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Body composition and level of physical activity of elderly people living in north-eastern Poland associated with socioeconomic factors

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ABSTRACT: *Introduction:* Studies conducted in various regions of the world have indicated that physical activity level, body composition and socioeconomic variables can be associated. Therefore, the objective of this study was to determine whether socioeconomic factors are associated with level of physical activity and differences in the body composition of elderly people living in north-eastern Poland.

Materials and Methods: The study involved 774 older residents (60 years or more). Physical activity levels were measured with the International Physical Activity Questionnaire. The respondents' body composition was determined with an InBody 270 analyser. Pairs of means were compared with Student's *t*-test; more than two means were compared with one-way ANOVA; and proportions were compared with the chi-square test. Statistical significance was defined as $p \leq 0.05$.

Results: The marital status of men and women was significantly associated with differences in physical activity level and body composition. The place of residence and level of education of women (but not of men), were also significantly associated with differences in body composition. Age and material situation were not significantly associated with differences in body composition and physical activity level.

Conclusion: The mean values of parameters of body composition in the surveyed group exceeded the norms. The level of physical activity of the subjects is at a sufficient level, but in the case of women it depends on socio-economic characteristics. Therefore, there is a need to find effective ways to support older adults in maintaining (or increase) their physical activity with a particular focus on women.

KEY WORDS: elderly people, socioeconomic factors, physical activity, body composition.

Original article

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Introduction

The elderly comprise about 12 per cent of the world's population. The World Health Organization (WHO) predicts that, by 2050, the number of people over 60 will reach 2 billion–22 per cent of the Earth's total population (WHO 2015). In Poland, the percentage of people who are 60 years old or older is 24.8 per cent, and demographic forecasts indicate that, within fifty years, the number of Polish seniors will increase substantially to 33.3 per cent of the population (European Commission 2017).

The aging of the body is a natural process and cannot be avoided. With age come degenerative changes in most physical and physiological functions (Ruiz-Montero and Castillo-Rodriguez 2016). This is also reflected by body composition–as the body ages, the percentage of each component changes. From early adolescence to approximately age 70, body fat increases and fat free mass decreases (Colado et al. 2012). These changes in fat mass and fat free mass may be a factor contributing to increased risk of certain conditions in the elderly, such as frailty, chronic diseases and functional disability, and they are risk factors for the development of Insulin Resistance (IR), Metabolic Syndrome (MS) and Cardiovascular Diseases (CVD), including arterial stiffness (Silva Neto et al. 2019). Changes in the ratio of fat mass to free fat mass lead to sarcopenia, a geriatric syndrome characterized by quantitative and qualitative changes in skeletal muscle, with reductions in fat free mass, muscle strength and physical performance (Ryall et al. 2008). For the elderly, obesity is also a major health risk (Houston et al. 2009; Batsis et al. 2014). When it occurs together with sarcopenia, it is termed sarcopenic obesity, a high-risk geriatric syndrome associated with increased risk of synergistic complications from both sarcopenia and obesity (Tyrovolas et al. 2016; Batsis and Villareal 2018). An elderly person with a more sedentary lifestyle loses fat free mass faster than one who is active. Physical inactivity in older adults (above 65 years) is associated with a higher risk of falling, mobility disorders, low muscle strength and loss of independence (WHO 2017). In contrast, physical activity helps to prevent weight loss and maintain functional capacity in people over the age of 70 (Woo et al. 2013). Thus, an active lifestyle can minimize the development of many disabling conditions and chronic diseases and can help in achieving healthy ageing and well-being (Awais et al. 2019).

Studies conducted in various regions of the world have indicated that physical activity level, body composition and socioeconomic variables can be associated (Dos-Santos et al. 2001; McLaren 2007; Ward et al. 2015; Staatz et al. 2019). Depending on the country and gender of the respondents, the associated socioeconomic variables include education, occupation, and financial situation. In Poland, individuals who are above 60 years of age differ in terms of various characteristics, such as the type of community in which they live, their level of education, or their amount of physical activity (Omelan et al. 2017; Omelan et al. 2020), which may be associated with differences in their body composition. However, to the authors' knowledge, these potential associations have not been examined in north-eastern Poland.

Body composition analyses support the assessment of disease risk factors, and the results can be used in health care and in programs aimed at replacing unhealthy habits with behaviors that promote health and overall well-being. Knowledge of which socioeconomic factors have the greatest impact on body composition will make it easier to identify groups of older people who are most at risk of health problems. Therefore, the objective of this study was to determine whether socioeconomic factors (community of residence, marital status, level of education, financial situation) and age, are associated with level of physical activity and differences in the body composition of elderly people living in north-eastern Poland in view of health problems associated with ageing.

Materials and methods

The study involved 774 older residents (above 60 years of age) of rural and urban areas in north-eastern Poland. These subjects were selected by purposive-probability sampling. The Federation of Social Work Organizations in the Warmia and Mazury Region maintains a database of seniors and helped the researchers in selecting the survey sample and contacting respondents from both urban and rural areas. Suburban areas (so-called satellite villages) are developing rapidly in Poland, attracting urban residents, who nevertheless maintain their urban lifestyles. But the authors wanted to reach seniors who have lived and worked in traditional villages, with a predominantly agricultural function, all their lives. The respondents surveyed in this study lived in rural areas far from urban areas. Access to this population was difficult, and some people were reluctant to participate in the study. It was definitely easier to reach older people living in cities, as they often belong to formal and informal senior organizations, participate in various activities and are more willing to take part in surveys. In addition, a study by Omelan et al. (2017), shows that Polish seniors also differ in terms of their preferred leisure activities – Urban seniors read more and are more physically active, while rural seniors watch more TV, are less physically active, and rarely use a computer. The participants were surveyed with the use of a questionnaire to elicit information about their socioeconomic status (place of residence, education, self-assessment of material situation, marital status). Physical activity (PA) levels were measured with the short version of the International Physical Activity Questionnaire (IPAQ). The IPAQ expresses physical activity in units of MET (Metabolic Equivalent of Work). Physical activity below 600 METs is defined as insufficient, between 600–1500 as sufficient, and above 1500 MET-min/week as high (Biernat, Stupnicki and Gajewski 2007). The interviewers were able to survey all respondents in person (face-to-face). The respondents' body composition was determined with an InBody 270 analyser (Bioelectrical Impedance Analysis, BIA). The following parameters were selected for analysis: Body mass [kg]; FFM (Fat Free Mass) [kg]; FFM control [kg]; SMM (Skeletal Muscle Mass) [kg]; BMI (Body Mass Index) [kg/m^2] – According to the World Health Organisation criteria BMI between: 18.5 and 24.9 kg/m^2 normal weight; 25.0 – 29.9 kg/m^2 pre-obesity; 30 – 34,99 kg/m^2 obesity class I; 35 – 39,99 kg/m^2 obesity class II; ≥40 extreme obesity; TBW (Total Body Water) – the InBody 270 criteria for a healthy values of body water content range from 45–60 per cent in women to 50–65 per cent in men; PBF (Percent Body Fat) – the InBody 270 criteria for a healthy percent body fat were followed: the standard for women is 18–24 per cent and for men 14–20 per cent; WHR (Waist-Hip Ratio) – The male reference values for waist-hip ratio ranges from 0.80 to 0.90, and for women 0.75 to 0.85; VFL (Visceral Fat Level) – The InBody 270 criteria for accepted norm for visceral fat is <100 cm^2 (<10 points); OD (Obesity degree) OD(%)= (current body weight/standard body weight)x100 – The normal norm for the degree of obesity (according to InBody 270 criteria) is 90 – 110%.

Normality was verified with the Shapiro-Wilk test (skewness, As, was also examined). Therefore, Student's t-test was used to compare pairs of arithmetic means. To compare more than two arithmetic means, one-way analysis of variance (ANOVA) was used. The chi-square test was used to compare proportions. Statistical significance was defined as $p \leq 0.05$. Measurements were statistically processed with Statistica PL, v. 13.5.

Most respondents (83%) are aged 60–74 and come from urban areas (65%). Women predominate in the study group. The majority of the respondents were well educated. There were statistically significant differences between the secondary education of men and women – women significantly more often ($p=0.020$) have a high school education. In other education categories, gender differences are not significant. Half of the respondents lived in single-person households. More men were married or in partnerships than women, and this difference was statistically significant ($p<0.001$). Almost 60 per cent of the respondents have chronic diseases, and some of them indicated several comorbidities.

Table 1. Age and socio-economic status of the surveyed men (N=121) and women (N=653)

Feature	Category	Sex				Difference (p)	Total	
		Male		Female				
		N	%	N	%		N	%
Age (years)	60–74	103	85.1	540	82.7	ns	643	83.0
	75–89	18	14.9	113	17.3	ns	131	17.0
Place of residence	rural	55	45.5	215	32.9	0.008	270	34.9
	urban	66	54.5	438	67.1	0.008	504	65.1
Education	primary	25	20.7	114	17.5	ns	139	18.0
	vocational	18	14.9	85	13.0	ns	103	13.3
	secondary	42	34.7	302	46.2	0.020	344	44.4
	university	36	29.7	152	23.3	ns	188	24.3
Financial situation (self-assessed)	low or average	59	48.8	373	57.1	ns	432	55.8
	satisfactory or high	62	51.2	280	42.9	ns	342	44.2
Marital status	single	36	29.8	348	53.3	<0.001	384	50.4
	married	85	70.2	305	46.7	<0.001	390	49.6
Chronic disease	no	58	47.9	260	39.8	ns	318	41.0
	yes	63	52.1	393	60.2	ns	456	59.1

Results

There is no statistically significant association between the body composition of seniors and their age and material situation, and for the men only, body composition and place of residence and education. Statistically significant associations were found between body composition and marital status, and for women only, body composition and place of residence and education.

Table 2. Descriptive statistics for the studied anthropometric features, physical activity and body composition of men and women

Feature	Male (N=121)				Female (N=653)				Difference (M-F)	
	Mean	SD	min–max	As	Mean	SD	min-max	As	t	p
Age [years]	68.20	6.58	58–87	0.77	68.69	6.36	58–91	0.75	-0.77	ns
MET	917.09	884.14	50–3150	1.09	782.11	684.25	50–3564	1.10	1.90	ns *)
Body height [cm]	172.58	6.88	150–193	-0.17	160.91	5.62	142–178	-0.03	20.21	<0.001
Body mass [kg]	84.13	12.91	54.7–127.8	0.53	73.94	13.23	37.4–132.4	0.61	7.81	<0.001
TBW (Total Body Water) [L]	45.06	6.10	28.7–69.5	0.35	33.59	4.33	20.5–50.7	0.42	24.93	<0.001
BMI (Body Mass Index) [kg/m^2]	28.21	3.71	21.4–38.2	0.40	28.84	4.84	16.8–51.7	0.83	-0.71	ns
PBF (Percent Body Fat) [%]	26.77	6.63	9.6–42.3	0.17	37.31	6.92	4.2–54.2	-0.55	-15.48	<0.001
WHR (Waist-Hip Ratio)	0.95	0.08	0.75–1.14	0.23	0.92	0.08	0.58–1.19	-0.24	3.44	<0.001
VFL (Visceral-Fat Level)	10.27	3.97	3–21	0.66	13.16	4.68	1–30	0.17	-6.38	<0.001
FFM (Fat Free Mass) [kg]	61.22	8.34	39.1–94.9	0.37	45.74	5.88	28.1–68.8	0.41	24.73	<0.001
FFM control [kg]	0.39	1.18	0.0–6.6	3.54	0.60	1.39	0.0–13.0	3.30	-1.54	ns
SMM (Skeletal Muscle Mass) [kg]	34.31	4.96	21.1–54.7	54.7	24.97	3.49	14.4–38.6	0.39	25.10	<0.001
Obesity degree	128.31	16.83	97–173	0.39	132.75	22.51	78–241	0.83	-2.06	0.039

* close to statistical significance.

The mean values of BMI indicated the presence of obesity in both the male and female groups. Irrespective of the sex of the participants, the normal range was exceeded for Waist-Hip-Ratio, Percent Body Fat, Visceral Fat Level and Obesity degree. However, these measurements remained within the normal range: Fat Free Mass, Skeletal Muscle Mass and Total Body Water. The relationship between the subjects' PA level and their gender is close to statistical significance.

Table 3. Descriptive statistics for the studied anthropometric features, physical activity and body composition of men and women grouped by marital status

Feature	Male						Female					
	Single (n=36)		Married (n=85)		Difference (S-M)		Single (n=348)		Married (n=305)		Difference (S-M)	
	Mean	SD	Mean	SD	t	p	Mean	SD	Mean	SD	t	p
MET	848.3	820.6	981.5	1031.9	-0.69	ns	700.45	618.5	875.0	742.23	-3.27	0.001
Body height [cm]	169.33	7.15	173.95	6.31	-3.54	<0.001	160.74	5.80	161.09	5.41	-0.79	ns
Body mass [kg]	78.65	10.68	86.46	13.12	-3.15	0.002	72.78	13.37	75.27	12.96	-2.41	0.016
TBW (Total Body Water) [L]	42.06	5.78	46.34	5.80	-3.71	<0.001	33.27	4.44	33.95	4.18	-2.00	0.046
BMI (Body Mass Index) [kg/m^2]	27.37	2.90	28.60	3.96	-1.64	ns	28.13	4.80	29.01	4.85	-2.33	0.020
PBF (Percent Body Fat) [%]	27.11	6.40	26.63	6.77	0.36	ns	36.87	7.04	37.80	6.76	-1.71	ns
WHR (Waist-Hip Ratio)	0.94	0.07	0.95	0.08	-0.59	ns	0.91	0.08	0.93	0.07	-2.80	0.005
VFL (Visceral Fat Level)	9.69	3.50	10.52	4.14	-1.04	ns	12.77	4.57	13.61	4.76	-2.31	0.021
FFM (Fat Free Mass) [kg]	57.12	7.85	62.95	7.96	-3.70	<0.001	45.30	6.01	46.23	5.69	-2.02	0.043
FFM control [kg]	0.70	1.48	0.26	1.01	1.88	ns	0.65	1.41	0.53	1.36	1.08	ns
SMM (Skeletal Muscle Mass) [kg]	31.91	4.72	35.32	4.73	-3.62	<0.001	24.67	3.56	25.31	3.38	-2.37	0.018
Obesity degree	124.47	13.18	129.94	17.98	-1.64	ns	130.85	22.33	134.92	22.55	-2.32	0.021

The Fat Free Mass and Skeletal Muscle Mass of men in stable, long-term relationships were significantly higher than those of single men ($p<0.001$ for both parameters). Apart from these parameters, the differences between men who were in long-term relationships and those who were not in such relationships were not statistically significant. Compared to single women, married women had significantly higher values for BMI ($p=0.020$), Waist-Hip Ratio ($p=0.005$), Fat Free Mass ($p=0.043$), Skeletal Muscle Mass ($p=0.018$), Visceral Fat Level ($p=0.021$) and Obesity degree ($p=0.021$). There is no statistically significant association between the PA level of married men and singles. In contrast, there is a statistically significant association between the PA levels of married and unmarried women ($p<0.001$) – married women obtain significantly higher average MET value than single women.

Urban men were significantly taller than rural men ($p=0.041$). Body composition did not differ significantly between men living in rural areas and those in urban areas although percent body fat was on the verge of statistical significance.

Table 4. Descriptive statistics for the studied anthropometric features, physical activity and body composition of men and women grouped by place of residence

Feature	Male						Female					
	Urban (n=66)		Rural (n=55)		Difference (U-R)		Urban (n=438)		Rural (n=215)		Difference (U-R)	
	Mean	SD	Mean	SD	t	p	Mean	SD	Mean	SD	t	p
MET	1015.6	985.6	798.8	735.9	1.35	ns	861.9	686.5	619.9	651.7	4.30	<0.001
Body height [cm]	173.74	6.84	171.18	6.72	2.07	0.041	160.80	5.74	161.13	5.37	-0.71	ns
Body mass [kg]	83.58	11.60	84.80	14.41	-0.52	ns	72.20	12.93	77.49	14.19	-4.88	<0.001
TBW (Total Body Water) [L]	45.49	6.01	44.56	6.22	0.83	ns	32.97	4.09	34.84	4.55	-5.30	<0.001
BMI (Body Mass Index) [kg/m²]	27.68	3.37	28.85	4.01	-1.74	ns	27.90	4.43	29.85	5.35	-4.94	<0.001
PBF (Percent Body Fat) [%]	25.72	6.49	28.03	6.64	-1.94	ns *)	37.02	6.66	37.89	7.40	-1.50	ns
WHR (Waist-Hip Ratio)	0.94	0.08	0.96	0.09	-1.76	ns	0.92	0.07	0.93	0.09	-0.89	ns
VFL (Visceral Fat Level)	9.68	3.62	10.98	4.28	-1.81	ns	12.81	4.50	13.88	4.95	-2.76	0.006
FFM (Fat Free Mass) [kg]	61.81	8.23	60.51	8.48	0.85	ns	44.92	5.57	47.39	6.15	-5.14	<0.001
FFM control [kg]	0.40	1.18	0.37	1.20	0.12	ns	0.68	1.34	0.43	1.48	2.16	0.032
SMM (Skeletal Muscle Mass) [kg]	34.64	4.87	33.90	5.09	0.82	ns	24.49	3.32	25.95	3.62	-5.11	<0.001
Obesity degree	126.02	15.30	131.07	18.27	-1.66	ns	129.77	20.61	138.83	24.92	-4.92	<0.001

* close to statistical significance.

There is no statistically significant association between body height, Percent Body Fat and Waist-Hip Ratio of women living in rural and urban areas. A statistically significant difference was noted between the other parameters. Apart from Fat Free Mass and Skeletal Muscle Mass, the women living in rural areas obtained lower values for body composition parameters than their urban peers. There is no statistically significant association between the PA level of men living in rural and urban areas. In contrast, there is a statistically significant association between the PA level of women and their place of residence ($p<0.001$) – women living in the city obtain significantly higher average MET value than women living in the countryside.

Table 5. Descriptive statistics for the studied anthropometric features, physical activity and body composition of women grouped by level of education

Feature	Education – women								Difference	
	primary (N=114)		vocational (N=85)		secondary (N=302)		higher (N=152)			
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	F	p
MET	457.06	541.06	720.87	658.93	848.75	710.92	928.71	664.15	12.72	<0.001
Body height [cm]	160.13	4.82	160.52	5.51	160.95	6.02	161.63	5.39	1.70	ns
Body mass [kg]	78.68	14.71	75.60	14.30	73.00	12.32	71.33	12.24	8.05	<0.001
TBW (Total Body Water) [L]	34.78	4.26	33.77	4.68	33.21	4.33	33.32	4.04	3.93	0.008
BMI (Body Mass Index) [kg/m^2]	30.67	5.55	29.30	5.24	28.13	4.23	27.31	4.62	12.67	<0.001
PBF (Percent Body Fat) [%]	38.88	7.14	38.32	6.45	37.35	6.48	35.47	7.47	6.27	<0.000
WHR (Waist-Hip Ratio)	0.92	0.09	0.94	0.07	0.92	0.07	0.90	0.07	2.69	0.045
VFL (Visceral Fat Level)	14.29	4.89	14.12	4.90	13.01	4.36	12.06	4.75	6.41	<0.000
BFM (Body Fat Mass) [kg]	31.40	10.63	29.60	9.86	27.75	8.54	35.47	7.47	8.53	<0.000
FFM (Fat Free Mass) [kg]	47.28	5.73	45.99	6.35	45.25	5.90	45.40	5.51	3.58	0.013
FFM control [kg]	0.31	1.05	0.56	1.46	0.64	1.36	0.73	1.59	2.24	ns
SMM (Skeletal Muscle Mass) [kg]	25.85	3.36	25.10	3.79	24.70	3.49	24.76	3.30	3.26	0.021
Obesity degree	142.65	25.89	136.30	24.34	130.87	19.70	127.06	21.48	12.62	<0.000

There was no statistically significant relationship between women's body height and FFM control and their level of education. A statistically significant difference was noted between the other parameters. In general, the higher the level of education that the women had attained, the more often their scores for BMI, body fat percentage, visceral fat level and degree of obesity were in the normal range. On the other hand, for skeletal muscle mass and free fat mass, the less educated women scored higher than the more educated women (the higher the value of these parameters, the more beneficial for the body). There is a statistically significant association between women's PA levels and their education level. The better educated the women, the significantly higher the average MET value.

Discussion

Most respondents are aged 60–74 and come from urban areas. The remaining respondents are older people living in so called traditional villages (far away from cities, whose inhabitants occasionally come into contact with urban areas).

Reaching them and carrying out the research was difficult because they do not belong to senior citizens' organisations and rarely use the Internet (Omelan et al. 2017; Omelan et al. 2020), that is why most of the respondents in this study lived in urban areas. The predominance of women in the study group is not surprising as it has been widely documented that, in developed countries, females live longer than males. This is the result of lower female death rates throughout the lifespan (Poulain et al. 2011), and in Poland, there are 139 women for every 100 men over 60 years of age. This ratio differs by place of residence: in cities, the number of women per 100 men is higher than in rural areas (146 vs. 128) (Statistics Poland 2020).

Half of the respondents lived in single-person households, which is another feature of aging and old age. The growing number of one-person households among the elderly is the result of socio-demographic changes that continue to take place in human history (Piekut 2020). More men were married or in partnerships than women. It can be assumed that this is related to the fact that women statistically live longer than men. Almost 60 per cent of the respondents have chronic diseases, and some of them indicated several comorbidities. This is a dangerous situation because the occurrence of several comorbidities may accelerate the progression of the regressive processes caused by ageing (Vercelli and Ciferri 2018).

Body compositions features and physical activity in men and women

The Body Mass Index (BMI) is generally accepted as an indicator of optimal weight. According to the World Health Organisation (WHO) criteria, a BMI between 18.5 and 24.9 kg/m^2 indicates normal weight. The use of the BMI with elderly populations is sometimes criticized. According to Bahat et al. (2012), the BMI scale recommended by the WHO should not be used with older adults because a higher body weight is better for the health of senior citizens.The standard BMI proposed for people above 60 years of age ranges from 24 to 29 kg/m^2 (Queensland Government 2017). Nevertheless, in this study, it was decided to adopt the scale recommended by the WHO. The average BMI for the studied group of women was 28.84 kg/m2, and for men 28.21 kg/m2. These values are in above normal range, close to the first degree of obesity. Similar results were obtained by Malczyk et al. (2016).

A generally accepted body fat range does not exist, and the proposed models rely on empirically set limits, population percentiles and scores, which all have serious limitations (Gallagher et al. 2000). In this study, the InBody 270 criteria for a healthy percent body fat were followed: the standard for women is 18-24 per cent and for men 14–20 per cent. Both the men and the women in this study were well above the norm, but the situation of the women was worse. This is a very alarming result because a high body fat content in combination with a high BMI significantly increases the risk of functional limitations in older women (Zoico et al. 2004).

Considering the magnitude of their BMI and percent body fat values, it is not surprising that other elements of the subjects' body composition were at alarmingly high levels. The male norm for waist-hip ratio ranges from 0.80 to 0.90, and the men exceeded this norm. A similar situation was observed with the women. Thus, the studied seniors are characterised by so-called abdominal obesity.

Accumulation of excess visceral fat significantly increases the risk of health problems, including proximal aortic dilatation, diabetes, heart disease and cancer (Jiang et al. 2018). The accepted norm for visceral fat is <10 points. The men and women both exceeded the norm, but the visceral fat levels were significantly higher in the women.

The obesity degree results conclusively confirmed that the examined seniors were in a health risk group. Regardless of gender, the subjects exceeded the norm, the upper limit of which is 110 per cent.

In an ageing population, healthy values of body water content range from 45–60 per cent in women to 50–65 per cent in men (Verbalis 2003). During this study, the total body water values were measured in litres (L) and used to calculate percent body water for males and females. The mean value for women's Total Body Water was 45.42 per cent, which is basically the lower limit of the norm. The men scored slightly better with 53.55 per cent, but this is also dangerously close to the lower limit of the norm. Similar results were reported by Malczyk et al. (2016). The above could suggest that senior citizens, regardless of gender, are at risk of dehydration. Research by other authors shows that this is a very dangerous situation. A 1–2 per cent decrease in percent body water can impair physiological and mental functions, compromise endurance and contribute to cardiovascular, neural and renal dysfunctions (Josko-Ochojska et al. 2014). Dehydration is a common cause of hospitalisation among older people (El-Sharkawy et al. 2014). Preventive measures are required to increase hydration, improve health and decrease hospitalisation rates among older adults.

In general, physical activity positively influences health status and improves quality of life, allowing seniors to enjoy their independence (Lampinen et al. 2006). Worldwide, approximately 3.2 million deaths per year are attributed to a lack of physical activity. In highly developed countries, the level of chronic disease increases proportionally as physical activity levels decrease. For improved health, moderate to vigorous intensity exercise at least 5 days per week is a key factor. According to Taylor (2014), few older people achieve this level of activity. Based on the results obtained by Polish seniors in this study, their physical activity can be described as sufficient : men 917.09 MET, women 782.11 MET. These values are very close to the upper limit of insufficient physical activity (600 MET) and at the same time very far from the lower limit of high physical activity (1500 MET). Reducing the activity level of the subjects might negatively affect their functional independence, potentially leading to serious social consequences.

Body composition, physical activity and marital status

In ageing and old age, not being married or living alone has negative consequences for many aspects of life. Similarly, there is research confirming that being married protects health. Married people lead more stable, structured and healthier lifestyles and enjoy more psychological and physical support. As a result, married people enjoy better health than single people (Janghorbani et al. 2008; Mata 2015; Dakowicz 2017). A study by Williams, Zhangb and Packardc (2017) found that older people who were married had higher levels of life satisfaction and lower depression scale scores than those who had never been married, were divorced or were widowed. Entry into marriage is associated with weight gain, and exit from marriage, with weight loss (Dinour et al. 2012).

It is interesting that married men were significantly taller than singles ($p<0.001$). Apart from this, our study found that single men did not differ significantly from married men in terms of important parameters such as BMI, Waist-Hip-Ratio, Percent Body Fat, Visceral Fat Level and Obesity degree. In contrast, single women had a number of statistically significant differences from married women. The single women had lower (and therefore better) values for Waist-Hip-Ratio, Visceral Fat Level and Obesity degree. These are interesting results, as the study showed that single women had significantly lower levels of physical activity than married women. Markey et al. (2005) found that being married as opposed to being single is associated with proactive health beliefs in men but not in women. In addition, they reported that women are socialized to see themselves as caretakers and to selflessly support others. Therefore, the role of wife may make a woman less inclined to prioritize her own health care and more inclined to provide care for other family members (Markey et al. 2005). This may be why married women differ from singles in terms of body composition, while the men (regardless of marital status) do not. The manner in which women think about their individual needs, including their health needs, is the product of many thousands of years of shaping male and female social roles and of being brought up according to gender-specific cultural patterns. As we can see, this is also reflected by the women's body composition. To change such deep-rooted traditions is a huge social challenge.

Body composition, physical activity, and place of residence

Rural residents aged 60 years or more constitute 36.1 per cent of the elderly population in Poland (Czapiński and Bledowski 2013). This group remains poorly studied, especially in terms of health. In rural areas, a combination of unique health problems, resource scarcity, demographic characteristics, cultural behaviours and economic concerns influence the health status of residents (Warren and Smalley 2014). These factors can affect body composition.

Except for height (men living in urban areas were significantly taller than those living in rural areas), place of residence (urban/rural) did not affect the men's body composition parameters. However, place of residence was associated with differences in the body composition of the women. Senior women living in urban areas had significantly lower BMI, Visceral Fat Level and Obesity degree. Rural women had a significantly higher Skeletal Muscle Mass score and a higher Fat Free Mass than their urban counterparts, even though their physical activity expressed in MET was lower than that of their urban peers. Percent Body Fat and Waist-Hip ratio were similar in rural and urban women.

The rural women in this study most likely performed physical labor on farms for most of their lives, which may have been the reason for their increased muscle mass relative to their urban peers. The lifestyle of the people living in traditional Polish villages did not include regular recreational physical activity. They did not form lasting habits of exercising for health in their leisure time and this is probably why, after retirement, their physical activity was at a fairly low level, although their Skeletal Muscle Mass remained at a fairly good level. In contrast, older women living in cities are usually better educated and often have white-collar jobs (Omelan et al. 2017; Omelan et al. 2020). It can also be assumed that they were not physically active in their youth and adulthood. But in retirement, they have ample opportunities to change this. In Polish cities, regardless of their size, Third Age Universities and other social organisations that were established to work with the elderly are thriving. Only 11 per cent of these Universities operate in rural areas (Statistic Poland 2019). Senior organisations offer their students various forms of physical activities, which seniors enjoy. This is probably why both the men and women living in cities had higher physical activity than their rural peers, and in general, urban seniors are more likely to maintain a high quality of life for longer. The rural women in this study may be at greater risk of more rapid loss of muscle strength and mass. An elderly person with a more sedentary lifestyle loses Fat Free Mass faster than one who is active. Consequently, physical activity serves to prevent weight loss and maintain functional capacity in people over the age of 70 (Woo et al. 2013). It is well established that loss of muscle mass and strength in older men and frail elderly women can be reversed with resistance training exercises, even into the seventh decade (Gallagher et al. 2000). An effective effort should be made as soon as possible to facilitate access to Physical Culture for older rural residents in Poland.

Body composition, physical activity and level of education

Education provides individuals with better access to information and greater critical thinking skills, so educated people make better use of health information than less educated people. A better education appears to be associated with a lower likelihood of obesity, especially among women (Devaux et al. 2011). Yoon et al. (2006) analyzed gender differences in a study of socioeconomic factors and obesity and found that higher levels of education resulted in lower BMI and waist circumference in women, but not in men. Similarly, the study presented here found that the body composition of women differed significantly by level of education, but that of men did not. The lower the education of the women in this study, the higher the rates of such parameters as BMI, Waist-Hip-Ratio, percent body fat, visceral fat level and obesity degree. The only exception was skeletal muscle mass: women with the lowest education had a significantly higher value for this index than better educated ones (and the higher the value of these parameters, the more beneficial for the body). It can be assumed that this is the result of doing physical work throughout an occupationally active life. However, due to the fact that this group's levels of physical activity (457.06 MET) were insufficient at the time of this study, they may be at risk of more quickly losing strength and muscle mass. Cutler and Lleras-Muney (2006) found that better educated women are more likely to exercise, which was confirmed by the present study: physical activity among women with a university education was twice as high as among those with only a primary education.

Therefore, it can be assumed that the higher the education of women, the lower their risk of sarcopenia.

Conclusions

In Poland, expenditures on treatment of people 60 years or more constitute a significant part of the costs incurred for health care. In 2018, the National Health Fund spent E 7,456,140.30 (PLN 34 million) for this purpose, which was an increase of 8 per cent compared to the previous year (Statistics Poland 2020). Considering the results of the research presented in this article, it can be expected that spending on seniors will continue to increase, not only because their number is still growing. The data presented here show that older people, regardless of gender, exceed the norms set for body composition parameters, which increases their risk of age-related diseases and of being overweight or obese, which also lead to health complications. Many countries are concerned not only about the rate of increase in overweight and obesity, but also about inequalities in their distribution across social groups, particularly according to educational level, socio-economic status or ethnicity. Inequalities between social groups appear to be particularly high in women (Wardle et al. 2002). Our study confirmed that the situation is similar in Poland, suggesting that the issue of such differences between women in different socioeconomic groups may be a universal problem. The body composition of Polish female seniors differs significantly by their place of residence, marital status, and level of education. Men differ only by marital status, but with respect to only a few body components. However, it should be emphasised again that, irrespective of socio-economic characteristics, the senior citizens exceeded the norms set for individual body composition components. Attention should also be paid to the physical activity of the subjects. In fact, the average value for both genders indicates sufficient PA, but studies have shown that for women PA is dependent on socio-economic characteristics. Therefore, there is a need to find effective ways to support older adults in maintaining (or increase) their physical activity, and subsequently, to develop habitual physical activity behaviors (Taylor 2014). These should be large-scale preventative measures (which are lacking in Poland) with a particular focus on women with a certain socio-economic profile. This is necessary if we are to improve the quality of life of senior citizens, and as a consequence, reduce expenditures on health care.

Declaration of interest statement

The authors declare that they have no conflict of interest.

Authors' contribution

AAO was the initiator of the article, the main executor of the project, the leader of the research team, co-author of working and final version of the paper; KB was the performer of statistical analyses, interpretation of results and co-author of the draft of the paper; RP was the project contractor, co-author of the working and final version of the paper.

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References

Awais M, Chiari L, Ihlen, EAF, Helbostad JL, Palmerini L. 2013. Physical Activity Classification for Elderly People in Free-Living Conditions. IEEE Journal of Biomedical and Health Informatics 23(1):197–207.

Bahat G, Tufan F, Saka B, Akin S, Ozkaya H, Yucel N, Erten N, Karan MA. 2011. Which body mass index (BMI) is better in the elderly for functional status? Archives of Gerontology and Geriatrics 54:78–81.

Batsis J, Mackenzie T, Barre L, Lopez-Jimerez F, Bartels SJ. 2014. Sarcopenia, sarcopenic obesity and mortality in older adults: results from the National Health and Nutrition Examination Survey III. Eur J Clin Nutr 68:1001–1007.

Batsis JA, Villareal DT. 2018. Sarcopenic obesity in older adults: etiology, epidemiology and treatment strategies. Nature reviews. Endocrinology 14(9):513–537.

Biernat E, Stupnicki R, Gajewski A. 2007. International Physical Activity Questionnaire (IPAQ) – Polish version. Physical Education and Sport 51(1):47–54.

Czapińsk J, Bledowski P. 2014. [Social activity of elderly citizens based on the perceptions of Polish respondents. Social diagnosis 2013]. MPiPS, Warszawa (in Polish).

Colado JC, Garcia-Masso X, Rogers ME, Tella V, Benavent J, Dantas EH. 2012. Effects of Aquatic and Dry Land Resistance Training Devices on Body Composition and Physical Capacity in Postmenopausal Women. J Hum Kinet 32:185–195.

Cutler D, Lleras-Muney A. 2006. "Education and Health: Evaluating Theories and Evidence", NBER Working Paper 12352, www.nber.org/papers/w12352 [Accessed 17.05.2021].

Dakowicz A. 2017. [The psychotransgressive approach to marital success]. Kwartalnik Naukowy. Problematyka transgresji i transcendencji 2(30):1–15 (in Polish).

Devaux M, Sassi F, Church J, Cecchini M, Borgonovi F. 2011. Exploring the Relationship Between Education and Obesity. OECD Journal: Economic Studies 1:121–159.

Dos-Santos JE, Oths KS, Dressler WW. 2001. Socioeconomic factors and adult body-composition in a developing socjety. Rev Bras Hipertens 8(2):173–178.

El-Sharkawy AM, Sahota O, Maughan RJ, Lobo DN. 2014. The pathophysiology of fluid and electrolyte balance in the older adult surgical patient. Clin Nutr 33(1):6–13.

European Commission, 2017. The 2018 Ageing Report. Underlying Assumptions & Projection Methodologies. Institutional paper 065, November 2017. ISSN 2443-8014. Available at: https://ec.europa.eu/info/publications/economy-finance/2018-ageing-report-underlying-assumptions-and-projection-methodologies_en [Accessed 17.06.2021].

Gallagher D, Ruts E, Visser M, Heshka S, Baumgartner RN, Wang J. et al. 2000. Weight stability masks sarcopenia in elderly men and women. Am J Physiol Endocrinol Metab 279(2):366–375.

Houston DK, Niclas B, Zizza CA. 2009. Weighty Concerns: The Growing Prevalence of Obesity among Older Adults. Journal of the American Dietetic Association 109/11:1886–1895.

Janghorbani M, Amini M, Rezvanian H, Gouya MM, Delavari A, Alikhani S. et al. 2008. Association of Body Mass Index and Abdominal Obesity with Marital Status in Adults. Arch Iran Med 11(3):274–281.

Jiang Z, Lin B, Liu T, Qin S, Huang S, Shao S. et al. 2018. Visceral fat index/percentage body fat ratio is independently associated with proximal aortic dilatation in a middle-aged and aged Chinese population in Liujiang of Guangxi. Atherosclerosis 268:19–26.

Jośko-Ochojska J, Spandel L, Brus R. 2014. Dehydration in the elderly as a public health problem. Hygeia Public Health 49(4):712–717.

Lampinen P, Heikkinen RL, Kauppinen M, Heikkinen E. 2006. Activity as a predictor of mental well-being among older adults. Aging & Mental Health 10(5):454-466.

Malczyk E, Dzięgielewska-Gesiak S, Fatyga E, Ziółko E, Kokot T, Muc-Wierzgon M. 2016. Body composition in healthy older persons: role of the ratio of extracellular/ total body water. Journal of Biological Regulators & Homeostatic Agents 30(3):447–452.

Markey CN, Markey PM, Schneider C, Brownlee S. 2005. Marital Status and Health Beliefs: Different Relations for Men and Women. Sex Roles 53:443–451.

McLaren L. 2007. Socioeconomic Status and Obesity. Epidemiologic Reviews 29:29–48.

Mata J, Frank R, Hertwig R. 2015. Higher body mass index, less exercise, but healthier eating in married adults: Nine representative surveys across Europe. Social Science & Medicine 138:119–127.

Omelan AA, Podstawski RS, Wziątek B, Merino-Marban R, Romero-Ramos O. 2017. Physical activity levels of rural and urban seniors in the region of Warmia and Mazury in Poland. Baltic Journal of Health and Physical Activity 9(4):74–88.

Omelan AA, Zielińska I, Wziątek B, Bielinis E, Podstawski R. 2020. Health-related behaviors of seniors in rural versus urban areas: a cross-sectional study. Health Prob Civil 14(1):1–8.

Piekut M. 2020. Living Standards in One-Person Households of the Elderly Population. Sustainability 12, 992, 1–26.

Poulain M, Pes G, Salaris L. 2011. A Population Where Men Live As Long As Women: Villagrande Strisaili, Sardinia. Journal of Aging Research, https://doi.org/10.4061/2011/153756

Queesland Government 2017. Using Boby Mass Index. Available at: https://www.health.qld.gov.au/__data/assets/pdf_file/0031/147937/hphe_usingbmi.pdf [Accessed 17.04.2021].

Ruiz-Montero P, Castillo-Rodríguez A. 2016. Body composition, physical fitness and exercise activities of elderly. Journal of Physical Education and Sport, 16(3):136, 860–865.

Ryall JG, Schertzer JD, Lynch GS. 2008. Cellular and molecular mechanisms underlying age-related skeletal muscle wasting and weakness. Biogerontology 9:213–228.

Silva Neto LS, Medeiros A, Travassos A, Osório NB, Nunes GF. 2019. Association between sarcopenic obesity, muscle strength and risk of cardiovascular and cardiometabolic diseases in the elderly: A systematic review. Rev Nutr 32, http://doi.org/10.1590/1678-9865201932e180237

Staatz CB, Kelly I, Lacey R, Hardy R. (2019). Socioeconomic position and body composition across the life course: a systematic review protocol. Systematic Reviews 8,263, https://doi.org/10.1186/s13643-019-1197-z

Statistics Poland 2020. The situation of older people in Poland in 2018. Statistical analyses. Statistics Poland Statistical Office in Białystok.

Statistic Poland 2019. [Universities of the Third Age in Poland in 2018]. Warszawa GUS. Available at: https://stat.gov.pl/obszary-tematyczne/edukacja/edukacja/uniwersytety-trzeciego-wieku-w-polsce-w-2018-r-,10,2.html [Accessed 27.03.2022].

Taylor D. 2014. Physical activity is medicine for older adults. Postgrad Med 90:26–32.

Tyrovolas S, Ai Koyanagi A, Olaya B, Ayuso-Mateos JL, Miret M, Chatterji S. et al. 2016. Factors associated with skeletal muscle mass, sarcopenia, and sarcopenic obesity in older adults: a multi-continent study. Journal of Cachexia, Sarcopenia and Muscle 7:312–321.

Verbalis JG. 2003. Disorders of body water homeostasis. Best Pract Res Clin Endocrinol Metab 17(4):471–503.

Vercelli A, Ciferri L. 2018. Ageing and the Grey Society: An Opportunity to Change Our Views in Medicine? DigitCult, Scientific Journal on Digital Cultures 3(1):1–6.

Ward J, de Lima Friche AA, Caiaffa WT, Proietti FA, Xavier CC, Diez Roux AV. 2015. Association of socioeconomic factors with body mass index, obesity, physical activity, and dietary factors in Belo Horizonte, Minas Gerais State, Brazil: The BH Health Study. Social Patterning of Obesity and its Risk Factors 31:182–194.

Wardle J, Waller J, Jarvis MJ. 2002. Sex Differences in the Association of Socioeconomic Status With Obesity. American Journal of Public Health 92(8):1299–1304.

Warren JC, Smalley KB (editors). 2014. Rural Public Health. Best Practices and Preventive Models. LLC New York: Springer Publishing Company.

Williams L, Zhangb R, Packardc KC. 2017. Factors affecting the physical and mental health of older adults in China: The importance of marital status, child proximity, and gender. Population Health 3:20–36.

Woo J, Yu R, Yau F. 2013. Fitness, fatness and survival in elderly populations. Age 35(3):973–984.

World Health Organization, 2015. Action for Ageing. A toolkit for organizing innovative events on the World report on ageing and health. Available at: https://www.who.int/ageing/events/world-report-2015-launch/ageing-health-events-toolkit.pdf?ua=1 [Accessed 17.04.2021].

World Health Organization, 2017. Policies and Priority Interventions for Healthy Ageing. Available at: https://www.euro.who.int/__data/assets/pdf_file/0006/161637/WHD-Policies-and-Priority-Interventions-for-Healthy-Ageing.pdf [Accessed 07.04.2021].

Yoon YS, Oh SW, Park HS. 2006. Socio-Economic Status in Relation to Obesity and Abdominal Obesity in Korean Adults: A Focus on Sex Differences. Obesity (Silver Spring) 14(5):909–919.

Zoico E, Di Francesco V, Guralnik JM, Mazzali G, Bortolani A, Guariento S et al. 2004. Physical disability and muscular strength in relation to obesity and different body composition indexes in a sample of healthy elderly women. Int J Obes 28:234–241.