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Analysis of body composition in elderly residents of social welfare and 24-hour care facilities

Analiza składu ciała starszych mieszkańców ośrodka pomocy społecznej i opieki całodobowej

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Abstract

Introduction. *Regular use of bioelectrical impedance analysis (BIA) in clinical practice and institutional care enables early detection of abnormalities in nutritional status and body composition, which is particularly important in the elderly population where the risk of malnutrition, deterioration of physical function, and quality of life is very high.* **Aim.** *The aim of this study was to assess the body composition of individuals over 60 years of age residing in 24-hour care facilities using BIA.* **Materials and Methods**. *The study included 80 individuals with the average age of 85.* **Results.** *The mean BMI in the studied group was 27.6 ± 5.3. A statistical significance test between BMI and muscle mass showed (p=0.000004) that as BMI values increased, muscle mass (PMM) values also increased. Similarly, with an increase in the percentage of body fat, the visceral fat index increased. This relationship was moderate in the overall group (r=0.491), while in the group of women and men, this relationship (r=0.912; r=0.933) was very strong. The analysis also showed a moderate significant positive correlation between age and the extracellular water to total body water ratio (ECW/TBW) (r = 0.338, p = 0.002).* **Conclusions.** *Based on the conducted analyses, it can be concluded that routine monitoring of body composition in older adults using more precise methods such as BIA is an important element in assessing their nutritional status and metabolic risk. This allows for better tailoring of nutritional and therapeutic strategies, which can genuinely translate into an improved quality of life for this population. (Gerontol Pol 2025; 33; 217-222) doi: 10.53139/GP.20253326*

Keywords*: elderly, electrical bioimpedance, social welfare home*

Streszczenie

Wstęp. *Regularne wykorzystanie bioimpedancji elektrycznej (BIA) w praktyce klinicznej i opiece instytucjonalnej umożliwia wczesne wykrywanie nieprawidłowości w stanie odżywienia i składzie ciała, co jest szczególnie ważne w grupie osób starszych u których ryzyko niedożywienia, pogorszenia funkcji fizycznych i jakości życia jest bardzo wysokie.* **Cel.** *Celem pracy była ocena składu ciała osób powyżej 60 roku życia przebywających w placówkach świadczących całodobową opiekę za pomocą BIA.* **Materiał i metoda.** *W badaniu wzięło udział 80 osób o średniej wieku 85 lat.* **Wyniki.** *Średnia wartość BMI w badanej grupie wynosiła 27,6±5,3. Test istotności statystycznej między BMI, a masą mięśniową wykazał (p=0,000004), że wraz ze wzrostem wartości BMI wzrastają wartości masy mięśniowej (PMM). Również wraz ze wzrostem wartości procentowym tkanki tłuszczowej wzrasta wskaźnik tkanki tłuszczowej trzewnej. Zależność ta w całej grupie była umiarkowana ((r=0,491) natomiast w grupie kobiet i mężczyzn zależność (r=0,912; r=0,933) ta była bardzo silna. W przeprowadzonej analizie wykazano również umiarkowaną istotną dodatnią korelację pomiędzy wiekiem a stosunkiem wody pozakomórkowej do całkowitej (ECW/TBW) (r = 0,338, p = 0,002).* **Wnioski.** *Na podstawie przeprowadzonych analiz można wnioskować, że rutynowe monitorowanie składu ciała osób starszych za pomocą bardziej precyzyjnych metod takich jak BIA jest istotnym elementem oceny ich stanu odżywienia oraz ryzyka metabolicznego. Pozwala to na lepsze dopasowanie strategii żywieniowych i terapeutycznych, co może realnie przełożyć się na poprawę jakości życia tej populacji. (Gerontol Pol 2025; 33; 217-222) doi: 10.53139/GP.20253326*

Słowa kluczowe: *osoby starsze, bioimpedacja elektryczna, dom pomocy społecznej*

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Introduction

The dynamically progressing aging process in all societies poses the greatest challenge of the current century both in Poland and worldwide. The Central Statistical Office prepared a population forecast for Poland for the years 2023-2060, which assumes a significant increase in the number of people aged 65 and over relative to 2023 in all three scenarios that were studied. The high scenario predicts that the number of people aged 65 and over will be 11.09 million in 2060, while the low scenario predicts 8.98 million [1]. The largest increase will occur among people aged 85 and over, this increase being more than twofold compared to 2023[2].

Population aging is associated not only with an increase in the number of people requiring help and care, but also with an increase in the percentage of people struggling with multimorbidity, sarcopenia, malnutrition, obesity, dementia, depression, neoplastic diseases, and other ailments. Often, the negative impact of the clinical course of diseases on the functioning and quality of life of older adults could be alleviated by ensuring adequate intake of nutritional components, hydration, and physical activity [3,4].

At the end of 2023, there were 2138 stationary social welfare facilities operating in Poland, including 904 social welfare homes and 652 facilities providing 24-hour care for people with disabilities, chronic illnesses, or the elderly. At the end of 2023, nearly 121.9 thousand people resided in stationary social welfare facilities, 82.9 thousand of whom were aged 60 and over, constituting 68% of the total number of residents in these facilities [2].

Monitoring body composition using bioelectrical impedance analysis (BIA) in social welfare centres and those providing 24-hour care for older adults can significantly contribute to optimizing nutritional and physiotherapeutic interventions, thereby supporting the maintenance of physical fitness, improving quality of life, and reducing the risk of health complications. BIA is a modern, non-invasive, and rapid method of body composition analysis that allows for precise determination of fat mass, muscle mass, and water content in the body [5,6]. In light of current guidelines from the European Society for Clinical Nutrition and Metabolism (ESPEN) and contemporary research on healthy aging, a comprehensive approach to assessing nutritional status and body composition becomes an indispensable element of effective care for older adults, especially in institutional settings where the risk of malnutrition, chronic dehydration, and deterioration of health is particularly high [3].

Aim

The aim of the study was to assess the body composition of individuals over 60 years of age residing in 24-hour care facilities using a bioelectrical impedance analyser.

Materials and Methods

The study was conducted among residents of a social welfare home and a 24-hour care facility. Inclusion criteria were the consent of the participant, age over 60, and the ability to stand independently on a Tanita MC-780 scale during measurement. The following parameters were considered in the analysis: body weight, height, body mass index (BMI), percentage of body fat (FATP), fat mass in kg (FATM), visceral fat index (VFATL), muscle mass (PMM), bone mineral mass (BONEM), fat-free mass (FFM), total body water (TBW), intracellular water (ICW), and extracellular water (ECW).

Spearman's rank correlation coefficient and its corresponding significance test were used to examine the existence of relationships in the statistical analysis. The STATISTICA program was used for statistical analysis.

Results

The study included 80 people (65 women and 15 men), where the average age was 85 years, and the participants ranged in age from 60-99 years. Table I and II present the parameters of body composition analysis divided by age and sex, which indicate, among other things, that: the average BMI value in the studied group was 27.6±5.3 and was comparable in the group of women (27.7±5.6) and men (26.9±3.9), as well as in early old age (27.3±7.3) and late old age (27.6±3.9). The muscle mass (PMM) value for the entire study group was 43.9±7.2, among women it was 41.8±5.8, and among men 53.1±5.2. The percentage of body fat (FATP) for all participants was 31%±9.3, for women 27.7%±5.6, and for men 26.9%±7.4.

Due to the analysis of various studies concerning optimal BMI ranges for the elderly, table III presents the distribution of BMI values in specific subgroups, divided by sex. For 43% of the subjects, BMI values were in the range of 23-29.9, and for 15% of the respondents, the result indicated underweight (BMI<23) and for the same number of respondents (15%) overweight (BMI>30). In the group of men, there were no individuals with a BMI value above 35, while in the group of women, this accounted for 11%.

Table I. Parameters of Body Composition Analysis (Overall and by Gender)

Gender	Overall					Women					Men				
Variable	N	Mean	Min	Max	Std. Dev.	N	Mean	Min	Max	Std. Dey.	N	Mean	Min	Max.	Std. Dey.
Hight	80	157.3	142.0	172.0	6.7	65	155.4	142.0	170.0	5.8	15	165.2	158.0	172.0	4.0
Weight	80	68.1	44.5	101.1	13.0	65	66.8	44.5	101.1	13.3	15	73.4	48.2	89.2	10.5
BMI	80	27.6	17.4	42.0	5.3	65	27.7	17.4	42.0	5.6	15	26.9	19.3	32.4	3.9
FATP	80	31.0	11.0	46.5	9.3	65	32.9	11.0	46.5	8.7	15	23.0	11.2	33.8	7.4
FATM	80	21.8	5.4	45.5	9.5	65	22.8	7.3	45.5	9.7	15	17.5	5.4	30.1	7.4
PMM	80	43.9	31.3	59.9	7.2	65	41.8	31.3	55.9	5.8	15	53.1	40.6	59.9	5.2
VFATL	80	12.2	5.0	22.0	4.1	65	11.1	5.0	19.0	3.3	15	17.2	11.0	22.0	3.6
BONEM	80	2.3	1.7	3.1	0.4	65	2.2	1.7	3.0	0.3	15	2.8	2.2	3.1	0.2
FFM	80	46.3	33.0	63.0	7.6	65	44.1	33.0	58.9	6.1	15	55.9	42.8	63.0	5.4
TBW	80	32.2	23.1	44.5	5.3	65	30.7	23.1	41.2	4.4	15	38.4	29.5	44.5	4.3
ECW	80	15.3	11.4	19.8	2.3	65	14.8	11.4	19.5	2.0	15	17.9	14.4	19.8	1.4
ICW	80	16.8	11.6	25.5	3.2	65	16.0	11.6	23.2	2.7	15	20.5	15.1	25.5	3.0

Table II. Parameters of Body Composition Analysis by Age

Age group	60-74 years					75 years and more				
Variable	N	Mean	Min	Max	Std. Dev.	N	Mean	Min	Max	Std. Dev.
Height	9	157.8	149.0	170.0	6.0	71	157.2	142.0	172.0	6.8
Weight	9	68.0	44.5	101.1	18.4	71	68.1	45.6	97.1	12.3
BMI	9	27.3	17.4	41.5	7.3	71	27.6	19.3	42.0	5.1
FATP	9	31.5	15.8	45.0	10.0	71	31.0	11.0	46.5	9.3
FATM	9	22.6	8.5	45.5	12.0	71	21.7	5.4	43.6	9.2
VFATL	9	43.1	31.3	52.8	8.1	71	44.0	32.5	59.9	7.1
PMM	9	9.1	5.0	17.0	3.7	71	12.6	7.0	22.0	4.0
BONEM	9	2.3	1.7	2.8	0.4	71	2.4	1.8	3.1	0.4
FFM	9	45.4	33.0	55.6	8.6	71	46.4	34.3	63.0	7.5
TBW	9	32.0	23.1	39.2	6.1	71	32.2	23.7	44.5	5.2
ECW	9	14.8	11.4	19.5	2.9	71	15.4	11.5	19.8	2.2
ICW	9	17.2	11.6	22.1	3.5	71	16.8	11.8	25.5	3.2

Table III. BMI Values

BMI	Overall		Women		Men	
	N	%	N	%	N	%
< 23	17	21	15	23	2	13
23-29,9	36	45	28	43	8	54
30-35	20	25	15	23	5	33
≥35	7	9	7	11	–	–
Total	80	100	65	100	15	100

When correlating the percentage of fat content (FATP) with age, it can be observed that neither in the group of women (p=0.063531) nor in the group of men (p=0.744182) did the significance test for Spearman's correlation coefficient show a statistically significant correlation between the examined characteristics. However, in the case of women, p=0.0663531 was just slightly above the threshold to conclude that the percentage of body fat increases with age.

In the studied group of women and men, the significance test for Spearman's correlation coefficient did not show a statistically significant correlation between age and fat-free body mass in kg (FFM). Both p-values were greater than 0.05 (for women p=0.339657, for men p=0.893301).

Table IV compiles the results of the significance test for the Spearman's correlation coefficient, which showed a statistically significant correlation (p=0.000004) between BMI and muscle mass (PMM). The results indicate that as BMI values increase, PMM values also increase. This relationship is moderate in the general population. In the group of women, the significance test for Spearman's correlation coefficient showed a statistically significant correlation (p<0.000001) and this relationship is strong. In the group of men, no correlation was found between the examined characteristics (p=0.080943).

Table IV. Correlation Coefficient between BMI and PMM

Variable	Gender	N	Spearman's Correlation Coefficient	p- value
BMI and PMM	Women	65	0.629	<0.000001
	Men	15	0.465	0.080943
	Overall	80	0.485	0.000004

Table V presents the percentage content of body fat according to sex. The analysis shows that in the group of women – 46% and in the group of men – 47% have a high percentage content of body fat, while nearly one in five women (19%) and 13% of men have a low percentage content of body fat.

Table V. Percentage of Body Fat

Gender	Women			Men		
FATP (%)	Parameters	N	%	Parameters	N	%
	<24 (low)	12	19	<13 (low)	2	13
	24-35 (norm)	23	35	13-25 (norm)	6	40
	>36 (high)	30	46	>26% (high)	7	47
Total		65	100		15	100

The analysis of the Visceral Fat Area/Visceral Fat Index (VFATL) is presented in table VI, based on which it can be observed that in the studied group, the values are elevated for 44% of the subjects, and for every fourth subject (25%), the values indicate a high metabolic risk. In the group of women, for 15% the visceral fat index indicates a high metabolic risk, and in the group of men, as many as 67%. In the group of men, there was not a single man whose visceral fat index was within the normal range.

Table VI. Visceral Fat Index

VFATL	Overall		Women		Men	
	N	%	N	%	N	%
1-9	25	31	25	38	–	–
10-14	35	44	35	47	5	33
15 and more	20	25	10	15	10	67
Total	80	100	65	100	15	100

In the studied group, the significance test for the Spearman's correlation coefficient showed a statistically significant correlation (p<0.000001) between body fat in % (FATP), and the Visceral Fat Area/Visceral Fat Index (VFATL), which is presented in Table No. VII. The results indicate that as the percentage of body fat increases, the visceral fat index also increases. This relationship is moderate in the overall group, while in the group of women and men (p<0.000001), this relationship between the examined variables is very strong. This may be relevant for assessing metabolic risk and planning nutritional interventions.

Table VII: Correlation Coefficient between FATP and VFATL

Variable	Gender	N	Spearman's Correlation Coefficient	p- value
FATP and VFATL	Women	65	0.912	<0.000001
	Men	15	0.933	<0.000001
	Overall	80	0.491	<0.000001

Table VIII presents the Spearman's correlation between age and extracellular wather to total body water (ECW/TBW). In the conducted analysis, it can be observed that with increasing age in the studied group, the values of the ratio of extracellular water to total body water (ECW/TBW) increase (p=0.002029) and this relationship is moderate. This relationship is also moderate in the group of women (p=0.000172), while there is no statistically significant correlation between the examined characteristics in the group of men (p=0.482140).

Table VIII. Correlation Coefficient of Age and ECW/TBW

Variable	Gender	N	Spearman's Correlation Coefficient	p- value
AGE and (ECW/TBW)	Women	65	0.446	0.000172
	Men	15	0.197	0.482140
	Overall	80	0.338	0.002029

Discussion

The Body Mass Index (BMI) is a widely used tool for assessing nutritional status and is applied in, among others, screening scales such as the Nutritional Risk Screening 2002 (NRS 2002) and the Mini Nutritional Assessment (MNA®). In the elderly population, its diagnostic value may be limited due to physiological changes associated with age, including a decrease in muscle mass and an increase in fat tissue percentage. Therefore, this study utilized the bioelectrical impedance (BIA) method, enabling a more precise assessment of body composition [7].

In the study group, the mean BMI value was 27.6 kg/m^2, which falls within the range of 25–29.9 kg/m^2, considered optimal for older adults and associated with a lower mortality risk [8]. This is consistent with reports by Grzegorzewska et al., indicating the protective effect of moderate overweight in this population. However, two extremes were also observed: underweight (BMI

<23 kg/m^2) in 21% of the subjects and a BMI value ≥35 kg/m^2 among women (11%). The latter may suggest a risk of sarcopenic obesity (SO), one of the criteria for which is a BMI exceeding 35 kg/m^2 [9].

Sarcopenic obesity (SO) is associated with a twofold higher risk of developing hypertension and diabetes, and a fourfold higher risk of metabolic syndrome compared to individuals with normal body composition. In the treatment of SO, non-pharmacological therapeutic strategies focusing on reducing fat tissue and preserving muscle mass are crucial. Elements of these actions include a properly balanced diet with adequate energy and protein intake, as well as regular physical activity [10,11].

In our own analysis, a positive correlation between BMI and muscle mass (PMM) was observed, regardless of gender. A particularly strong correlation was found among women. This may suggest that higher BMI values in some cases are not solely due to excess fat tissue but also to increased muscle mass, which potentially translates into a better quality of life in old age [12].

Concurrently, it was found that an increase in total fat content (FATP) significantly correlates with higher levels of visceral fat (VFATL) in the entire study group. Although moderate fat content can be protective in older adults, excessive accumulation of visceral fat is a risk factor for many chronic diseases, including: cardiovascular diseases, insulin resistance, type 2 diabetes, metabolic syndrome, some cancers, and the occurrence of osteoarthritis [13,14].

In the analysed group, clear differences in VFATL levels between genders were noted. Among men (n=15), 33% had VFATL values exceeding the norm, and the remaining 67% were in the high metabolic risk range (VFATL ≥ 15). None of the men achieved values considered normal (1–9). Among women (n=65), 38% met the norm, while 47% showed elevated VFATL levels, and 15% very high. Similar gender differences were described in a study published in Clinical Nutrition ESPEN, which showed that women more often have normal VFATL values, while men tend to exceed them [15]. The collected results suggest that elderly men tend to accumulate more visceral fat, which may have significant metabolic and clinical consequences. Importantly, although the literature indicates a relationship between aging and an increase in fat tissue with a simultaneous decrease in fat-free mass, this study did not show statistically significant correlations between age and FATP or FFM content. However, in the case of women, the results were very close to concluding that the percentage of body fat shows an increasing trend with age. The analysis in the group of women showed a p-value of 0.0663531, indicating an increasing trend but not reaching statistical significance. According to the results of Macek et al., the fat tissue content in women increases by an average of about 0.6% per year with age. The observed direction of changes is therefore consistent with previous reports and may be important in assessing metabolic risk and planning nutritional interventions in the population of older women [16,17].

The conducted analysis showed a moderate, significant positive correlation between age and the ratio of extracellular water to total body water (ECW/TBW) ($r=0.338$, $p = 0.002$), with this relationship being stronger in the group of women ($r = 0.446$, $p = 0.00017$), while it did not reach statistical significance in men ($p=0.48$). These results indicate significant changes in fluid distribution associated with the aging process, especially in women. This phenomenon may have serious clinical consequences, as the study by Knudsen et al. showed that an elevated ECW/TBW ratio (>0.68) is an independent risk factor for increased overall mortality and cardiovascular diseases in a healthy population [18]. Similar results were obtained by Hioka et al. in a study which showed that with age, the ECW/TBW ratio increases with a simultaneous decrease in SMI (skeletal muscle mass index) in the group of studied women. Furthermore, the negative effects of aging were visible earlier in ECW/TBW than in SMI. Assessing muscle mass alone may be insufficient to capture the impact of aging on muscle composition, therefore, assessing ECW/TBW may be crucial in the diagnosis of sarcopenia [19].

Although one of the main nutritional problems in older adults is an inadequate intake of protein, as well as existing obesity or malnutrition, the satisfactory body composition parameters observed in a significant portion of the participants may be related to the high standard of dietary care in the facility where the study was conducted [20]. Thanks to the presence of a dietitian, menus were developed in accordance with current nutritional standards for older adults, which may have contributed to the relative stability of nutritional status regardless of age.

Conclusions

Based on the conducted analyses, it can be concluded that routine monitoring of body composition in older adults using more precise methods than BMI – such as BIA – is an important element in assessing their nutritional status and metabolic risk. This allows for better tailoring of nutritional and therapeutic strategies, which can genuinely translate into an improved quality of life for this population.

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Conflict of interest
None

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