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An assessment of the relationship between the level of physical activity and the risk of falls and depression in elderly adults aged 60–75 years from the Podkarpackie region

Ocena zależności pomiędzy poziomem aktywności fizycznej a ryzykiem wystąpienia upadku oraz depresją u osób w wieku 60–75 lat mieszkających na terenie województwa podkarpackiego

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Abstract

Introduction: Almost all societies of the world are ageing. One of the most common problems of the elderly are falls and mobility disorders. They may result in disability and in loss of functional independence. We conducted the study to assess the relationship between the level of physical activity and the risk of falls and depression in adults aged 60–75 years.

Materials and Methods: We used the random route method and included 500 subjects from southeast Poland. We measured physical activity with the International Physical Activity Questionnaire (IPAQ), and we assessed the risk of falls with the Tinetti test. To assess depressive states, we used the Geriatric Depression Scale (GDS-15). We used a questionnaire to obtain sociodemographic and anthropometric data.

Results: The mean weekly energy expense (metabolic equivalent of task – MET) of the studied population measured with the IPAQ was 823.88 MET min/week. We found a statistically significant relationship between the level of physical activity and the risk of falls and depression in the studied population. Subjects with insufficient physical activity had statistically higher risk of falls ($p=0.0373$), and had depression statistically more often ($p=0.0003$).

Conclusion: Subsequent studies should aim at establishing an optimal training programme for the elderly. It is important for subjects over 60 years of age to know that physical activity is crucial for maintaining good health and functional ability, as well as for subjective wellbeing.

Key words:

aged, physical performance, depressive disorder, falls risk

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Streszczenie

Wstęp: Starzenie się jest obecnie zjawiskiem dotyczącym niemal wszystkich społeczeństw świata. Jednym z najczęstszych problemów tego okresu są upadki i zaburzenia mobilności. Mogą one prowadzić do niepełnosprawności oraz do utraty samodzielności funkcjonalnej. Badanie zostało przeprowadzone w celu oceny zależności pomiędzy poziomem aktywności fizycznej a ryzykiem wystąpienia upadku oraz depresją u osób w wieku 60–75 lat.

Material i metody: Badanie przeprowadzono metodą random route obejmując grupę 500 osób mieszkających na terenie południowo – wschodniej części Polski. Aktywność fizyczną zmierzono za pomocą Międzynarodowego Kwestionariusza Aktywności Fizycznej (IPAQ), natomiast ryzyko upadków oceniono testem Tinetti. Do oceny stanów depresyjnych zastosowano Geriatryczną Skalę Oceny Depresji (GDS-15). Za pomocą kwestionariusza metrykalnego zebrano podstawowe dane socjodemograficzne i antropometryczne.

Wyniki: Średni całkowity tygodniowy wydatek energetyczny (MET) badanych osób mierzony za pomocą kwestionariusza IPAQ wynosił 823,88 MET- min/tydzień. Wykazano istotnie statystyczną zależność pomiędzy poziomem aktywności fizycznej a ryzykiem upadku i występowaniem depresji w badanej grupie. Osoby charakteryzujące się aktywnością fizyczną niedostateczną mieli istotnie wyższe ryzyko wystąpienia upadku ($p = 0,0373$). U osób charakteryzujących się niedostatecznym poziomem aktywności fizycznej istotnie częściej stwierdzono depresję ($p=0,0003$).

Wnioski: Przyszłe badania powinny dążyć do ustalenia optymalnego programu ćwiczeń dla osób starszych, w ramach profilaktyki zdrowotnej. Ważne jest kształtowanie świadomości osób już po 60 roku życia, że aktywność fizyczna jest najlepszym sposobem na zachowanie zdrowia i sprawności funkcjonalnej, a także dobrego samopoczucia.

Słowa kluczowe: osoby starsze, aktywność fizyczna, zaburzenia depresyjne, ryzyko upadków

Introduction

The process of ageing affects almost all societies worldwide [1]. The age structure of the European Union (EU), including Poland, has recently undergone significant changes [2]. In 2014, Poland's population amounted to approximately 38.5 million citizens, while 8.5 million of them were citizens aged 60 years and older (over 22%). It is forecasted that between 2015 and 2050, the percentage of citizens aged 60 years and older will have amounted to almost 40% [3].

Ageing results in decreasing physical and psychological ability and in multiple diseases. One of the most common problems related to this age group are falls and mobility disorders. They may result in disability and in loss of functional independence [4]. The frequency of falls increases with age, as involuntal changes to the body accumulate. Milat et al. report that 25-40% of the elderly aged 65 years and older experience falls. Among those older than 80 years, every second person experiences a fall at least once a year [5]. This leads to an increase in the level of disability and dependence of older people

with age [6]. It is estimated that falls are the sixth most common cause of death among people older than 65 years and the fifth most common cause of death among people older than 75 years [7].

Apart from functional disability, a common affliction of the elderly is depressive disorder. It is estimated that at least 15% of people older than 65 years suffer from depression [8]. Depressive states are related to an increased risk of falls in the elderly. In their meta-analysis, Kvelde et al. confirm that depression in the elderly is closely related to increased risk of falls [9]. Launay et al. found a significant relationship between depression in the elderly and recurrent falls and they pointed out that depressive disorders themselves constitute a risk of fall [10]. Despite the progress in pharmacological treatment of depressive disorders, symptoms of depression do not fully remit in more than a half of subjects who take medicines [11]. Numerous clinical studies have found that engaging in physical activity may be effective in reducing depressive symptoms in the elderly [12]. The guidelines of National Institute for Health and Clinical Excellence names physical activity as one of the strategies for

curing depression. The Institute recommend at least 150 minutes of moderate intensity training or 75 minutes of intensive training three to five days a week for patients with depressive states [13].

Laboratory tests have found that physical activity increases concentration of endorphin and decreases the levels of cortisol in blood, leading to increased subjective wellbeing [14]. Matthews et al. conducted an intervention in 424 subjects aged 70-89 years with symptoms of depression and they proved that the subjects, with and without depression, improved their physical ability [15]. In their randomized study assessing the impact of physical ability on depressive syndromes, Dotson et al proved that the subjective wellbeing of their subjects improved after 12 weeks of physical activity. In their study population, they also found a greater improvement in elderly men than in elderly women [16].

Regular physical activity of the elderly results in improvement of breathing, increased muscle strength, and increased joint mobility [17]. Physical activity results in better health and it is essential for functional ability of the elderly.

The World Health Organisation and the European Union recommend that the elderly engage in moderate physical activity for a minimum of 30 minutes five times a week, or intense physical activity for 20 minutes three times a week [18].

A study by Gusi et al reveal that doing general mobility exercises and balance exercise lowers the risk of falls by 17% [19]. Having analysed 30 studies, Kendrick et al concluded that an intervention in the form of physical exercise has a positive effect on functional state and that it lowers the fear of falls in the elderly [20].

Elderly Europeans have quite low physical activity levels. According to the Polish Central Statistical Office, only 24.6% citizens older than 60 years participated in sports or recreational exercises. The level of physical activity of adults is one of the lowest in Europe [21]. The PolSenior study revealed that approximately 40% of the elderly over the age of 65 do recreational physical activity. The age group of 65-69 was most active (50.4%), and the index lowered steadily for subsequent age groups to drop to 8.7% for 90-year-old subjects and older. Approximately 75% of respondents named their health as the factor that hindered their physical activity; 30% admitted they did not feel the need for undertaking physical activity, and approximately 6% agreed with the statement that “doing physical exercise was improper at their age” [22].

This article presents study results of the relationship between the level of physical activity and the risk of falls and depression in subjects aged 60 to 75 years living in southeast Poland.

Material and method

We used the random route method and included 500 subjects living in the Podkarpackie region (southeast Poland). Participation in the study was voluntary, and all the subjects were informed of the aim and course of the study. The criteria were: age between 60 and 75 years, normal or slightly lowered cognitive state without dementia (a minimal score of 24 in the Mini-Mental State Examination). Subjects who had had a stroke, subjects with hemiplegia or other neurological disorders were not included in the study. Of 500 subjects who met the criteria for including in the study, 29 did not provide us with all the data necessary for our analysis. Finally, we analysed data obtained from 487 subjects, including 271 women and 216 men. Table 1 presents the data of the study population.

The study was conducted at the subjects' places of residence, with the subjects' informed consent to participate in the study. The approval to conduct the study was obtained from the Bioethical Commission of the University of Rzeszów.

We prepared a questionnaire to obtain basic sociodemographic and anthropometric data, such as sex, age, education, place of residence, body height and body mass (we calculated the BMI). The questionnaire also comprised questions on respondents' wellbeing in the preceding two weeks, the preferred type of rest, types of leisure activities, as well as diagnosed chronic illnesses.

To assess cognitive abilities, we used the Mini-Mental State Examination (MMSE) – a screening test for cognitive impairment. The questionnaire comprises 30 questions and statements that allow for quantitative assessment of several aspects of cognitive functioning. The assessed areas are: orientation in time and space, memorizing, attention and calculation, immediate and postponed recall, naming, repetition, comprehension, reading, writing and constructive praxis. The maximum score is 30. A result below 24 points suggests dementia and indicates a necessity for further diagnostic procedures [23].

We used the Geriatric Depression Scale (GDS-15) to assess depressive states. This screening tool

allows for an assessment of intensity of depressive symptoms in the elderly. It comprises 15 short questions, requiring short yes/no answers. The higher the score, the more intense the depression: 0-5 points denote no depression, 6-10 points denote mild depression, 11-15 severe depression [24].

We used the Tinetti Test (POMA - Performance-Oriented Mobility Assessment) to assess gait and the risk of falls. The test assesses 16 tasks, including 9 tasks that assess balance in doing numerous activities, and 7 tasks that assess gait. A score of 26 to 28 points means low risk of falls, a score of 19 to 25 means moderate risk of fall, and a score of 18 points and fewer means that the risk of fall for a given person rises fivefold (high risk of fall) [25].

We used the shortened version of the International Physical Activity Questionnaire (IPAQ) to assess physical activity. The questionnaire comprises 7 questions on all kind of physical activities related to everyday life, work and leisure. The questionnaire defines intense activity as hard effort that leads to quicker breathing and significantly higher heartbeat. Moderate activity is understood as average effort with slightly quicker breathing and slightly higher heartbeat. Also, walking (e.g. going shopping, going to work) and going for walks were analysed. Calculating the total energy expense, or defining the level of physical activity of the respondent, consisted in multiplying the frequency and duration of the effort by its intensity, expressed in MET units. The results were classified according to the following criteria:

1. Insufficient physical activity (less than 600 MET min/week);
2. Sufficient physical activity (between 600 and 1500 MET min/week);
3. High physical activity (over 1500 MET min/week at least three days a week of intense effort, or at least 3000 MET min/week) [26].

Tab. 1. Study population data

Sex	Number (n=487)	Percent (%)
Female	271	55.65
Male	216	44.35
Place of residence		
Urban	208	42.71
Rural	279	57.29
Education		
Primary	98	20.12
Secondary vocational	142	29.16
Secondary comprehensive	179	36.76

Higher	68	13.96
BMI		
Underweight	5	1.03
Normal weight	157	32.24
Overweight	202	41.48
Obesity	123	25.25
MMSE		
Normal (30-27 points)	381	78.23
Below norm (26-24 points)	106	21.77
GDS		
No depression (0-5 points)	405	83.16
Mild depression (6-10 points)	51	10.47
Severe depression (11-15 points)	31	6.37
Tinetti test		
Low risk of fall (26-29 points)	225	46.20
Moderate risk of fall (19-25 points)	188	38.60
High risk of fall (18 and fewer points)	74	15.20
Subjective wellbeing		
Very good	6	1.23
Good	74	15.20
Sufficient	142	29.16
Bad	234	48.05
Very bad	31	6.37
Preferred type of rest		
Physically active	231	47.43
Physically passive	256	52.57
Preferred forms of leisure activities		
Walking	266	54.62
Sports	108	22.18
Trips	112	23.00
Reading	273	56.06
Watching TV	363	74.54
Diagnosed diseases		
Diabetes	122	25.05
Hypertension	231	47.43
Cardiovascular diseases	75	15.40
Osteoporosis	68	13.96
Degenerative disease of peripheral joints	182	37.37
Degenerative diseases of the spine	243	49.90
Rheumatism	119	24.44

Statistical analysis

We analysed the collected data with the use of StatSoft Inc. (2011) STATISTICA (data analysis software system), version 10. For measurable variables, we calculated the means and standard deviations. For non-measurable variables we provided the quantities and structure indicators.

We tested the relationships between measurable variables with the chi-square independence test. Statistical significance was set at $p \leq 0.05$.

Results

The mean weekly energy expense (MET) of the study population as measured by IPAQ was 823.88 MET min/week. The subjects did a mean of 4.38 minutes of intense physical activity per day, and a mean of 20.13 minutes of moderate physical activity. The respondents spend most of their days sitting – a mean of 196.04 minutes per day. Table 2 presents mean values of MET – min/week, frequency and duration for the four types of physical activity of the study population.

Tab. 2. Weekly energy expense of the study population.

Weekly energy expense [MET - min/tydzień]	Mean (x)	Standard deviation (SD)
Intense	51.66	84.81
Moderate	184.89	144.59
Walking	587.33	493.68
Sitting	1372.26	1148.94
Total MET	823.88	536.39
Frequency [days/week]		
Intense - frequency	1.95	1.51
Moderate - frequency	4.54	2.25
Walking - frequency	3.26	2.74
Duration [min/day]		
Intense - duration	4.38	6.61
Moderate - duration	20.13	16.75
Walking - duration	38.40	26.17
Sitting - duration	196.04	164.13

We found a statistically significant relationship between physical activity of men and women in the study population ($p=0.0488$). Men usually had insufficient level of physical activity (43.30%), while women had sufficient level of physical activity (49.08%) (Table 3).

Tab. 3. Level of physical activity and sex.

Level of physical activity – IPAQ	Sex		Total
	Men	Women	
Insufficient physical activity	100 (46.30%)	102 (37.64%)	202 (41.48%)
Sufficient physical activity	82 (37.96%)	133 (49.08%)	215 (44.15%)
High physical activity	34 (15.74%)	36 (13.28%)	70 (14.37%)

$p = 0.0488$

We found a statistically significant relationship between level of physical activity and risk of falls in the study population. Subjects with insufficient physical activity had significantly higher risk of falls (Table 4).

Tab. 4. Level of physical activity and risk of falls.

Level of physical activity – IPAQ	Assessment of risk of falls – the Tinetti test			Total
	High	Moderate	Low	
Insufficient physical activity	37 (50.00%)	81 (43.09%)	84 (37.33%)	202 (41.48%)
Sufficient physical activity	22 (29.73%)	80 (42.55%)	113 (50.22%)	215 (44.15%)
High physical activity	15 (20.27%)	27 (14.36%)	28 (12.44%)	70 (14.37%)

$p = 0.0373$

We found a statistically significant relationship between physical activity and depression (measured with GDS) in the study population ($p=0.0003$). Subjects with insufficient physical activity were diagnosed with depression (with the GDS) significantly more often (Table 5).

Tab. 5. Level of physical activity and depression

Level of physical activity – IPAQ	Depression – GDS		Total
	No depression	Depression	
Insufficient physical activity	152 (37.53%)	50 (60.98%)	202 (41.48%)
Sufficient physical activity	193 (47.65%)	22 (26.83%)	215 (44.15%)
High physical activity	60 (14.81%)	10 (12.20%)	70 (14.37%)

$p = 0.0003$

Discussion

Physical activity is an important factor influencing people’s health. The Centers for Disease Control and Prevention CDC put forward recommendations for physical activity of the elderly to help them maintain good health. Older persons need a minimum of 150 minutes of moderate intensity physical activity, and the more activity, the better health [27].

Our study aimed to assess the relationship between level of physical activity and the risk of falls and of developing depression in elderly subjects aged 60-75 years living in the Podkarpackie region. In our study population, most of the subject preferred passive form of rest (52.57%), usually watching

television (74.54%). Sedentary lifestyle and lack of physical activity among the elderly cause problems worldwide, and Poles are affected, too [28].

Insufficient level of physical activity affects Podkarpackie men significantly more often than women. 44.15% of our subjects had at least sufficient level of physical activity, or 37.96% men and 49.08% women. The level of physical activity of the elderly is lower in Podkarpackie region than in Mazowieckie region. According to Biernat et al., 67% of Warsaw's 60-69 year olds have moderate or high level of physical activity [29]. These results are in line with the Eurobarometer data, which found that 46% of Poles older than 50 years have sufficient level of physical activity [30]. Among adult Americans, 50.7% of men and 47.9% of women have sufficient level of physical activity [31].

We found a statistically significant relationship between the level of physical activity and risk of falls. Subjects with insufficient physical activity had significantly higher risk of falls. A study by Zakkoyya et al. on Americans aged 65 and older pointed out that low level of physical activity increases risk of falls [32]. A study by Skalska and Gałaś concluded that subjects who reported fear of falls, regardless of whether they experienced falls or not, had significantly worse result in physical and functional ability assessment [33]. In their meta-analysis of 159 randomized studies, Gillespie et al. confirmed a positive effect of physical activity and *tai chi* classes on limiting the risk of falls [34]. A meta-analysis of randomized studies on subjects between 68 and 85 years by Kendrick et al. found a positive effect of physical activity on decreasing fear of falls and risk of falls during intervention. There was not, however, sufficient evidence to conclude whether physical activity decreases fear of falls and risk of falls after intervention has ended [35]. In their systematic review, de Labra et al proved that physical activity of the elderly may result in improving functional ability and decreasing risk of falls. They have also recommended that an optimal

training programme be designed [36]. Carode et al. in their meta-analysis examined the effect of training programmes on muscle strength, balance, gait and risk of falls in the elderly. They found that multidimensional interventions are the best strategy for improving functional state of the elderly and for decreasing the risk of falls [37].

In our study population of subjects aged 60-75 years, we found a statistically significant relationship between physical activity and depression, measured with GDS ($p=0.0003$). In subjects with insufficient level of physical activity depression was diagnosed significantly more often. Wassink-Vossen et al. had similar results. In their study on Dutch elderly, they found that subjects aged 60 years and older who have depression are less physically active than subjects without depression. This difference did not depend on socio-demographic features, cognitive functions or other determinants of life style [38]. Borges et al conducted an intervention in which they introduced a training programme for elderly patients with depression and found a statistically significant improvement in subjects who participated in at least 75% of the classes. These results proved a positive effect of physical exercise in decreasing depressive symptoms and improvement of functional ability [39]. Lindwall et al. conducted a 6 yearlong study in which they proved a positive effect of physical exercise on controlling anxiety and depressive symptoms [40]. Mead et al. had different results, having proven no relationship between physical activity and depression [41].

Our study found a statistically significant relationship between the level of physical activity and the risk of falls and depression. Subsequent studies should aim at establishing an optimal training programme for the elderly. It is important for subjects over 60 years of age to know that physical activity is crucial for maintaining good health and functional ability, as well as for subjective wellbeing.

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