated based on the height and weight measurements. Interpretation of the index was made after taking into account the correction for age. For the subjects aged 55-65, a BMI of 23-28 was accepted as the norm, and for subjects 65 years old and more it was set at 24-29 [25].

Statistical analysis was performed using Statistica 12. The Shapiro-Wilk test was used to check the normality of the distribution. Quantitative variables are presented as mean (m) and standard deviation (SD). Due to the non-parametric distribution of some variables, median (M) and range of parameters have been taken into account. Mann-Whitney U test, Kruskal-Wallis test and Correlation of Spearman were used in the analysis. The p-value of <0.05 was considered statistically significant (ss).

Results

99 volunteers participated in the study: 88 women and 11 men, aged 60-90 years old. Statistically significant differences in the results of women and men were demonstrated in 5 variables: the level of PA measured with the IPAQ (p=0.004), PCS of the SF-36 test (p=0.008), the total SPPB score (p=0.003) and the grip strength of the dominant hand (p=0.00007) and the non-dominant hand (p=0.0005). In all examinations, men obtained higher scores than women. The characteristics of the studied group are presented in Table 2.

The average PA of the participants was 1751 (± 799) MET min/wk. In less than 79% of subjects PA was defined as moderate, in 13% as high, and in 8% low. Positive correlations between PA and the result of the ADL scale ($p = 0.022$, $r = 0.23$) and IADL ($p = 0.000059$, $r = 0.392$) were shown. Physical fitness measured by the SPPB also positively correlated with the results of the IPAQ ($p = 0.006$, $r = 0.276$). The same dependence was observed in relation to the grip strength of the dominant hand ($p = 0$, $r = 0.540$) and the non-dominant one ($p = 0$, $r = 0.535$). In the SF-36 questionnaire only the PCS positively correlated with PA ($p = 0.004$, $r = 0.288$).

People whose PA was below the norm obtained a lower number of points in the IADL scale, compared to people who were moderately and highly active (p=0.006, p=0.015). A similar dependence was found in the SF-36 PCS as people who were physically inactive assessed their QoL worse than those who were moderately and highly active (p=0.001, p=0.0004). The results of the SPPB were significantly lower in the low-activity group compared to the high-activity group (p=0.034). The grip strength of the non-dominant hand was higher in subjects who were moderately and highly physically active (p=0.01, p=0.0004). In the results of the dominant hand a statistically significant difference was found in the juxtaposition of low activity and high activity groups ($p = 0.012$). Detailed results are presented in Table 3.

Discussion

A low level of PA in older people is a global problem. 45% of people who are over 60 years old do not meet the norms of PA [26]. In this study recommendations regarding PA were met by almost 92% of the participants. Such high PA may stem from the fact that the participants of the study were recruited among the students of the U3A where various physical activities are offered.

Sun et al. showed in a systematic review that the percentage of active older people ranged between 2.4-83% and that men were more active than women, which was also shown in our study [27]. A high percentage of people who meet WHO standards in our study may be caused by the use of a subjective questionnaire – IPAQ. In a review, Prince et al. [28] compare direct measures with self-reporting measures but they do not recommend any of them. Such questionnaires as IPAQ have advantages as they are easy, cheap and they are not problematic for the participants. Zając-Gawlak achieved high scores in the research on PA among U3A students [9]. The study checked the level of activity of 104 U3A students by counting the daily number of steps using an accelerometer. Most of them did more than 10,000

Table 2. Characteristics of the studied group

parameter	total n=99	women n=88	men n=11	p value
age (years) m ± SD	72 ± 7	72 ± 7	74 ± 7	0.343
BMI (kg/m^2) m ± SD underweight n (%) normal weight n (%) overweight n (%)	28.02 ± 4.4 18 (18.2) 40 (40.4) 41 (41.4)	27.9 ± 4.4 16 (18.8) 35(39.8) 37(42)	28.3 ± 4.5 2 (18.8) 5(45.5) 4(36.4)	0.528
diseases: n (%) – musculoskeletal – cardiovascular – diabetes – cancer – thyroid diseases – Parkinson's disease – COPD number of diseases M (range)	 65 (65.7) 60 (61.3) 11 (11.1) 13 (13.1) 15 (15.2) 1 (1) 5 (5.1) 2 (0-4)	 60 (68.2) 54 (61.4) 11 (12.5) 11 (12.5) 15 (17) 1 (1.1) 4 (4.5) 2 (0-4)	 5 (45.5) 6 (54.5) 0 (0) 2 (18.2) 0 (0) 0 (0) 1 (9.1) 1 (0-2)	 0.073
ADL (points) M (range)	6 (1-6)	6 (1-6)	6 (5-6)	0.973
IADL (points) M (range)	8 (0-8)	8 (0-8)	8 (0-8)	0.241
SPPB TOTAL (points) M (range)	7 (0-12)	7 (0-12)	12 (4-12)	0.003ss
GDS (points) M (range) 0-5 n (%) >5	3 (0-9) 88 (88.9) 11 (11.1)	3 (0-9) 78 (88.6) 10 (11.4)	1 (0-7) 10 (90.9) 1 (10.1)	0.052
SF-36 PCS (points) M (range)	39.6 (12.6-68.5)	38.1 (12.6-68.5)	48.7 (16.8-54.9)	0.008ss
SF-36 MCS (points) M (range)	55.7(11-77.6)	54.3 (11-77.6)	58.4(42.5-77.6)	0.202
IPAQ (MET) m± SD low n (%) moderate n (%) high n (%)	1751 ± 799 8 (8.08) 78 (78.8) 13 (13.1)	1659,3 ± 753,8 8 (9.09) 71 (80.68) 9 (10.23)	2484.1 ± 804.2 0 (0) 7 (63.64) 4 (36.36)	0.004ss
HS dominant (kg) m ± SD	22.7 ± 5.8	21.7 ± 4.8	30.7 ± 7.1	0.00007ss
HS non-dominant (kg) m ± SD	21.1 ± 6,1	20.2 ± 5.3	28.1 ± 7.8	0.0005ss

Abbreviations: m, mean; SD, standard deviation; M, median, BMI, Body Mass Index; COPD, Chronic obstructive pulmonary disease; ADL, Activities of Daily Living; IADL, Instrumental Activities of Daily Living; SPPB; Short Physical Performance Battery; GDS, Geriatric Depression Scale; PCS, Physical Component Summary; MCS, Mental Component Summary; IPAQ, International Physical Activity Questionnaire; HS, handgrip strength; ss, statistically significant.

Table 3. Average test scores results obtained by volunteers with different levels of physical activity

parameter	low pa m ± SD	medium paa m ± SD	high pab m ± SD	p value
ADL points	5.6±0.5	5.8±0.7	6±0	a0.574 b0.503
IADL points	4.5±2.7	7.2±2	7.4±1.5	a0.006ss b0.015ss
SPPB points	4.5±3.4	7.4±3.8	8.9±3.5	a0.148 b0.034ss
SF-36 PCS points	22.5±7.6	39.7±11.4	44±9.5	a0.001ss b0.0004ss
SF-36 MCS points	53.9±19	51.8±12.6	56.4±8.6	a1 b1
GDS points	3.7±2.6	2.8±2.2	1.5±1.7	a0.951 b0.108
HS dominant kg	18.7±5.3	22.5±5.2	26.7±7.6	a0.222 b0.012ss
HS non-dominant kg	14.5±7.2	21±5	25.5±7.7	a0.01ss b0.0004ss

Notes: aa comparison of the moderate activity group with the low activity group, b b a comparison of the high activity group with the low activity group.

Abbreviations: PA, physical activity; m, mean; SD, standard deviation; ADL, Activities of Daily Living; IADL, Instrumental Activities of Daily Living; SPPB; Short Physical Performance Battery; GDS, Geriatric Depression Scale; PCS, Physical Component Summary; MCS, Mental Component Summary; HS, handgrip strength; ss, statistically significant.

steps and thus met the standards of the American College of Sports Medicine for cardiorespiratory exercises.

The study showed a correlation between the functional fitness of older people and the level of their PA. The ADL and IADL tests positively correlated with the results of the IPAQ. Paterson and Warburton also showed a positive effect of PA on the fitness and independence of older people. The aim of their study was to systematically review the relationship between PA of people aged 65 and older and their functional fitness,

disability or loss of independence. They showed that even regular aerobic exercise and short-term exercise programs decrease the risk of functional limitations and disabilities in old age [29].

The relationship between the HS and PA was researched by, among others, Cooper et al. [30] on a group of 65,582 people aged 60 years or older, using the IPAQ and the Jamar hydraulic dynamometer. In their study people who declared undertaking more moderate-intensity PA achieved higher values of the HS.

The correlation between physical fitness of people aged 65 years and older and PA was also studied by Yasunaga et al. [31]. The authors assessed daily PA using the accelerometer and divided this activity into time spent in a sedentary position, light PA (LIPA) and moderate- to vigorous-intensity PA (MVPA). However, physical fitness was assessed based on a HS, maximal and normal gait, "Stand up and go" test and standing on one leg with eyes open. The results of the study confirmed the beneficial effects of PA on physical fitness of older people, except for the HS. Researchers suggest that replacing sedentary behaviour or light-intensity PA with moderate- to vigorous-intensity PA for 10 minutes a day can improve the fitness of older people. This is confirmed by our research in which the participants with a moderate and high level of PA demonstrated better physical fitness measured by the SPPB and the HS.

Mijnarends et al. present PA as a factor preventing sarcopenia [32]. For 5 years the authors examined 2309 people aged 66-93 years and showed that in people declaring moderate and high level of PA the risk of sarcopenia was lower than in people with a low level of PA (OR = 0.64, 95% CI 0.45- 0.91). The group with an initial higher level of PA had stronger HS, greater muscle mass and faster gait. The meta-analysis conducted by Steffi et al. confirms an important role of PA in older people [5]. According to its authors regular PA (work-related, aerobic and muscle-strengthening activity) is crucial for healthy aging and decreases the risk of sarcopenia. Our research demonstrates a positive correlation between PA and the HS of the dominant and non-dominant hand.

Apart from showing a relationship between PA and physical fitness our research demonstrates a correlation between PA and QoL. Valadares et al. [33] examined 271 women aged 60 years and older using a longer version of the IPAQ to assess PA, and World Health Organization Quality of Life Questionnaire (WHO QOL-OLD) to assess QoL. A positive correlation of QoL was demonstrated only with PA related to transport. Our research showed a positive correlation between PA and the PCS of the SF-36 questionnaire.

Ethical approval

The study obtained the approval of the Bioethics Committee at the Poznan University of Medical Sciences, no: 389/16 and 390/16.

Conclusions

Physically active people have a better QoL and are more physically fit than those who are not very active. At the same time they cope better with basic and complex activities of everyday life. The study confirmed that older people participating in the U3A classes mostly meet the recommendations regarding minimum PA and they willingly undertake regular physical exercise, which translates into high functional and physical fitness and a good assessment of QoL.

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Word count: 3188 • Tables: 3 • Figures: – • References: 33

Sources of funding:
The research was funded by the authors.

Conflicts of interests:
The authors report that there were no conflicts of interest.

Cite this article as:
Pieczyńska A, Zasadzka E, Trzmiel T, Pawlaczyk M.
Physical activity, physical fitness and quality of life of the University of the Third Age students.
MSP 2019; 13, 3: 10–15.

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Received: 19.07.2019
Reviewed: 24.09.2019
Accepted: 30.09.2019