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Original research papers

INTENSITY OF PHYSICAL ACTIVITY AND QUALITY OF LIFE AMONG OLDER ADULTS

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Abstract
Introduction. Low physical activity, transition to retirement and unfavorable socio-economic changes may significantly reduce the quality of life of older people. The increasing average life expectancy of the population requires measures intended to promote physical activity among the elderly in order to improve their quality of life. The aim of the research was to determine the relationship between exercise intensity and the quality of life in U3A students over 60 years of age. ***Material and methods.*** A diagnostic survey was applied in the research. The following research tools were used: WHOQOL-BREF Questionnaire to assess the quality of life, Minnesota Questionnaire (MLTPAQ) to test the intensity level of physical activity, and the authors' own questionnaire. The study involved 673 individuals over 60 years of age from the Kuyavian-Pomeranian Region in Poland. ***Results.*** People who took low-intensity exercise more often were more satisfied with life and health. Likewise, they had higher quality of life assessments in the physical, psychological and environmental context in comparison with those who were not sporty. Individuals who went in for moderate physical effort more often assessed their quality of life better in the social area. Respondents who engaged in intense physical activities valued the quality of life in physical, psychological and environmental domains higher. ***Conclusions.*** The positive influence of regular exercise on the quality of life requires further promotion of this activity, health education, and extension, diversification and adjustment of the offer of sports activities to the needs and capabilities of the elderly.

Key words: MLTPAQ, physical activity, quality of life, older adults

Introduction

An increase in life expectancy is one of the greatest achievements of civilization; however, it is a serious challenge for the modern world at the same time. The World Health Organization (WHO) includes active and successful aging in key documents and strategies [1]. Physical activity of the elderly not only has a positive effect on all body systems, but also alleviates the course of chronic diseases, and improves physical and mental performance [2, 3, 4, 5]. Moreover, it plays an indispensable role in the prevention of premature death [6], frequent hospitalization and a smaller amount of medications taken [7]. People over 60 years of age are more likely to suffer from civilization diseases and other disorders caused among others by a sedentary lifestyle [8, 9] and insufficient physical activity.

Physical and social activation of older adults aimed at inhibiting progressive involutional changes, improving psychophysical well-being, maintaining a healthy body shape, and enhancing balance, prevents the limitation of an individual's living space and their quality of life [10, 11]. In recent years, many programs have been developed to encourage physical activity. An example can be the program developed in 2004-2007 in cooperation with 66 higher education institutions in 29 countries [12]. The American charity NCOA (National Council on Aging) has created numerous program proposals to motivate older people to be physically active. These include: "Active Choices", "Active Living Every Day", "Enhance Fitness", "Enhance Wellness", "Fit and Strong!", "Healthy Moves for Aging Well", and "Walk with Ease" [13].

Human life should be approached holistically as the quality of life depends on various areas such as physical, psychological, social and environmental ones [14]. The needs, expectations, social and family situation of the elderly change with age [15]. A study on the correlations between physical activity (intensity and duration) taken in the past and the risk of non-Hodgkin's lymphoma (NHL) involving more than 800 subjects confirmed that intense physical activity during their lifetime was associated with a much lower NHL risk [16]. The impact of lifelong physical activity on reducing the risk of urinary incontinence was confirmed in 1,560 elderly women aged 39-65 [17]. Between 1986 and 2010, a cohort of 2,448 former athletes and 1,712 men as controls were observed via the Finnish Cancer Registry. The risk of developing cancer was reported to be lower among older adult men who had practiced sport in the past [18]. In Saudi Arabia, an attempt was made to assess the quality of life after aerobic exercise in Alzheimer's disease. Forty elderly patients with Alzheimer's disease were divided into two groups. The first one received aerobic treadmills, while the other one was considered the control group and received no equipment. The study lasted two months. Treadmill walking was found to be an effective treatment method to improve the quality of life in Alzheimer's disease [19].

The undertaking of this research is justified by a longer life expectancy and related increasing costs of social welfare, as well

as the growing demand for institutional care. This poses new challenges to long-term care and requires a holistic approach to the future of the elderly. The growing number of older adults also entails changes in the Polish pension system, including the lowering of the retirement age for women and men [20]. To date, there has been a lack of research on the level of physical activity intensity in older adults throughout the year in terms of quality of life. Recent studies have shown that such analyses were conducted in other age groups [21] or depending on various types of diseases [22]. The Minnesota Questionnaire (MLTPAQ) applied to these studies to determine the level of intensity of physical activity in older adults in the context of the quality of life of older adults seems to partially fill this gap.

The purpose of the study was to determine the relationship between the intensity of physical activity and the quality of life in U3A students over 60 years of age.

It was hypothesized that older adults undertake low-intensity exercise most often, but they spend more time on physical activity. It is also assumed that people who engage in sports activities in comparison with those who are not sporty, are characterized by a higher overall quality of life and in specific areas (physical, psychological, social and environmental) and greater satisfaction with health.

Material and methods

The study was conducted on Third Age Universities in the Kuyavian-Pomeranian Region in Poland. Research was carried out before lectures which attracted the largest number of participants. Simple random sampling was applied to have a highly representative sample. By using the sample size formula with the finite population, it was possible to calculate the necessary number of respondents required to participate in the specific research. Assuming that the population size is 7,600 subjects [23], the level of confidence is 95%, and the permissible assessment error is 5%, the sample size should be 366 subjects. About 1,100 questionnaires were distributed and 877 were given back (of which 708 were correctly filled out). The study involved 673 individuals over 60 years of age from the Kuyavian-Pomeranian Region in Poland. Most of the respondents were women (n = 571) and individuals within the age range of 65-69 years (n = 284). The majority of respondents (n = 379) participated in sports U3A activities. The average age in the examined group was 68.2 ± 4.9. Detailed figures are shown in Table 1.

Table 1. The number of respondents depending on sex and age (independence $\chi 2$ test and Cramér's V)

Age range	Sex				Total	
	F		M			
	n	%	n	%	N = 673	%
P = 0.0000 for test χ^2; V Cramér = 0.2						
60-64 years	136	23.8	15	14.7	151	22.4
65-69 years	254	44.5	30	29.4	284	42.2
70-74 years	125	21.9	37	36.3	162	24.1
75 years and over	56	9.8	20	19.6	76	11.3
Total	571	84.8	102	15.2	673	100

F – females; M – males.

A diagnostic survey was applied in the research. The following research tools were used: WHOQOL-BREF Questionnaire (World Health Organization Quality of Life), Minnesota Questionnaire, and the authors' own questionnaire. The standardized Questionnaire WHOQOL-BREF is used to assess the quality of life. The questionnaire consists of 26 questions. The first two questions relate to the degree of satisfaction with life and health. Individual dimensions of the quality of life include: a) physical dimension – pain and discomfort, dependence on medications and treatment; energy and fatigue; mobility, rest and sleep, basic everyday activities, ability to work; b) psychological dimension – joy of life, meaning of life, concentration, body image, self-esteem, feeling sad; c) social dimension – personal relationships, coexistence, social support; d) environmental dimension – safety, immediate vicinity, financial resources, access to information, recreation and free time, housing conditions, access to medical care, transport [25]. The standardized Minnesota Questionnaire (MLTPAQ, Minnesota Leisure Time Physical Activity Questionnaire) [25] enables the collection of data on the intensity of leisure time physical activity not related to work or study during the last twelve months. The MLTPAQ distinguishes seven groups of activities, namely: walking and similar physical activities, general fitness exercises, aquatic exercises, winter sports, other sports, gardening, fishing and hunting. Energy expenditure (Activity Metabolic Index; AMI) for each category (L, M, H) was defined as follows: AMI = (intensity code x duration x number of times / month x number of months / year / 52) [26]. Division of effort intensity was applied according to a 3-degree scale: low intensity (L) <4 MET; medium intensity (M) 4-6 MET); high intensity (H) (≥6 MET) [27, 28].

The authors' own questionnaire contains questions about age, sex, place of residence, education, family situation, and physical activity in particular stages of life.

In all variables, a distribution differing from the normal one was reported. Therefore, non-parametric statistics were used for calculations – rho-Spearman correlation and H Kruskal-Wallis Test, the Mann-Whitney U test used for checking the significance of differences. The effect size was calculated for each test: E2R for the Kruskal-Wallis H test, Glass rank biserial correlation (rg) for the Mann-Whitney U test, Cramér's V for the $\chi 2$ test. Statistical significance was accepted as p = 0.05 in the research. Statistical calculations were made with Statistica 13.1 for Windows (StatSoft Sp. z o.o., Cracow, Poland) and Microsoft Office Excel 2007 (Microsoft Sp. z o.o., Warsaw, Poland).

The Bioethics Committee of the Collegium Medicum Nicolaus Copernicus University in Toruń gave consent for the research (KB 577/2017).

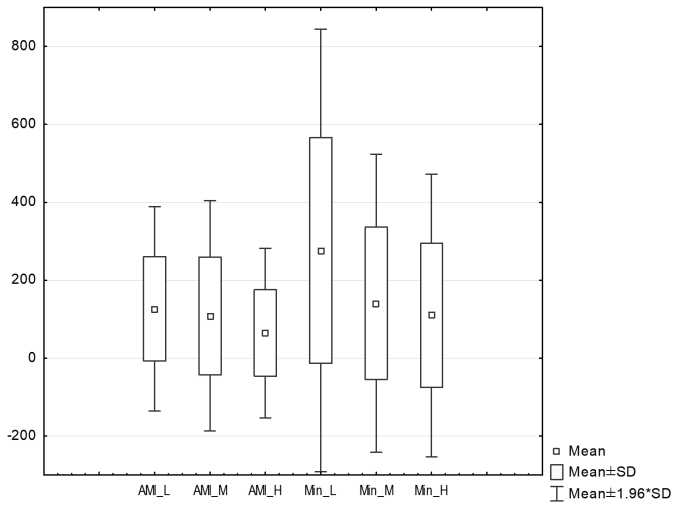
Results

Inhabitants of towns and cities representing a population of less than 100,000 dominated in each age group. Most of the respondents had secondary and higher education. In all age groups, most people lived with their spouses (Tab. 2). The demonstrated relationships between age and place of residence (p = 0.0277 for the χ^2 test), level of education (0.0205 for the χ^2 test) and family situation (p = 0.0036 for the χ^2 test) showed a low effect size (Cramér V 0.1). Regular participation in sports activities organized by U3A was declared by 38% of the respondents and irregular exercise by 18.3% of them; 43.7% of the respondents engaged in physical activity outside U3A.

The total AMI index for the respondents was 290.52 MET* min/week, and the average duration of exercise was 511.36 min/week (Fig. 1). Low-intensity activities dominated, taking into ac-

Table 2. Social characteristics of U3A students in the Kuyavian-Pomeranian Region depending on age (independence $\chi 2$ test and Cramér's V)

Variable	Age								Total	
	60-64		65-69		70-74		>75			
	n	%	n	%	n	%	n	%	N = 673	%
Place of residence	**p = 0.0277 for test χ^2; V Cramér = 0.1**									
rural area	28	32.9	38	44.7	15	17.7	4	4.7	85	12.6
urban area of less than 100k	74	22.0	145	43.2	74	22.0	43	12.8	336	49.9
urban area of more than 100k	49	19.4	101	40.1	73	29.0	29	11.5	252	37.4
Education level	**p = 0.0205 for test χ^2; V Cramér = 0.1**									
< secondary	11	22.9	22	45.8	9	18.8	6	12.5	48	7.13
secondary	97	24.4	177	44.5	92	23.1	32	8.0	398	59.1
> secondary	43	18.9	85	37.4	61	26.9	38	16.7	227	33.7
Family situation	**p = 0.0036 for test χ^2; V Cramér = 0.1**									
single	37	14.2	119	45.8	68	26.2	36	13.9	260	38.6
with wife/husband	103	28.3	144	39.6	83	22.8	34	9.3	364	54.1
with a partner	7	36.8	9	47.4	2	10.5	1	5.3	19	2.8
with children	4	13.3	12	40.0	9	30.0	5	16.7	30	4.5
Participation in U3A sports activities	**n.s.**									
on a regular basis	59	39.1	116	40.8	63	38.9	18	23.7	256	38.0
no participation	69	45.7	111	40.8	67	41.4	42	55.3	294	43.7
on an irregular basis	23	15.2	52	18.4	32	19.7	16	21.0	123	18.3



Legend: AMI_L; AMI_M; AMI_H: respectively – low, moderate and high intensity physical activity; Min_L; Min_M; Min H: respectively – low, medium and high duration of physical activity expressed in min/week.

Figure 1. Comparison of mean values of the AMI activity metabolic index and duration (min/ week) of individual exercises (N = 673)

count both AMI values (123.39 MET * min/week) and the duration of individual exercises (269.49 min/week). The AMI index for moderate-intensity activities was 104.66 MET * min/week with a mean duration of 136.01 min/week. As far as intensive exercise is concerned, it was 62.19 MET* min/week with an average duration of 105.36 min/week (Fig. 1).

It was found that there was a general differentiation between satisfaction with life and health and individual domains (except for the social area) and participation in U3A sports activities ($p \leq 0.05$) (H test) (Tab. 3). Differences in overall quality of life and health satisfaction were observed between people who took sports activities on a regular basis and those who did so irregularly ($p = 0.0219$ for the U test; $p = 0.0017$ for the U test) or did not engage in these activities ($p = 0.0029$ for the U test; $p = 0.0110$ for the U test). Differences were also confirmed in physical, psychological and environmental domains between subjects who regularly did sports activities and those who did not engage in exercise ($p = 0.0091$; $p = 0.0149$; $p = 0.0021$ for the U test, respectively). People participating in U3A classes rated the overall quality of life and satisfaction with health higher, as well as the quality of life in physical, psychological and environmental domains. In the social domain, individuals engaged in U3A sports activities on a regular or irregular basis achieved similar results.

Adults who took low-intensity exercise more often were more satisfied with life (R = 0.13) and health (R = 0.10). They also had higher quality of life scores in physical (R = 0.11), psychological (R = 0.15) and environmental (R = 0.10) domains (Tab. 4). Individuals who engaged in moderate physical activities more often, rated their quality of life better in the social field (R = 0.09). The quality of life in physical, psychological and environmental areas was assessed higher by older adults taking intensive exercise (respectively: R = 0.12; R = 0.08; R = 0.12). The analysis of exercise duration (min / week) and intensity (MET * min / week) reveals analogous correlations.

Discussion

The purpose of the conducted research was to determine the relationships between the intensity of physical activity and the quality of life of U3A students over 60 years of age. Respondents who regularly or irregularly participated in sports activi-

Table 3. Satisfaction with life and health as well as with particular areas of the quality of life of older adults (WHOQOL-BREF) depending on participation in sports activities organized by U3A (H test, E2R, U test, rg)

Specification	Participation in U3A sports activities	I don't participate	Irregular	I don't participate	Irregular	Rank means
		Value of p for U statistics		Glass rank biserial correlation (rg)		
Satisfaction with life H(2,673) = 9.95 E²R = 0.01 p = 0.0069*	Regular	0.0029*	0.0219*	0.1	0.1	360.53
	I don't exercise		0.9756		0.0	322.63
	Irregular					322.34
Satisfaction with health H(2,673) = 11.35 E²R = 0.02 p = 0.0034*	Regular	0.0110*	0.0017*	0.1	0.2	363.32
	I don't exercise		0.2965		0.1	326.70
	Irregular					306.81
Physical domain H(2,673) = 7.36 E²R = 0.01 p = 0.0252*	Regular	0.0091*	0.0778	0.1	0.1	362.71
	I don't exercise		0.7927		-0.0	319.57
	Irregular					325.13
Psychological domain H(2,673) = 6.26 E²R = 0.01 p = 0.0438*	Regular	0.0149*	0.5538	0.1	0.0	356.89
	I don't exercise		0.1622		-0.1	316.37
	Irregular					344.90
Social domain H(2,673) = 2.96 E²R = 0.00 p = 0.2272	Regular	0.1413	0.8935	0.1	-0.1	346.99
	I don't exercise		0.1667		-0.1	322.64
	Irregular					350.49
Environmental domain H(2,689) = 9.30 E²R = 0.01 p = 0.0095*	Regular	0.0021*	0.2204	0.2	0.1	363.96
	I don't exercise		0.2705		-0.1	313.47
	Irregular					337.10

* – p ≤ 0.05.

Table 4. AMI values and average duration of particular exercises (MLTPAQ) and the quality of life of U3A students (WHOQOL-BREF) (Spearman's rho)

Variable	Satisfaction with life	Satisfaction with health	Domain	Psychological domain	Social domain	Environmental domain
Total (N = 673)						
AMI values for particular physical activities (MET*min/week)						
Low	0.13*	0.10*	0.11*	0.15*	0.06	0.10*
Moderate	0.05	0.02	0.04	0.07	0.09*	0.05
Intensive	0.07	0.07	0.12*	0.08*	0.05	0.12*
Duration of particular physical activities (min/week)						
Low	0.13*	0.10*	0.11*	0.15*	0.05	0.09*
Moderate	0.05	0.02	0.04	0.06	0.09*	0.05
Intensive	0.07	0.07	0.12*	0.08*	0.06	0.12*

* – p ≤ 0.05.

ties organized by the U3A accounted for 56.3%. The remaining adults did not engage in any sports activities organized by U3A. A similar distribution can be observed in the nationwide study conducted in 100 Universities of the Third Age in Poland [29].

Among women and men involved in the study, low-intensity exercises prevailed, both in terms of the metabolic index (AMI) and the duration of individual exercises. The research results are in line with the findings of other studies on older adults in Poland [30, 31].

The research results were updated and the Benefit Systems Report from Mind&Roses study was used. The latest MultiSport INDEX [32] shows that 64% of adult Poles are physically active. The most active are people under 30 years of age. The decline in physical activity of Poles after the age of 30 is probably related to intense professional work.

Regular participation in sports activities resulted in a higher overall quality of life and health satisfaction compared to irregular or no participation. Respondents engaged in U3A classes assessed the quality of life higher in physical, psychological and environmental domains. However, no dependence was observed in the social domain. A study conducted among 49 men aged 60-81 aimed at examining the impact of 12-week strength

training on their quality of life showed a significant improvement in the quality of life, especially in the physical area [33]. In the US and Canada, the effects of a combination of two mental activity and exercise programs on physical fitness and quality of life were analyzed. Combined mental activity and various types of physical exercise improved both physical performance as well as physical quality of life among older people with cognitive impairment. It was found that even a few low-intensity exercises brought benefits related to improving the quality of life in these people [34]. Similar results (in terms of exercise frequency) were obtained in a group of 100 elderly adults who performed exercises developed by a sports physician. The first subgroup took physical activities twice a week, whereas the second one three times a week. A greater impact linked to an improvement in the quality of life was obtained in the second group [35]. Regular physical activity, especially outdoor activity, has a positive effect on the physical and mental well-being of the elderly. It plays a significant role in a better, subjective perception of the quality of life [36, 37]. Regular performance of strength exercises for one year contributes to an improvement in well-being of older adults [38].

The authors' own research found that people who took low-intensity exercise more often were more satisfied with life and health. Additionally, they valued more the quality of life in the physical, psychological and environmental areas. Adults who performed moderate physical activities more often assessed their quality of life better in the social domain. Intensive exercises resulted in better assessment of the quality of life in physical, psychological and environmental domains. Low-intensity physical activity maintains and improves cognitive functions, and consequently improves health-related quality of life (HRQoL) [39]. Using the IPAQ questionnaires and the 36-Item Short Form Survey (SF-36), researchers from Taiwan proved that older men with greater physical activity had a better quality of life compared to women in terms of perceiving the level of quality of life among older adults depending on gender [40]. This was not confirmed by our own research. Both women and men engaging in high-intensity exercises assessed their quality of life higher. A study involving 1,934 subjects aged 51-94 analyzed the relationship between the distribution of time spent on various activities and the quality of life among older adults. It was found that giving up 30 minutes of passive rest and replacing it with moderate or intensive physical activity significantly influenced the quality of life of respondents. Older adults who took moderate and high intensity exercise better assessed the quality of life in all areas [41]. In the study conducted in Poland on U3A students (50-88 years), the WHOQOL-BREF questionnaire, Fullerton functional fitness test, hand grip strength test and Romberg test were used. Respondents participating in sports activities organized by U3A assessed their quality of life as relatively high [42]. Physical activity, anxiety, resilience, and commitment (physical and psychological domains) may influence optimism in older adults. Research participants in Spain who did not engage in physical activity showed an increased overall anxiety and a much greater decrease in concentration compared to those who undertook physical activity [43].

The aging process is influenced not only by gender, financial situation, marital status, genetic factors, past diseases and injuries, but also by lifestyle and socio-professional activity. In the life of older adults, physical activity seems to be meaningful, as it allows for a significant improvement in the quality of life in its various areas, as well as for greater satisfaction with life and health. It does not matter whether these are physical exercises undertaken in sports clubs under the supervision of an instructor or individually as part of recreation.

The study showed a positive relationship between regular physical activity and the quality of life of students of the University of the Third Age. However, caution is advised when applying the results to the overall elderly population. The research was conducted in a selected group, and older adults who did not participate in U3A classes were not taken into account. Undoubtedly, a peculiarity of the group was that it was composed of more educated people compared to the education level of older adults in the Polish population.

Conclusions

The research results showed that older adults most often took low-intensity exercise, but they spent more time on physical activity.

It was found that people participating in sports activities organized by U3A in comparison with those who were not sporty rated the overall quality of life and satisfaction with their health higher. They also had higher ratings in the quality of life in the physical, psychological and environmental domains. However, no relationship was demonstrated in the social field.

Elderly subjects who performed low-intensity exercise more often had more satisfaction with life and health. They also had higher quality of life ratings in the physical, psychological and environmental areas. Individuals who engaged in moderate physical activities more often assessed their quality of life better in the social field. Older people undertaking intensive physical exercise assessed the quality of life in the physical, psychological and environmental domains higher.

The positive impact of regular physical activity on the quality of life, as stated in the research, requires further promotion of this activity, as well as broadening, diversifying and adapting the offer of sports activities to the needs and capabilities of the elderly. With the increasing number of people over 60 years of age, such activities are becoming a social obligation. Under the current circumstances, it is necessary to educate the older generation in the context of managing free time and the ability to choose those forms which provide the greatest opportunities for maintaining health and improving the quality of life.

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