THE EVALUATION OF BODY COMPOSITION IN RELATION TO PHYSICAL ACTIVITY IN 56–73 YEAR OLD WOMEN: A PILOT STUDY

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Lack of physical activity is associated with an increase in the prevalence of overweight and obesity. Preventing excessive weight gain is a public health priority.

The aim of this study was to analyze the relationship between body composition and the level of physical activity in 56–73 year old women.

We divided the sample into individual subgroups according to recommendations concerning moderate physical activity and the number of steps made on average per day. Body composition was measured by means of multifrequency bioelectrical impedance analysis (InBody 720) and the accelerometer ActiGraph GT1M was used to monitor physical activity.

The BMI mean values were in the zone of overweight in all the measured subgroups with the exception of the women who met the recommendation relating to average steps made per day, where the BMI mean value (24.93 kg/m^2) was within the zone of normal range. The positive effect of physical activity was shown especially in the changes of body fat amount. The absolute and relative body fat proportion and the BFMI was higher ($p < .05$; $p < .01$) in the inactive women than in the active ones and its proportion decreased in correlation with the intensity of physical activity ($r_p = -0.40$; $p < .05$) and the number of steps per day ($r_p = -0.50$; $p < .05$). Concerning the distribution of body fat mass, we found that in all subgroups fat is deposited in the central part of the body. In both cases the level of very high risk was reached (WHR > 0.90). The average values of visceral fat were above the safe limit (100 cm^2) in all measured subgroups, however, its proportion was significantly lower ($p < .05$) in the active women. Based on the analysis of basic body parts it was found out that the proportion of soft lean mass in the right and left upper limb and on the trunk is higher ($p < .05$; $p < .01$) in active women than in inactive women.

The above mentioned results support the assertion of the positive effect of physical activity on human health. Regarding the body composition, physical activity results in a reduction of body fat, excessive levels of which cause a great deal of public health problems worldwide.

Keywords: Healthy aging, InBody 720, body fat mass, moderate physical activity, walking, ActiGraph.

INTRODUCTION

Aging is a complex process that is determined by genetic factors and modified by environmental factors. From the ontogenetic perspective, senescence is considered to be an important fundamental point. Since ageing is associated with an increasing risk of chronic disease, disability and cognitive decline, a sharp rise in the need for medical and social services and associated costs is to be expected (Schuit, 2006). A basic attribute of aging is physical activity decline and the adoption of sedentary lifestyle. In developed countries, physical inactivity is regarded as one of the main causes of total mortality and morbidity (Blair & Brodney, 1999; Leitzmann et al., 2007).

From the somatometric point of view, the effect of physical activity is evaluated mainly in relation to the change in ratio of body mass fractions – reduction of body fat mass and an increase in muscle tissue (Riegerová & Přidalová, 1996), thus the decrease of physical activity considerably affects the changes of body composition that are seen as an adequate indicator of body functional state (Guo, Zeller, Chumlea, & Siervogel, 1999). The reduction of active energy expenditure that is disproportionally lower than energy intake results in body weight increase and potential obesity advancement.

The Body Mass Index (BMI) is a basic indicator enabling us to classify obesity and associated risks. When the BMI value exceedes 30 kg/m^2, the person is regarded to be obese. Some authors (Kalvach, Zadák, Jirák, Zavázalová, & Sucharda, 2004; Kyle, Genton, Gremion, Slosman, & Richard, 2004a; Kyle, Morabia, Schutz, & Pichard, 2004b; Schutz, Kyle, & Pichard, 2002) however, view the evaluation of obesity by means of BMI as inadequate because this index does not allow for involving the variability and changes in the proportions of Fat Free Mass (FFM) and Body Fat Mass (BFM).

The relation of FFM to body height is presented by the FFMI (Fat Free Mass Index), which is also used for the basic evaluation of sarcopenia.

The age related decline of FFMI is lower in physically active individuals than in sedentary lifestyle individuals (Kyle et al., 2004a). According to Heyward and Wagner (2004) the optimal percentage of body fat in the male population older than 55 is 10–16%, respectively 25–35% in women. In the case of BFMI (Body Fat Mass Index), that shows the relation of the absolute proportion of body fat to body height. The normal range is 1.8–5.1 kg/m^2 for men and 3.9–8.1 kg/m^2 for women (Kyle et al., 2004a). To evaluate the type of obesity concerning the distribution of body fat, the WHR (Waist Hip Ratio) can be used. It indicates abdominal obesity based on the ratio of the waist and hip circumferential parameters. The limit of the moderate risk ratio in its relative value is 0.76 for women (60–69 years) and 0.91 for men of the same age (Bray & Gray, 1988). Clasey et al. (1999) considers WHR to be adequate for the evaluation of abdominal obesity, however the value of visceral fat appears to be even more predictive of some of the adverse health consequences of obesity.

In the field of the treatment and prevention of obesity in the senior population, the most explicit results were obtained by increasing physical activity (Shephard, 1997). The frequency, intensity and duration of physical load need an individual approach that must be in accordance with the individual's biological age. Aerobic exercises, including walking, are thought to be the basis in order to maintain the functional efficiency of seniors, to reduce their risk for cardiovascular disease (Mazzeo et al., 1998) and total cholesterol concentration (Ready, Drinkwater, Ducas, Fitzpatrick, Brereton, & Oades, 1995). There is growing evidence that 10 000 steps/day is an amount of physical activity that is associated with indicators of good health and persons accumulating this amount of steps per day are classified as active (Tudor-Locke & Bassett, 2004). Concerning the intensity of physical activity, it is generally recommended for the adult and senior population to perform moderate physical activity at least 150 minutes a week or vigorous physical activity at least 75 minutes a week, eventually to combine both intensities. To multiply the effects of physical activity on human health, it is recommended to increase moderate physical activity to above 300 minutes or vigorous physical activity above 150 minutes a week, eventually to suitably combine these (U. S. Department of Health and Human Services, 2008).

Investigating the level of physical activity and its impact on weight and body composition changes is necessary for health promotion strategies. However, the selection of physical activity and body composition assessment tools is crucial considering the study population and overall research settings (Gabriel et al., 2009). Some studies dealing with physical activity have assessed body composition using the methods of standard anthropometry (Rana, Li, Manson, & Hu, 2007; Stevens et al., 2007.) or the bioelectrical impedance method (50 kHz) (Kyle et al., 2004a, 2004b). As regards physical activity measurement, some studies have assessed it subjectively via self reported physical activity questionnaires (Hughes, Frontera, Roubenoff, Evans, & Singh, 2002; Kyle, Melzer, Kayser, Picard-Kossovsky, Gremion, & Pichard, 2006). However, subject to the age group for whom physical activity levels are being measured, along with other factors, contrasting results about the usefulness of such questionnaires have been reported. For older people, questionnaires may not be entirely satisfactory (e.g. Jørstad-Stein et al., 2005), as their reliability may be questionable (Tudor-Locke & Myers, 2001), although some questionnaires are moderately correlated with objective motion sensor measures of physical activity (pedometer and accelerometer counts) (Gabriel et al., 2009; Harris, Owen, Victor, Adams, Ekelund, & Cook, 2009). Only a few studies monitored physical activity in relation to body composition objectively, e.g. Thompson, Rakow and Perdue (2004) and Tudor-Locke, Ainsworth, Whitt, Thompson, Addy and Jones (2001), who used pedometers. To our knowledge, no study has employed accelerometers for physical activity assessment along with the multifrequency bioelectrical impedance method for body composition assessment to find out the relationship between physical activity level, walking behaviour and body composition variables.

AIM

In order to bridge this gap in literature, the aim of our study was to analyse the relationship between body composition and (1) the level of physical activity and (2) the daily number of steps in 56–73 years old women.

METHODS

Study sample

The study sample consisted of 43 women. They voluntarily participated in the study after they provided their written consent. The study was approved by the Ethical Committee of the Faculty of Physical Culture at Palacký University in Olomouc. The average age of the participants was 63.89 years (SD = 4.22). They were recruited by offering them free physical activity programmes within the University of Third Age at the Faculty of Physical Culture of Palacký University in Olomouc and the University of Technology in Brno.

Assessment of body composition

Body composition was diagnosed by the InBody 720 (1–1 000 kHz; a multifrequency bioelectrical impedance method) device that differentiates body weight into 3 components – total body water (intracellular and extra cellular), dry mass (proteins and minerals) and body fat. That technology employs 8 contact electrodes (2 are positioned on the palm and on the thumb, another 2 are on the front part of the foot and on the foot's heel) that enable us to analyse 5 basic body parts (the left and right upper limb, trunk, and left and right lower limb) independently from each other. The measurement was performed under laboratory conditions according to user manual instructions (Biospace, 2008).

The basic anthropometrical characteristics were determined with an accuracy of 0.5 cm for body height and 0.1 cm for body weight. The relative risk of health problems is judged by means of BMI, FFMI and BFMI. To evaluate abdominal obesity, we use the WHR (Waist Hip Ratio), Visceral Fat Area (VFA) and abdominal circumference. The classification of FFMI and BFMI is based on the norms as stated by Kyle et al. (2004b). The evaluation of VFA is described in the user manual (Biospace, 2008), which defines this parameter as the area of transversal cut in the abdominal zone (L_4–L_5). The correlation between the Computer Tomography and InBody 720 is set at $r = 0.92$.

Assessment of physical activity

To find out the volume, the intensity of physical activity per week and the average number of steps, we used the ActiGraph GT1M accelerometer, which, for the monitoring of physical activity in adults for 7 days, is considered reliable (Trost, McIver, & Pate, 2005). It was shown by McClain, Sisson and Tudor-Locke (2007) that the interinstrumental reliability of the ActiGraph accelerometer in adults regarding common life is 0.97 for counts and 0.99 for steps. Each participant agreed with the measurements and was acquainted with how to operate the accelerometer. To analyse the relationship between body composition and physical activity, the sample was divided into subgroups according to the classification of the U. S. Department of Health and Human Services (2008) and the number of steps made on an average per one day (TABLE 1, 2).

TABLE 1
Number of participants in individual subgroups according to number of minutes spent on moderate physical activity

	Subgroup	Intensity PA (3–6 METs)	n
Insufficiently active	SUB1A	< 150 min/week	6
Active	SUB1B	150–300 min/ week	16
Highly active	SUB1C	> 300 min/ week	21

Legend:
Classification according to the U. S. Department of Health and Human Services (2008).

TABLE 2
Number of participants in individual subgroups according to number of steps taken on average per day

	Subgroup	Steps/day	n
Not meeting recommendation	SUB2A	< 10 000	21
Meeting recommendation	SUB2B	> 10 000	22

Statistical analysis

The obtained data were adequately processed by Lookin' Body 3.0, ActiPA 2006 software (Chytil, 2006) and Statistica 7 software. To test the average differences between the individual subgroups, we used Fisher's LSD post-hoc after one factor analysis of variance (ANOVA) and the Shapiro-Wilk W test was used in testing for normality before each analysis. Cohen's coefficient *d* (Cohen, 1988) was calculated for the determination of effect size between two variables. The values of 0.2, 0.5 and 0.8 were interpreted according to the small, medium and large ranges of Cohen's standard. The strength of the relationship between physical activity characteristics and body composition variables was quantified by means of Pearson's correlation coefficient (r_p). Statistical significance was set at $p < .05$ or $p < .01$.

RESULTS AND DISCUSSION

Making 10 000 steps everyday means an energy expenditure of 300–400 kcal (depending on walking speed and somatic parameters), whereas 30 minutes of moderate physical activity amounts to 150 kcal (Tudor-Locke & Bassett, 2004). As far as weekly energy expenditure is concerned, it is more effective to take 10 000 steps a day than to attain the criteria of 150–300 minutes of moderate physical activity a week. This statement corresponds with the results presented in TABLE 3 and 4.

When we divided our sample according to the intensity of the physical activity, we could see that only those women performing more than 300 minutes of moderate physical activity attained the criterion of taking 10 000 steps a day. The women attaining the general recommendations for adults and older adults (at least 150 min/week) took only 8 430 steps/day. Different results were obtained when evaluating the number of steps taken in one day (TABLE 4). Even the test subjects that do not perform the generally recommended number of steps per one day (< 10 000/day) attained the recommendation of having 150 minutes of medium intensity physical activity (3–6 METs) a week. This statement corresponds with research results of Payn et al. (2008).

When evaluating the effect of physical activity on body composition, it is necessary to view every classification with regard to its sensitivity. Elia (2001) describes the declination of total energy expenditure as a result of natural involution. This declination is, on average, 165 kcal per decade in women and 103 kcal in men. It is mainly caused by increasing physical inactivity and reduction of basal metabolism. This trend is initiated by natural involution changes but there is also an important effect of external factors. It is evident that adhering to the above mentioned recommendations helps in keeping the energy balance and it prevents the growth of undesirable body fat mass.

According to the U. S. Department of Health and Human Services (2008), at least 150 minutes of moderate physical activity a week is recommended to maintain physical and mental health (for adults and older adults). Only 6 participants (14%) did not meet this recommendation, on the other hand 49% subjects reached more than 300 min/week (TABLE 3). European research points out that approximately 60% of people older than 65 year do not perform any moderate physical activity (European Commission, 2003). Thus participants seem to be very active according to European findings.

TABLE 3 presents the selected anthropometrical characteristics in the study sample divided into subgroups according to moderate physical activity. In SUB1A are the women who did not meet the guidelines or physical activity (insufficiently active – less than 150 minutes of moderate activity a week), in SUB1B are

TABLE 3
Selected anthropometrical characteristics in relation to meeting moderate physical activity recommendations

		< 150 min/week insufficiently active SUB1A (n = 6)		150–300 min/week active SUB1B (n = 16)		> 300 min/week highly active SUB1C (n = 21)	
		Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**
Age		63.00	4.08	63.88	4.34	64.14	4.12
Body height (cm)		164.92	7.13	164.91	4.30	164.62	5.79
Body weight (kg)	†	76.16	10.00	72.26	13.19	68.70	7.73
Intracellular water (l)		21.32	2.75	21.06	2.36	21.05	1.36
Extracellular water (l)		13.38	1.77	13.36	1.62	13.31	0.88
Proteins (kg)		9.22	1.20	9.10	1.02	9.10	0.58
Minerals (kg)		3.44	0.50	3.35	0.40	3.34	0.23
Body fat (kg)	*, †	28.82	5.51	25.39	8.54	21.92	6.23
Percentage body fat (%)	*, †	37.69	4.21	34.12	6.50	31.40	5.54
Fat free mass (kg)		47.35	6.18	46.87	5.37	46.78	3.00
FFMI (kg/m²)		17.36	1.51	17.20	1.56	17.29	1.12
BFMI (kg/m²)	†	10.64	2.16	9.30	3.06	8.14	2.52
BMI (kg/m²)		28.00	3.21	26.51	4.43	25.43	3.32
WHR		0.98	0.04	0.96	0.04	0.96	0.04
Bone minerals (kg)		2.85	0.41	2.78	0.33	2.77	0.19
Cell mass (kg)		30.54	3.98	30.15	3.39	30.14	1.94
Visceral fat (cm²)	*, †	149.88	21.10	130.03	31.13	123.50	24.69
Abdominal circumference (cm)	†	104.13	9.03	95.74	13.55	94.64	8.60
Steps (per day)	**, †	6 373	1 566	8 430	1 681	12 515	2 738
Moderate physical activity (min/week)	**, †	120	39	230	40	442	113

Legend:
Differences were analysed by Fisher's LSD post-hoc after one factor ANOVA. The differences between SUB1A vs. SUB1B and SUB1B vs. SUB1C were significant only in physical activity variables (* $p < .05$, ** $p < .01$), whereas the differences between SUB1A vs. SUB1C was also significant (* $p < .05$, ** $p < .01$) in body composition variables. Large range of Cohen's coefficients († $d < 0.80$) were obtained only between SUB1A vs. SUB1C.

the women who met the general guidelines or adults and older adults (active – at least 150 min/week) and in SUB1C are the highly active women whose volume of moderate physical activity is more than that set forth in the general guidelines (they accomplished more than 300 min of moderate physical activity a week). The average body height was comparable in all subgroups and the higher was the physical activity the lower was the body weight (r_p = –0.29). Although the differences in body weight were insignificant, based on ANOVA (Fisher's LSD post-hoc), between insufficiently active and highly active women, the effect size was found to be 0.92. Following Cohen's guidelines, this should be interpreted as a large effect.

BMI and BFMI mean values showed that all the measured groups are overweight. The differences between the insufficiently active women (SUB1A) and physically active ones (SUB1B and SUB1C) were insignificant, whereas the effect size was, for BMI, in the medium (d = 0.78) and for BFMI in the large range (d = 1.02) of Cohen's standard between insufficiently active and highly active women. This is in agreement with the results of Kyle et al. (2004a) who described higher values of BFMI in the inactive senior population comparing it to the active one. A significantly lower proportion of body fat was found in SUB1C compared to SUB1A, where the body fat difference was 6.9 kg ($p < .05$ by Fisher's LSD post-hoc; d = 1.13), i.e. 6.29% ($p < .05$ by Fisher's LSD post-hoc; d = 1.19) in relative values. The mean value of visceral fat proportion was significantly lower in the highly active ($p < .05$ by Fisher's LSD post-hoc; d = 1.10) than in insufficiently active women. A significant difference in abdominal circumference between insufficiently active and highly active women was confirmed by the large effect of effect size (d = 1.09). Inverse linear correlation was found between moderate physical activity and the absolute (r_p = –0.40; $p < .05$) and relative (r_p = –0.43; $p < .05$) proportion of body fat, BFMI (r_p = –0.40; $p < .05$) and visceral fat area (r_p = –0.36; $p < .05$). FFMI mean values

TABLE 4
Selected anthropometrical characteristics in relation to the number of steps per day

		< 10 000 steps/day not meeting recommendation SUB2A (n = 21)		> 10 000 steps/day meeting recommendation SUB2B (n = 22)	
		Mean	**SD**	**Mean**	**SD**
Age		64.05	4.02	63.73	4.39
Body height (cm)		165.48	5.06	164.09	5.84
Body weight (kg)	*, †	75.31	10.35	67.01	9.40
Intracellular water (l)		21.45	2.26	20.75	1.68
Extracellular water (l)		13.59	1.51	13.10	1.09
Proteins (kg)		9.27	0.97	8.96	0.72
Minerals (kg)		3.45	0.38	3.27	0.30
Body fat (kg)	**, †	27.57	6.50	20.93	6.92
Percentage body fat (%)	**, †	36.22	4.64	30.50	6.13
Fat free mass (kg)		47.75	5.08	46.08	3.75
FFMI (kg/m²)		17.42	1.45	17.12	1.25
BFMI (kg/m²)	**, †	10.09	2.44	7.81	2.72
BMI (kg/m²)	*	27.51	3.59	24.93	3.68
WHR		0.97	0.04	0.96	0.04
Bone minerals (kg)		2.85	0.31	2.72	0.24
Cell mass (kg)		30.72	3.24	29.70	2.40
Visceral fat (cm²)	*, †	140.52	24.87	119.20	27.27
Abdominal circumference (cm)	*	100.12	10.93	92.80	10.29
Steps (per day)	**, †	7 498	1 431	12 658	2 509
Moderate physical activity (min/week)	**, †	208	79	424	127

Legend:
Differences were analysed by Fisher's LSD post-hoc after one factor ANOVA between SUB2A and SUB2B (* $p < .05$, ** $p < .01$). Cohen's coefficient was calculated for determination of effect sizes between two variables († $d < 0.80$).

did not show the characteristics of sarcopenia because they were above the upper limit of normal range in all subgroups. We found similar conclusions regarding the cell mass (BCM). In case of FFMI and BCM, the differences between the highly active and insufficiently active subgroup, and active and insufficiently active subgroup were insignificant.

TABLE 4 enables us to judge the differences between the women who did not meet the recommendation (SUB2A) and women who met the recommendation (SUB2B). This classification results from the recommendations made by by Tudor-Locke and Bassett (2004). Taking over 10 000 steps everyday brings lots of health benefits, amongst others the reduction of body fat. Tudor-Locke et al. (2001) found the correlation between the number of steps taken per day and the percentual proportion of body fat (r_p = –0.27) a BMI (r_p = –0.30). A similar trend was observed in our study, however, the connections between these parameters are much closer (Fig. 1). In the case of percentage body fat, the correlation coefficient is –0.52 ($p < .05$) and –0.38 ($p < .05$) in the case of BMI.

The absolute proportion of body fat mass was significantly lower ($p < .05$ by Fisher's LSD post-hoc; $d = 0.84$) in the women who met the recommendation in comparison to women who did not meet the recommendation. The same trend was found concerning the BFMI ($p < .05$ by Fisher's LSD post-hoc; $d = 0.88$). According to Kyle et al. (2004a) classification, the mean value of the BFMI was high in the women who did not meet the recommendation (BFMI = 10.09 kg/m^2), whereas in women who met the recommendation it was within the normal range (BFMI = 7.81 kg/m^2). Mean values of the WHR were in all measured subgroups in the zone of very high risk (WHR > 0.90) and values were going down with increasing physical activity. This trend is confirmed in the study of Hu, Tuomilehto, Silventoinen, Barengo and Jousilahti (2004) where they found significant differences ($p < .001$) in the WHR between physically active and inactive individuals. Furthermore, it is evident from the study that the physically active population was, on average, younger, had lower BMI, waist and hip circumference, diastolic blood pressure and a higher level of HDL cholesterol than the population with a lower volume of physical activity. In general we can state that the rising of WHR is not only affected by age, as is shown by the results of Jones, Hunt, Brown and Norgan (1986) or Gába, Riegerová and Přidalová (2008), but also by the volume of physical activity. The central distribution of body fat mass is also connected to the average values of the visceral fat area and abdominal circumference and unlike in WHR, the differences are significant ($p < .05$ by Fisher's LSD post-hoc). Based on these results, we can state that physical activity might lower the risk related to the central distribution of body fat mass in which high levels are connected to an increase in total mortality and morbidity (Elia, 2001; Spirduso, Francis, & Macese, 200).

Soft lean mass (SLM) is an active body mass, which is defined as a fat free mass without bone minerals. Its proportion in the individual body parts is shown in TABLE 5. The percentual SLM is expressed in relation to body weight, which enables us to evaluate the differences in body constitution in the monitored groups. The absolute amount of the SLM is higher in the insufficiently active and women who did not meet the recommendation with the exception of lower limbs, however the situation is different in relative amounts. On the basis of the higher body weight of the inactive women (SUB1A and SUB2A), the percentual amount of the SLM in the individual body parts is lower than in the active women (SUB1B, SUB1C and SUB2B). We found statistically significant differences in the left and right upper limb ($p < .01$ by means of Fisher's LSD post-hoc) and the trunk ($p < .05$ by means of Fisher's LSD post-hoc) between the active and highly active.

Fig. 1
Correlation of the percentage of body fat (r_p = –0.52; $p < .05$) a BMI (r_p = –0.38; $p < .05$) with number of steps made per day

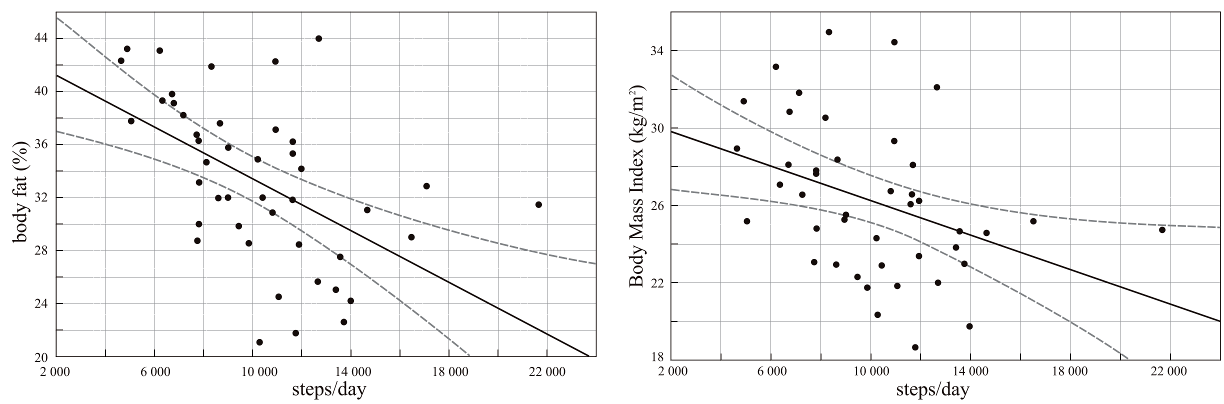

TABLE 5
Segmental analysis of soft lean mass (kg)

	SUB1A n = 6		SUB1B n = 16		SUB1C n = 21		SUB2A n = 21		SUB2B n = 22	
	Mean	% weight	Mean	% weight	Mean	% weight	Mean	% weight	Mean	% weight
RA (kg)	2.57	3.37	2.41	3.34 **	2.47	3.60	2.51	3.33 **	2.42	3.61
LA (kg)	2.52	3.31	2.38	3.29 **	2.43	3.54	2.48	3.29 **	2.37	3.54
TR (kg)	21.63	28.40 *	20.70	28.65 *	20.91	30.44	21.32	28.31 **	20.57	30.70
RL (kg)	7.00	9.19	7.28	10.07	6.98	10.16	7.30	9.69	6.90	10.30
LL (kg)	7.00	9.19	7.23	10.01	6.98	10.16	7.30	9.69	6.86	10.24

Legend:
RA – right arm
LA – left arm
TR – trunk
RL – right leg
LL – left leg
Differences between subgroups were analysed by Fisher's LSD post-hoc after one factor ANOVA – SUB1A vs. SUB1C, SUB1B vs. SUB1C (* $p < .05$, ** $p < .01$); SUB2A vs. SUB2B (** $p < .01$).

The same conclusions were found when we compared the subgroups on the basis of the number of steps taken on average per day. Concerning the evaluation of SLM changes, the most stable are the lower limbs. Further, we concentrated on the evaluation of muscle mass proportion on the limbs regarding laterality. When we compared the selected body parts (RA vs. LA, RL vs. LL), we found factually significant differences between the left and right upper limb. The mean value of the SLM was higher in the right upper limb in all cases, which most likely illustrates its side dominance.

CONCLUSIONS

Results of the presented study support the positive effect of physical activity on body composition, particularly on body fat mass. The more moderate physical activity or number of steps on average a day the more significant changes we observed in body fat mass quantity, in absolute and relative values and we observed distinct changes in the BMFI values. The differences in changes in the visceral fat area in the subgroups appear to be very substantial; similarly we found different values in abdominal circumference and the WHR. The quantity of fat free mass, FFMI and body cell mass did not substantially differ within the subgroups because the fat free fractions are much less affected by this type of physical activity. The mean values of intracellular and extracellular water correspond with these findings. In the women with the highest volume of physical activity, their BMFI values dropped to the safe zone level, which is regarded as a very major effect.

Since this study was conducted as a pilot study in women and concerning the small sample size, future studies investigating the relationship between the body composition and the level of physical activity in female and male population are needed to confirm these findings. Moreover, as the study sample was identified as predominantly active, the follow up research should focus on the sedentary population. It should also be noted, that other factors affecting body composition and physical activity (e.g. dietary, disease or smoking status) were not observed. In spite of these limitations, the presented study is beneficial to follow up research on body composition and in the physical activity research area in the elderly population, particularly in the Czech Republic.

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HODNOCENÍ TĚLESNÉHO SLOŽENÍ VE VZTAHU K POHYBOVÉ AKTIVITĚ U ŽEN VE VĚKU 56–73 LET: PILOTNÍ STUDIE

(Souhrn anglického textu)

Nedostatek pohybové aktivity je spojován se vzrůstajícím výskytem nadváhy a obezity. Z tohoto důvodu se v oblasti veřejného zdraví stává prevence nadváhy a obezity prioritou.

Primárním cílem prezentované studie bylo analyzovat vztah mezi tělesným složením a úrovní pohybové aktivity u žen ve věku 56–73 let.

Sledovaný soubor jsme rozdělili na dílčí podsoubory dle doporučení vztahujících se ke středně zatěžující pohybové aktivitě a počtu kroků vykonaných v průměru za den. Diagnostika tělesného složení byla realizována s využitím multifrekvenční bioimpedanční metody (InBody 720) a pro monitoring pohybové aktivity bylo využito akcelerometru ActiGraph GT1M.

Průměrné hodnoty BMI byly u všech sledovaných podsouborů lokalizovány v pásmu nadváhy s výjimkou žen, které plnily obecná doporučení vztahující se k množství kroků vykonaných v průměru za den. U tohoto podsouboru byla průměrná hodnota BMI (24,93 kg/m^2) lokalizována v pásmu optimální hmotnosti. Pozitivní vliv pohybové aktivity na složení těla se projevil především ve změně zastoupení tukové složky. Absolutní i relativní zastoupení tělesného tuku a BFMI byl u inaktivních žen vyšší než u žen aktivních ($p < 0,05$; $p < 0,01$) a jeho množství klesalo v závislosti na intenzitě pohybové aktivity ($r_p = -0,40$; $p < 0,05$) a průměrném počtu kroků vykonaných za den ($r_p = -0,50$; $p < 0,05$). Z hlediska distribuce tukové tkáně bylo prokázáno její centrální ukládání, a to jak u žen aktivních, tak u žen inaktivních. V obou případech jsme zaznamenali překročení hranice vysoké rizikovosti (WHR > 0,90). Průměrné hodnoty viscerálního tuku se u všech sledovaných podsouborů nacházely nad zdravotně bezpečnou hranicí (100 cm^2), avšak jeho množství bylo signifikantně nižší u aktivních žen ($p < 0,05$). Na základě analýzy základních tělesných segmentů bylo zjištěno, že u aktivních žen je zastoupení SLM na pravé a levé horní končetině a na trupu vyšší ($p < 0,05$; $p < 0,01$) než u žen inaktivních.

Výše zmíněné výsledky podporují tvrzení o pozitivním vlivu pohybové aktivity na zdraví člověka. U tělesného složení se tento vliv projevuje především v redukci tělesného tuku, jehož nadbytek v organismu způsobuje v celosvětovém měřítku velké množství problémů.

Klíčová slova: zdravé stárnutí, InBody 720, tělesný tuk, středně zatěžující pohybová aktivita, chůze, ActiGraph.

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