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FAT TISSUE CONTENT ASSESSMENT IN WOMEN POPULATION BETWEEN 50 AND 79 YEARS OF AGE

OCENA ZAWARTOŚCI TKANKI TŁUSZCZOWEJ W POPULACJI KOBIET MIĘDZY 50 A 79 ROKIEM ŻYCIA

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S u m m a r y

Nowadays obesity is one of the most important problems in the developed countries. It is characterized by the excess increase of fat tissue. The main causes of obesity are insufficient amount of physical activity and overdosing of energy delivered with food.

The purpose of this paper is the assessment of skinfold thickness and the percentage of fat tissue content in women between 50 and 80 years of age.

1215 female inhabitants of Kujawsko-Pomorskie Voivodeship participated in the study and were divided into 6 age groups in 5-year divisions. The skinfold thickness was assessed and the percentage of fat tissue content was calculated. The measurements were made with the skinfold caliper.

All tested women in the respective age groups, according to BMI index, were overweight, whereas the percentage of fat tissue content was over 40% in all groups. In 65-69 age bracket there is an increase of all tested parameters, whereas in women above 70 years of age a visible decrease of measured skinfold thickness values is observed as well as reduction of proportional fat tissue content.

S t r e s z c z e n i e

Otyłość obecnie jest jednym z ważniejszych problemów w krajach wysokorozwiniętych. Charakteryzuje się nadmiernym zwiększeniem ilości tkanki tłuszczowej. Głównymi przyczynami występowania otyłości są: niedostateczna ilość aktywności fizycznej i nadmiar dostarczanej energii z pożywieniem.

Celem pracy jest ocena grubości fałdów skórno-tłuszczowych i procentowej zawartości tkanki tłuszczowej u kobiet między 50 a 80 rokiem życia.

W badaniu uczestniczyło 1215 mieszkanek województwa kujawsko-pomorskiego, które podzielono na sześć grup wiekowych w przedziałach 5-letnich. Oceniono grubość fałdów skórno-tłuszczowych i obliczono procentową zawartość tkanki tłuszczowej. Pomiary wykonano u nich za pomocą fałdomierza.

Wszystkie badane kobiety w poszczególnych grupach wiekowych według wskaźnika BMI miały nadwagę, natomiast procentowa zawartość tkanki tłuszczowej wyniosła we wszystkich grupach ponad 40% wskazując na otyłość według norm WHO. W przedziale wiekowym 65-69 lat dochodzi do wzrostu wszystkich badanych parametrów, natomiast u kobiet powyżej 70 roku życia obserwuje się wyraźny spadek wartości mierzonych fałdów skórno-tłuszczowych i zmniejszenie procentowej zawartości tkanki tłuszczowej.

Key words: fat mass**,** skinfolds**,** elderly women

Słowa kluczowe: masa tkanki tłuszczowej, fałd skórno- tłuszczowy, kobiety w wieku starszym

INTRODUCTION

The 60-67 age bracket is defined as early old age according to the World Health Organization (WHO). In Europe after 2000 it has been demonstrated that the percentage of people who have not turned 14 is smaller in comparison with the population over 60 years of age. The results of demographic studies indicate the increase of elderly people percentage in the world [1]. The pace of evolutional changes occurring within the organism depends on genetic and environmental factors which include physical activity and nourishment procedures [2]. Aging as a physiological process refers to changes ongoing in all systems and organs functioning. In elderly people cardiopulmonary sufficiency gets reduced, muscle tension and muscle strength dwindle, flexibility diminishes, which may cause problems that refer to movement. Metabolic processes are being slowed down and the pace of metabolism is reduced [1]. Changes in body composition follow these processes. With age, the tendencies to gather fat tissue as well as more frequent occurrences of overweight and obesity are observed [1, 3].

Obesity is defined when fat tissue constitutes 30% in women and over 25% in men of the entire body mass. According to WHO, the number of overweight people is estimated at 1.6 billion and the number of obese people: 522 million [2].

Due to unfavorable influence of obesity on human health and its contribution to creating tumors, type 2 diabetes and circulatory system diseases, it is estimated that this problem is responsible for 10-13% of premature deaths in Europe [2]. The expansion of excess body weight phenomenon refers in particular to the developed countries in which it is observed that the need for physical exercises is reduced due to technological progress, all kinds of conveniences as well as too big energy supply which surpasses individual needs of the organism thanks to easily accessible high-energy food.

Various methods and measuring tools are used to assess overweight and obesity. They allow the sheer assessment whether we are dealing with the discussed problem and, also, they are helpful for body composition assessment – the crucial element determining the state of human nutrition. The classic anthropometric methods frequently used in population studies include, among others: Quetelet index (BMI), waist circumference (WC), waist-hips circumference ratio (WHR), hips circumference (HC) and also skinfold thickness (CFF) allowing for assessing the fat tissue amount within the body.

Due to drastic increase in the frequency of overweight as well as obesity occurrence in Polish society, which is shown by numerous previous studies, the decision was made to test the level of adiposis in elderly women population in Kujawsko-Pomorskie Voivodship. Women are especially exposed to this process due to postmenopausal changes taking place in the organism and a smaller activity often associated with ceasing job activities. The body composition analysis was made and the percentage and fat tissue content in kilograms were measured in elderly women.

MATERIAL AND METHODS

1215 female participants took part in the study which was conducted in 2007-2009 on women participating in Senior Physical Activity Regional Programme of Kujawsko-Pomorskie Voivodship. Women taking part in the study were informed about the purpose and methodology of the study and they endorsed written consents. All women were examined by a doctor assisted by a nurse. The examination covered an interview, arterial blood pressure and heart contraction frequency measurement, EKG, lung auscultation, examining of reflexes, balance and color vision. Next, the Master of physiotherapy measured height, body mass, waist and hips circumference, and the skinfolds with the caliper. With the assistance of this, the basic body composition parameters were achieved, such as Fat Mass in % and kg. All examinations were conducted in the afternoon, in rooms meeting the safety standards, in temperature 18-22ºC.

The skinfold thickness measurement was made with Harpenden skinfold caliper with the range of 0-80mm and the pressure of 10g/mm². The skinfold was grabbed together with fat tissue with a thumb and index finger of a left hand within a distance of about 4cm and then the skinfold was pulled away from the body, after which the measurement was made with a right hand. The skinfold thickness measurement was made in three places: on triceps, abdomen and under scapula. All measurements were made in accordance with WHO norms. Next, all measurements were summarized and, with the assistance of mathematical transformations, the estimated fat tissue content was calculated in percentage and kilograms. The following formulas were used [4, 5]:

Body density (D) was calculated following the formula:

D=1.127900 – 0.000210 log(skinfolds abdomen) – 0.000164 log(skinfolds subscapula) – 0.000064 log(skinfolds triceps)

The percentage of total fat in body mass was calculated following the formula.

$$F\% = 100\% x (\frac{4{,}201}{D} - 3{,}813)$$

Total body fat in kilograms was calculated following the formula.

$$Fkg = \frac{MxF\%}{100}$$

Skinfolds were measured in the following way:

Skinfold on triceps – the skinfold thickness was measured on the rear surface of loosely lowered arm, in the mid distance between elbow and shoulder, the skinfold was grabbed vertically.

Skinfold in abdomen area – thickness was measured horizontally on abdomen in the fourth of a distance between the navel and the front upper iliac spine.

Subscapular skinfold – its thickness was measured vertically on the back below the lower angle of the scapula.

On the basis of weight and height measurement results the BMI was calculated. The mean values of the BMI were: 28.9 in the first age group; 29 in the second ; 28.9 in the third; 29.8 in the fourth; 28.7 in the fifth and 28.2 in the last one, respectively (Table I). According to the WHO classification, on the basis of the BMI, women examined in the study in all age groups are within range of the first degree of overweight.

Table I. *Characteristics of the subjects*

	Age Group	Number of subjects	Age (year)		Body height (cm)		Body weight (kg)		BMI	
			Mean	SD	Mean	SD	Mean	SD	Mean	SD
1	50-54	300	52	±1.5	161.9	±8	76.6	±14.9	28.9	±5.3
2	55-59	370	57	±1.4	161	±7.9	75.1	±12.1	29	±4.4
3	60-64	269	61.7	±1.3	160.4	±6	74.2	±13	28.9	±4.8
4	65-69	172	66.7	±1.5	159.2	±6	76.6	±12.6	29.8	±4.3
5	70-74	70	71.9	±1.3	159.3	±5.6	72.8	±12.1	28.7	±4.2
6	75-79	34	76.6	±1.6	157.9	±7.9	70.3	±10.5	28.2	±3.9

Table II. *Characteristics of the subjects II*

	Age Group	Number of subjects	Waist circumference (cm)		Hips circumference (cm)		WHR	
			Mean	SD	Mean	SD	Mean	SD
1	50-54	300	90.1	±12	108.2	±11.6	0.8	±0.1
2	55-59	370	90.8	±11.2	108.5	±9.3	0.8	±0.1
3	60-64	269	90.7	±11.2	108.2	±10	0.9	±0.4
4	65-69	172	92.9	±11	110.7	±10.8	0.8	±0.1
5	70-74	70	91.2	±10	109.4	±9.3	0.8	±0.1
6	75-79	34	89.7	±8.8	106.3	±8.8	0.8	±0.1

RESULTS

All participants of the study were tested with respect to the body composition evaluation. The body fat content measured in kg as well as assessed in percentage is on the rise from the youngest age group in where it is 33 kg (42.7%). In the second age group it is already 32.5 kg (42.8%), in the third age group – 32.1kg (42.6%) and in the fourth group of women 65-69 years old it is 33.2 kg (43.2%). The last two age groups show the decrease of fat tissue level and, respectively, in the 70-74 years age group it is 31 kg (42.2%) and in the last group – 28.1 kg (40.1%).

Having analyzed the results of respective skinfold thickness measurements, it is obvious that for the oblique skinfold in abdomen area, there is an increase of thickness in two first age groups, i.e. 45.2mm for 50-54 years and 46mm for 55-59 years; in the third age group (60-64) there is a minimal decrease of value to 45.4mm. In the fourth age group (65-69 years) there is a big increase of skinfold thickness, to 48.1mm. In the two following age groups there is a visible decrease to 45.7 in a group aged 70-74 and to 41.2 in a group aged 75-79. The results are similar for the skinfold on triceps and under scapula. The biggest increase in the skinfold thickness happens in age group 65-69, after which in the following age groups, i.e. 70-74 and 75-79, there is substantial decrease.

Table III. *Study results „Fat mass”*

	Age Group	Number of subjects	Fat Mass (%)		Fat Mass (kg)	
			Mean	SD	Mean	SD
1	50-54	300	42.7	±4.8	33	±9.2
2	55-59	370	42.8	±4.2	32.5	±7.6
3	60-64	269	42.6	±4.6	32.1	±8.2
4	65-69	172	43.2	±4.9	33.2	±8.2
5	70-74	70	42.2	±4.6	31	±7.5
6	75-79	34	40.1	±4.8	28.1	±6.6

Table IV. *Study results "Skinfolds"*

	Age Group	Number of subjects	Skinfolds abdomen (mm)		Skinfolds triceps (mm)		Skinfols subscapula (mm)		Sum total skinfolds	
			Mean	SD	Mean	SD	Mean	SD	Mean	SD
1	50-54	300	45.2	±15	25.3	±9.4	33	±12.6	103.4	±32.7
2	55-59	370	46	±13.5	24.2	±8.9	32.4	±11.2	102.5	±28.4
3	60-64	269	45.4	±14.6	25	±9.9	32	±11.5	102.4	±31
4	65-69	172	48.1	±14.9	27.4	±10.1	31.1	±10.9	106.6	±30.9
5	70-74	70	45.7	±14.3	24.7	±10	28.5	±10	98.9	±29.4
6	75-79	34	41.2	±14.6	19.2	±7.7	25.2	±11.3	85.6	±29.2

DISCUSSION

Obesity is a state which is characterized by the excess fat tissue. It greatly worsens the quality of life and influences unfavorably the state of health. Nowadays, it is observed that there is a bigger percentage of people with excess fat gathering and improper body mass in all age groups. With the assistance of anthropometric methods it is possible to determine the occurrence of overweight and obesity. The analysis of skinfold thickness is one of frequently used methods allowing an assessment of the percentage of fat tissue amount.

Fat tissue consists of connective tissue core and fat cells (adipocytes and lymphocytes). It is a type of connective tissue proper. It is a filler of space between organs, muscles, nerves and vessels. The division is made into brown adipose tissue (multivesicular), having a principle role in thermogenesis, which is observed in newborn babies and children. It appears in the first months of fetal life and later on it is transformed into yellow (white – single vesicular) tissue. Subcutaneous fat tissue – the amount of which undergoes the biggest fluctuation within the whole life – is an energy storage. Another type is celiac fat tissue – situated mainly in abdomen area – and it is responsible for so called abdomen obesity. The total body fat content strongly correlates with subcutaneous fat tissue and skinfold thickness.

In the studies by Różańska et al. conducted among elderly people above 60 years of age, a group of 198 women was selected. While measuring four skinfolds (above triceps, biceps of arm, subscapularis muscle and ala of ilium), using Durnin-Womersley equation, the percentage of fat tissue within the body was determined. It was shown that 94.9% of the tested women were characterized by the high fat tissue content - above 33% [6].

Our study shows that the average percentage of fat tissue content in tested women, regardless of age group, exceeds the recommended norms. In each group it is estimated for the content above 40%, which is a value defined as obesity.

Tung-Yang Yu et al. measured skinfold thickness in a group of 32 people (14 men, 18 women) above 60 years of age. The following results were obtained: above triceps 29.6±9.2mm and subscapular fold 27.7±8.0mm. With the assistance of bioimpedance method, the percentage of fat tissue content was determined and the result was 30.7±5.1mm [7].

Turkish researchers – Akyer et al. conducted a study on a group of 50 women aged 20-70. They measured the skinfold thickness above triceps, the average of which for the whole group was 11.9±7.6mm and the average subscapular skinfold thickness was 19.3±7.6mm [8].

Another study conducted by Kaur and Kochar, among 26 Indian women aged 40-70, determined the skinfold thickness above triceps at 21.25±3.04mm, whereas subscapular fold was measured at 29.17±6.17mm [9]. In our study the skinfold thickness in women of Kujawsko-Pomorskie Voivodship was, depending on age bracket, for the skinfold above triceps from 25.3±9.4mm in 50-54 age bracket to 19.2±7.7mm in 75-79 age bracket. The analogous situation referred to subscapular skinfold which was measured in 50-54 age group at 33±12.6 and in 75-79 age group at 25.2±11.3mm.

While analyzing the skinfold thickness measurements divided into various age groups, the decreasing tendency of this parameter size is observed in people above 70 years of age. It is confirmed that in three age groups the skinfold thickness above triceps was determined and in 60-69.9 age bracket it was measured at 25mm and the subscapular skinfold at 23.4mm. In women 70-79.9 years old, analogously for both skinfolds: 23.1mm and 21.9mm and in tested women above 80 years of age and more: 22.5mm for the skinfold above triceps and 18.6mm for the subscapular skinfold [10].

The similar observations were made in the study by Kadur in which 500 women took part. The participants were divided into two groups. I group – Nuclear Families (living in a modern way) and II group – Extended Families (living in a traditional way). The skinfold thickness above triceps had the following results: in women aged 60-64 in group I 35.17±11.64mm, in group II 33.61±11.47. In 65-69 age bracket analogously 33.11±8.71mm in group I and 33.71±10.16mm in group II. In women aged 75-79, 28.1±9.31mm in group I, and 22.91±8.97mm in group

II. Also, subscapular skinfold thickness was measured and estimated at 35.7±12.17mm in group I and 34.6±12.26mm in group II in women aged 60-64. In women aged 65-69 analogously for both groups: 33.24±11.52mm and 34.31±12.22mm, and in women aged 70-74: 30.9±12.63mm and 31.09±10.49mm. In a group aged 75-79: 29.07±10.06mm and 29.28±10.32mm, whereas in women 80 years old and more: 23.07±9.16 in group I and 26.51±13.91mm in group II [11].

The studies shown above frequently cannot be easily compared since they refer to differentiated groups due to measuring different skinfolds, age of tested participants, race and also sex.

The skinfold method that we used is based upon the assumption that subcutaneous fat constitutes about 50% of the total fat tissue and, in accordance with that, the skinfold thickness, after being measured and transformed mathematically, is significantly connected with the total fat tissue. In spite of existence of numerous, more contemporary methods determining the level of fat tissue in the organism, the caliper method is highly useful in screening just like our study, conducted on 1215 persons, which can be regarded as the study determining the level of the population adiposis in women above 50 years of age in the voivodship. What is also significant is the fact that during comparative studies, only skinfold thickness changes giving evidence of fat alterations existing within the organism are analyzed [12].

Our study, in which a division was made into 6 groups, confirms the earlier studies [13, 14, 15]. In persons above 70 years of age, dwindling values of skinfold thickness are observed. In case of subscapular skinfold the decrease of the discussed parameter happens in younger women – beginning with 50-54 age bracket. The tendency connected with reducing the values of measured skinfold thicknesses is also linked to reducing the percentage of fat tissue content in women above 70 years of age.

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CONFLICT OF INTEREST

The authors declare they have no conflict of interest

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