Analysis of the body composition of young adults and the frequency of occurrence of so-called normal weight obesity: A pilot study

Analiza składu ciała młodych dorosłych pod kątem częstości występowania tzw. ukrytej otyłości – badanie pilotażowe

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A – research concept and design; B – collection and/or assembly of data; C – data analysis and interpretation;
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Abstract

Introduction. In people with normal body mass and increased content of visceral fat, the same metabolic disorders occur as in obese people, including insulin resistance or metabolic syndrome features.

Objectives. The aim of the study was to analyze the components of the body composition of young adults, the prevalence of the so-called normal weight obesity (metabolically obese normal weight – MONW) and the presence of excessive body fat in individuals with normal body mass index (BMI).

Material and methods. The survey and anthropometric measurements (TANITA MC-780) were conducted in a group of 100 students of Wroclaw Medical University (48 men, 52 women) aged 18–26.

Results. In the study group, the average BMI of women was higher than in men, but the difference was not statistically significant ($p > 0.05$). There were no differences in the incidence of underweight, normal body weight and obesity depending on gender ($p > 0.05$). The presence of overweight (BMI 25–29.99) was significantly higher in female students ($p = 0.0039$). The average percentage of adipose tissue was statistically insignificantly higher in women ($p > 0.05$). Among 7 people in whom the percentage of adipose tissue was higher than desired, the correct BMI was observed in 2 people and BMI indicating overweight in 4 people. The visceral fat index for all subjects was medium (0–13).

Conclusions. The majority of young adults (73%) have correct BMI. Overweight is more common in women. In 7% of respondents, the percentage of adipose tissue was higher than desired. Identifying the individuals with an increased risk of obesity and metabolic syndrome enables the development and planning of preventive measures addressed to young adults.

Key words: obesity, adipose tissue, body mass, adults, body mass index

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Streszczenie

Wprowadzenie. U osób z prawidłową masą ciała oraz zwiększoną zawartością trzewnej tkanki tłuszczowej występują te same zaburzenia metaboliczne co u osób otyłych, w tym insulinooporność i cechy zespołu metabolicznego.

Cel pracy. Analiza poszczególnych komponentów ciała młodych dorosłych pod kątem występowania tzw. ukrytej otyłości (otyłości metabolicznej z prawidłową masą ciała) oraz występowania nadmiernej zawartości tkanki tłuszczowej przy prawidłowym wskaźniku BMI.

Materiał i metody. Badanie ankietowe oraz pomiary antropometryczne (aparatem TANITA MC-780) przeprowadzono wśród 100 studentów Uniwersytetu Medycznego we Wrocławiu (48 mężczyzn, 52 kobiety) w wieku 18–26 lat.

Wyniki. W badanej grupie średnie BMI kobiet było wyższe niż mężczyzn, ale różnica nie była istotna statystycznie ($p > 0,05$). Nie stwierdzono różnic w występowaniu niedowagi, prawidłowej masy ciała i otyłości w zależności od płci ($p > 0,05$). Problem nadwagi (BMI wynoszące 25–29,99) istotnie częściej dotyczył studentek ($p = 0,0039$) niż studentów. Średnia procentowa zawartość tkanki tłuszczowej była nieistotnie statystycznie wyższa u kobiet ($p > 0,05$). Wśród 7 osób, u których procentowa zawartość tkanki tłuszczowej była wyższa od pożądanej, prawidłowe BMI stwierdzono u 2, a BMI wskazujące na nadwagę u 4. Wskaźnik tkanki trzewnej dla wszystkich badanych był na średnim poziomie (0–13).

Wnioski. Większość młodych dorosłych (73%) ma prawidłowe BMI. Nadwaga częściej występuje u kobiet. Procentowa zawartość tkanki tłuszczowej była wyższa od pożądanej u 7% badanych. Wyodrębnienie osób z podwyższonym ryzykiem rozwoju otyłości i zespołu metabolicznego umożliwia opracowanie i zaplanowanie działań profilaktycznych adresowanych do młodych dorosłych.

Słowa kluczowe: otyłość, tkanka tłuszczowa, masa ciała, dorośli, wskaźnik masy ciała

Introduction

Over the last few years, there has been an increasing incidence of bad eating habits and sedentary lifestyle, resulting in the growing epidemic of obesity among children, adolescents and adults.[1–3]

Although obesity may be secondary, i.e., it may be genetic, caused by endocrine disorder or the use of medications, the most common problem is simple obesity, in which the dominant role is attributed to individual behaviors that constitute human lifestyle.[2,4]

Lifestyle changes that contribute to obesity include resignation from physical activity – spending free time in front of a television screen and a computer.[2] More frequent use of cars is observed among people living in urban areas, even when the route is less than 5 km long.[2] Additionally, the role of a high-calorie, high-fat diet poor in fruit and vegetables, the popularization of fast food, snacking, overeating in the evenings, and ordering ready-made meals at home and at work is emphasised.[2]

Since these lifestyle changes are the result of technological development and progress, obesity is considered a civilization disease.[4]

The phenomenon of the increasing number of overweight and obese people is global, which is reflected in the reports of the World Health Organization (WHO), a patron of epidemiological research which draws public attention to this problem by, among others, the World Obesity Day celebrated on October 24.[4]

The consequences of obesity affect every dimension of health: physical, mental and social. Obese people often suffer from low self-esteem, negative self-image, reduced self-confidence, and mood disorders.[5] They are also at a higher risk of carbohydrate metabolism disorders (e.g., type 2 diabetes mellitus), as well as lipid disorders, cholelithiasis, non-alcoholic fatty liver disease, glomerulonephritis, or respiratory complications (i.a., obstructive sleep apnea and bronchial asthma) and osteoarticular disorders.[6] In children with excessive body weight, pubescence disorders are observed.[6] In the obese population, much more common is the so-called metabolic syndrome consisting of concomitant cardiovascular risk factors such as abdominal obesity and lipid disorders (elevated triglyceride concentrations and reduced high-density lipoprotein (HDL) cholesterol), elevated glucose levels and hypertension.[6] Complications, especially in the cardiovascular system, lead to increased risk of death.[6]

It has been confirmed that persons with normal body weight and increased visceral fat content have the same metabolic disorders as obese persons, including insulin resistance and metabolic syndrome features.[2,7]

The aim of the study was to identify the body composition of young adults, to estimate the incidence of the so-called metabolically obese normal weight (MONW) in the studied population and the incidence of excessive adipose tissue at normal body mass index (BMI) in the study group.

Material and methods

The study group consisted of 100 students of Wroclaw Medical University (48 men, 52 women) aged 18–26 (mean (M) = 21.75, standard deviation (SD) = 1.53, median (Me) = 22).

The participants were selected randomly – each student of Wroclaw Medical University willing to take part in the study could participate, provided they consented to it. The study consisted of 3 parts: questions concerning basic information (age, gender), anthropometric measurements (height, weight) and measurements of body composition with the use of TANITA body composition monitor MC-780 (Tanita Corporation of America, Inc., Arlington Heights, USA).

Results

The mean BMI of women in the study group was higher than that of men, but the difference was not statistically significant (Student's *t*-test result: $p > 0.05$), which is shown in Table 1. There were no differences in the incidence of underweight, normal body weight and obesity between female and male students ($p > 0.05$). However, the presence of overweight (BMI 25–29.99) was significantly higher in female students ($p = 0.0039$).

Body composition analysis showed that the mean fat percentage (FAT%) was higher in women, but the difference was not statistically significant ($p > 0.05$; $p > 0.05$). Table 2 provides a detailed analysis. The values of 21–33% of body weight are considered normal. Both female and male students mostly (>50%) had lower body fat percent. Out of 7 individuals (4 women, 3 men) with fat percent higher than desired, normal BMI was found in 2 of them, and BMI indicating overweight in 4.

Visceral fat rating (VFR) for all respondents was at medium level (0–13). There were no statistically significant differences between female and male students. For details, see Table 3.

Discussion

Changes in lifestyle observed over the last decades have had a major impact on health, contributing to an increase in the incidence of obesity, metabolic syndrome and cardiovascular diseases. Bad eating habits, high-calorie snacks, foods rich in fats and simple sugars, bigger portions of eaten meals, and insufficient consumption of fruit and vegetables are dietary factors causing weight gain.[3] Long-term excessive calorie supply combined with reduced energy expenditure (predominance of sedentary lifestyle and reduced physical activity) lead to a positive energy balance and its effects.[7]

Obesity and metabolic disorders in children and adolescents are related to a significantly higher risk of obesity and its complications in adult life. It is crucial to re-

Table 1. BMI in the study group taking into account the gender of respondents

Tabela 1. BMI w badanej grupie z uwzględnieniem płci badanych

BMI	Women		Men		Total	
	n	%	*n*	%	*n*	%
<18,5	3	5.769231	4	8.333333	7	7
18.5–24.99	36	69.23077	37	77.08333	73	73
25–29.99	12	23.07692	6	12.5	18	18
≥30	1	1.923077	1	2.083333	2	2
M	22.97	–	21.95	–	22.48	–
SD	3.078140276	–	3.229276225	–	3.163236	–
Me	23.10	–	21.70	–	22.25	–
Min–max	17.5–30.5	–	15.9–34.0	–	15.9–34.0	–

n – number of the analyzed characteristic in the sample; *min* – minimal value; *max* – maximum value.

Table 2. FAT% in the study group taking into account the gender of respondents

Tabela 2. FAT% w badanej grupie z uwzględnieniem płci badanych

FAT%	Women		Men		Total	
	n	%	*n*	%	*n*	%
<21.0	30	57.69	27	56.25	57	57
21.0–33.0	18	34.62	18	37.5	33	33
>33.0	4	7.69	3	6.25	7	7
M	20.92	–	19.55	–	20.26	–
SD	6.6315857	–	6.985884	–	6.787159	–
Me	20.00	–	20.55	–	20.20	–
Min–max	12.4–39.5	–	6.50–34.40	–	6.5–29.50	–

Tabela 3. VFR in the study group taking into account the gender of respondents

Table 3. VFR w badanej grupie z uwzględnieniem płci badanych

VFR	Women		Men		Total	
	n	%	*n*	%	*n*	%
Mean (<13)	52	100	48	100	100	100
High (13–18)	0	0	0	0	0	0
Very high (>18)	0	0	0	0	0	0
M	2.17	–	2.00	–	2.09	–
SD	1.5898857	–	1.827559	–	1.712078	–
Me	2.00	–	1.00	–	1.00	–
Min–max	1.00–9.00	–	1.00–11.00	–	1.00–11.00	–

member that prevention should involve children, young people and young adults.[2,6]

For practical purposes, BMI is used in the diagnosis of obesity. The normal range is 18.5–24.9 kg/m^2.[8,9] This index has its limitations, as it does not provide data on the content of fatty tissue, which produces many active substances (i.a., leptin, cachectin, angiotensin, and renin), contributing to the development of insulin resistance and hypertension. It has been revealed that people with normal body weight and high visceral fat content have the same metabolic disorders as obese people.[10] In order to improve weight monitoring, the clinical use of bioelectrical impedance analysis (BIA) is recommended.[11]

In addition to BMI, BIA measurements such as FAT% and VFR were included in the body composition assessment study. As a result, the incidence of MONW in the studied population can be estimated. The majority of respondents had normal BMI, which is in line with the results of studies conducted among young adults.[12,13]

It may be assumed that due to the fact that the respondents were medical university students, their health awareness of obesity risk factors and their knowledge of proper nutrition and the role of regular physical activity in the prevention of civilization diseases is higher than in the general population.

The results of the conducted study indicate a greater incidence of higher BMI among women. Similar results were obtained by Kawalec-Kajsutra et al. in a study conducted among 18-year-olds – 15% of women and 4.9% of men had BMI higher than normal.[12] A higher mean fat percent in women than in men was also observed by other authors.[12]

In the studies conducted so far, various criteria for the diagnosis of the so-called normal weight obesity have been applied. One of the criteria applied to diagnose MONW in patients with normal BMI may be the body fat percentage >30%.[14]

An Icelandic study of 18-year-olds suggests that obese individuals with normal body weight compared to those with normal BMI and body fat content were at a higher risk of developing metabolic syndrome.[15]

The limitation of the performed analysis is that the elements of metabolic syndrome, body composition and body fat content were not assessed in the studied age group of young adults in relation to environmental factors and lifestyle, especially diet and physical activity.

In the future, the study should take into account the role of the "obesogenic" environment, i.e., one that promotes behavior that leads to the increase in obesity. One of the most significant factors contributing to the increase in the risk of obesity is urbanization.

The characteristics of the area surrounding the place of residence, study or work influence the decisions concerning physical activity and dietary choices. The availability of cycle paths, parks, swimming pools, playgrounds, gyms, and other sports facilities, as well as elements related to safety are of importance.

There is no research that addresses the above aspects that are part of the basic needs and affect the decision to reach the destination on foot (according to the hierarchy of walking-needs model), or physical activity in general (characteristics of the microenvironment – home, neighborhood and place of study or work), as well as other environmental factors potentially related to obesity.[16] As a result, environmental, socioeconomic and behavioral factors most strongly associated with obesity, normal weight obesity, insulin resistance, and metabolic syndrome components in young adults could be characterized.

Conclusions

The identification of individuals with an increased risk of developing obesity and metabolic syndrome enables the development and planning of preventive measures addressed to young adults, which would undoubtedly have a beneficial impact on their health in the following years of life and positive effects on the entire society.

While the results of the study indicate that the majority of young adults (73%) have normal BMI, it can be observed that overweight is more common in women, and

the body fat percent was higher than desired in 7% of respondents.

In the future, in addition to anthropometric measurements, it would be worth considering the characteristics of the area surrounding the place of residence, study or work and identifying how they influence the decisions regarding physical activity and dietary choices.

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