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Original article

OBESITY PARAMETERS IN FEMALE MEDICAL STUDENTS

Pluncevic Gligoroska Jasmina, Nestorova Mihaela, Manchevska Sanja

Institute of Physiology, Faculty of Medicine, Ss Cyril and Methodius University, Skopje, R.N. Macedonia
e-mail: *jasmina.pluncevic@medf.ukim.edu.mk*

Abstract

Introduction. The behavioral patterns, eating habits and participation in physical activities of university students have important influence on body composition of this young population group.

The aim of this study was to determine the level of overweight and obesity in female medical students and level of physical activity.

Material and methods. A descriptive cross-sectional study was conducted at Faculty of Medicine, Ss. Cyril and Methodius University in Skopje between December 2019 and April 2020. A total of 308 girls, students of the 1st and 2nd year of study, underwent body composition testing with InBody 720 bioimpedance analyzer. International physical activity questionnaire (IPAQ) was used for determining the level of physical activity.

Results. The average age of participants was 19.4 ± 1.1 years, and the mean values for obesity parameters were as followed: BMI = 22.5 ± 4.3 kg/m^2; BF% = 28.3 ± 8.5; WHR= 0.87 ± 0.07. One third of students had normal body fat percentage (34.5%) and waist-to-hip ratio (33.3%). Two thirds of students showed normal BMI, and 14.6% of girls were overweight while 6% were obese according to BMI. The greatest percentage of students, 60% of girls, showed BF% and WHR higher than normal values.

Conclusion. Analysis of obesity parameters derived from bioimpedance analyzer – (BIA) showed that BMI parameter was less sensitive to level of obesity than BF% and WHR. The findings revealed that more than half of the young female medical students were overweight and/or obese.

Key words: obesity, body mass index, body fat, waist to hip ratio, students

Introduction

Overweight and obesity are diagnosed when total body fat mass or relative presentation of subcutaneous fat is so excessive that may jeopardize the health. These medical conditions are quantified with obesity parameters such as body fat percentage (BF%), body mass index (BMI), waist-to-hip ratio (WHR), etc.[1]. Physical activity decreases total body fat mass and slows the development of abdominal obesity, which improves the cardiovascular and metabolic health. Young people should aim for at least an hour per day of vigorous activity to counteract the negative health effects of sedentary behavior which is commonly accompanied by overeating habit[2].

The prevalence of overweight and obesity in adolescents worldwide has risen from 4% to 18% over the past few decades[3]. The obesity is a result of multiple factors, but mostly two factors generate obesity: an increased intake of caloric foods and insufficient amount of physical activity. Unfortunately these life habits are dominantly present during student's life. Students practice unhealthy dietary and lifestyle behaviors that should be targeted and modified. Weight gain and drop of physical activity during early adulthood can increase the risk of chronic medical conditions[4]. The more active people are, there is better chance for them to keep their weight in optimal range. A comprehensive study about woman's health in the USA has found that practicing a moderate-to-vigorous physical activity for an hour a day is necessary to maintain a steady weight[5]. Many studies have confirmed that a large majority of young adults fail to meet scientifically approved recommendations for physical activity for better health, and that the proportion of overweight and obesity is increasing in whole population, independently of age, gender, race or nationality[6-8].

The aim of this study was to analyze the obesity parameters and physical activity volume in female medical students.

Material and methods

The study included a total of 308 female students enrolled in the first and third semester at the Faculty of Medicine, with an average age of 19.4 ± 1.1 years. Our study was part of the scientific project "The relationship between the parameters of body composition, the level of physical activity and the levels of anxiety and depression in medical students", approved by the Ethical Committee at University 'Ss Ciryl and Methodius, Faculty of Medicine, Skopje, number 03-3152/11 in 2018.

Participants completed a short demographic questionnaire, IPAQ questionnaire and underwent bioelectrical analysis of body composition.

Body components analysis

The analyses of body components were made in the Laboratory of Sports Medicine at the Institute of Physiology, Faculty of Medicine in Skopje. Body mass and height were measured following the standard procedure with a stadiometer and an electronic scale. InBody 720 body impedance analyzer measures body composition using a multi-frequent alternating current for measuring the impedance of different tissues. The examinee should stay barefoot on the tactile polar electrodes (front sole electrode and rear sole electrode) and take in hands electrode holder (thumb and palm electrodes). BIA result's sheet obtains plethora of parameters and we analyzed the section of the obesity diagnosis parameters: weight, BMI, body fat percent BF%, waist-to-hip ratio (WHR) and fat and muscle control (how many fat and/or muscle kilograms has to be decreased/increased).

Assessment of level of physical activity

International Physical Activity Questionnaire (IPAQ) in the short self-administered form comprises 7 items that quantify the physical activity (lasting at least 10 minutes) across four different domains of activity during the past seven days. The IPAQ is developed to estimate the total weekly volume of moderate and vigorous intensity activities in a typical week among several domains such as work, transportation and recreational activities. Frequency and duration (minimum 10 minute bouts) of vigorous activity, moderate activity and walking are assessed.

Participants also report the amount of time they spend sitting on a weekday. Weekly time spent on vigorous activity, moderate activity and walking is determined by multiplying reported frequency and duration within each category of activity. Total weekly time of physical activity is calculated by summing the three categories of activities listed above.

Statistical analysis

Data were analyzed by descriptive statistical methods using Microsoft Excel 2010. The data were presented as mean ± standard deviation and percentage (%) distribution.

Results

The participants' demographic and anthropometric characteristics are explained in Table 1. The girls were students in the first and third semester at the Faculty of Medicine in Skopje.

Table 1. Descriptive characteristics and BIA obesity parameters in female students

N=308	mean ±SD	Min / max
Age	19.4 ± 1.1 year	18.0 – 23.0
Height	165,8 ± 6.2 cm	148 - 188
Weight	62.3 ± 12.5 kg	42.9/138.6
BMI (kg/m^2)	22.5 ± 4.3	15/49.4
BF%	28.3 ± 8.5	3.4
WHR	0.87 ± 0.07	0.7/1.2
Fat control minus (kg) N= 231	8.1 ± 8.2	0.1/55.1
Fat control plus (kg) N= 70	3.1 ±2.5	0.1/13.0

*BMI – Body Mass Index; BF% - Body Fat percentage; WHR – Waist-to-Hip Ratio

The testing was made during the courses Physiology of Cell and Medical Physiology. The mean value of BMI was in normal range and slightly over optimal BMI for woman (22.5 *vs* 21.5). The mean value for body fat percentage (BF%) was in at the upper limit of the normal range for BF% according to BIA recommendations (20 -30%). The mean value for WHR was also slightly higher than the recommended one (0.87 *vs* 0.85). The InBody bioimpedance analyzer calculates ideal body weight and body composition of the examinee, presented as fat and muscle mass control. The derived recommendations for fat control suggested that 75% of all girls should decrease body fat mass while 22.7% should increase subcutaneous fat. According to the body composition analysis, only 7 girls (0.02%) had an ideal body weight and body composition.

The results of IPAQ questionnaire are presented in Table 2. Number of days of vigorous physical activity, moderate physical activity, walking and sitting during the last seven days and duration of these four domains are shown in Table 2. Duration of activity sessions (exercise and walking) are expressed in minutes, but duration of sitting is expressed in hours. 42.2% of

participants reported vigorous activity; 73% of participants reported a moderate physical activity in the last week and 74% walked in the last week. 32.5% of participants did not report sitting hours, while 67.5% reported an average 27.4 ± 25.6 hours of sitting in the regular week.

Table 2. Amount of physical activity in female students (International PA Questionnaire)

IPAQ		Day/week	Minutes/day	Minutes/week
	mean ±SD	3.2 ± 1.5	62 ± 37.4	193.3 ± 142.7
Vigorous	min-max	0 - 7	0 - 180	840
Moderate	mean ±SD	3.8 ± 2.2	58.9 ± 42.9	279.4 ± 337.7
	min-max	0 – 7	0-240	0 - 1500
Walking	mean ±SD	5.6 ± 1.8	60,9 ± 48.8	366,3 ± 336,9
	min-max	1 – 7	0 - 490	0- 1680
			Hours/day	Hours/week
Sitting	mean ±SD	6.7 ± 1.3	4.0 ± 3.7	27.4 ± 25.6
	min-max	0-7	0 - 20	0 – 140

The distribution of obesity diagnosis parameters in different range groups specified for each parameter (BMI, BF% and WHR) are presented in Table 3. Regarding BMI, two thirds of students were with normal BMI, only 20% showed overweight and obesity. Regarding BF%, one third of students belonged to groups with normal range of BF% (15-20%). The highest percentage of students, 60% of girls, showed BF% higher than normal values. Waist-to-hip ratio also showed that 33% of girls had normal or lower than 0.85 WH ratio. More than half of girls had high WHR, >0.85.

Table 3. Distribution of obesity parameters according to parameter's specific range values

BIA parameters						
BF% range	**<15%**	**15-19%**	**20-25%**	**25-30%**	**>30%**	**>40%**
% students	5.5%	14.2 %	20.3%	20.05%	27.7%	12.2%
BMI (kg/m^2)	**<18.5**	**18.5-24.9**	**25-29.9**	**>30**		
% students	12.3 %	66.9 %	14.6 %	6 %		
WHR - range	**<0.80**	**0.81-0.85**	**0.86-1.0**	**>1.0**		
% students	12.3%	33.3%	50.5%	3.9%		

The correlation between time spent in different levels of physical activities and obesity parameters were the same for all relationships, expressed as a very low negative Pearson's coefficient (p= - 0.1).

Discussion

Obesity is a global public health concern affecting people of all age groups and socioeconomic status. While medical conditions associated with under-nutrition are still an important topic, nowadays diseases associated with unhealthy lifestyles, overweight and obesity are dominant[9-11].

The analysis of obesity diagnosis parameters, classified in groups specified for each obesity parameter gave a profounder insight of obesity prevalence in female medical students.

Index of nutrition or BMI is defined as normal in range between 18.5 and 24.9 kg/m^2. In our study, the mean BMI value was slightly over the ideal one for Caucasian females (21.5). The distribution of different categories of BMI revealed that majority of girls (67%) was within normal ranges; 14% *vs* 6% of girls were classified as overweight and obese, respectively. Optimal values for body fat percentage for woman according to InBody 720 were between 18 and 28%. The mean value of our students was 28.3 ± 8.5%, which is at the upper limit of the normal range values. Despite this "normal" mean BF%, distribution of body fat percentage demonstrated that 34.3% of girls were between optimal BF% values (15-25%). The majority of female students (≈ 60%) had BF% higher than the optimal one. Similar distribution was noted with WHR obesity parameter, one third of girls (33.3%) were in the normal range, and majority of girls (55%) had WHR > 0.85.

The distribution of analyzed obesity parameters revealed BF% and WHR as an obvious marker for obesity, while BMI seems to be less strict health risk marker.

The prevalence of under nutrition according to BMI *vs* WHR *vs* BF% was 12.3% *vs* 12.3% *vs* 5.5%, respectively. Ideal body composition means optimal presentation of all body components, primarily muscle and fat mass. Only 0.02% of girls fulfilled the strict criteria of bioimpedance analyzer for ideal body composition.

Obesity parameters in university students

The most popular obesity parameter is body mass index (BMI), which is determined as weight (kg) divided by squared height (m^2). BMI is used for description of nutritional status, and categorized as healthy BMI, overweight and obese values[12]. Obesity increases with age but among young adults in developing countries the average weight gain of 1 kg/year is greater than that observed in developed countries (0.4–0.9 kg/year)[13]. Depending on the WHO references used, the overall occurrence of underweight, overweight (including obesity) and obesity in male university students were 14.2%, 11.5% and 2.5%, respectively, and in female university students 27.5%, 2.4% and 0.3%. In the last decade an interesting trend has been observed that the underweight prevalence of university students has an increasing tendency, especially in female students[14].

Increasing the obesity levels in this short period of life, between 18 -25 years, may be a result of the fact that young people at this age have the independence to choose lifestyle habits and future health is not their priority[15]. The majority of health sciences students examined in one study were overweight (24.3%) and obese (18.4%), similarly as in our sample[16]. The cross-sectional survey on broad population of university students from 22 countries revealed the following findings: among women the prevalence of underweight was 17.6%, normal weight 62.1%, overweight 14.1% and obesity 5.2%. In this study male students were significantly more obese than female students[17].

The analyzes of abdominal obesity in 1129 females students in Poland showed a lower prevalence of overweight *vs* underweight students, 7% *vs* 11.1%[18]. Obesity and overweight are related with level of studies which means that older students showed a higher prevalence of obesity. The prevalence of obesity was relatively high (36.8%) among university students in Botzwana[19]. The investigation of the prevalence of health risky anthropometric factors in students in Bulgaria showed 1.2% of underweight among men and 15.2% of women, 32.5% of overweight men and 13.9% of women. In this study young women (18 – 30 years) showed significantly better physical fitness than their male peers. Obesity was found among 10.8% of men and 8.6% of women. Central obesity occurred among 32% of males and 17% of females,

independently of their nutritional status[20]. The study conducted in China that evaluated physical health of university students found the overall prevalence of underweight, overweight (including obesity) and obesity in female university students to be 27.5%, 4.4% and 0.6%, respectively[14].

The investigation of obesity prevalence in Arabian students discovered that 10.8% of students were overweight and 30.6% were obese[21]. A similar research in adult female population in the United Arab Emirates estimated via body mass index the prevalence of overweight and obesity and showed 27% and 16%, respectively[22]. The study in Egyptian female students revealed that 31.5% of students were overweight and 11% were obese. The mean BMI was 25.13 ± 3.63 kg/m^2 [23].

Physical activity in university students

The self-explanatory questionnaire about the amount of time spent in physical activities of different intensity, IPAQ, obtains data for three modes of physical activities, low intensity (walking), moderate and vigorous activities which are described clearly so that one can easily understand the differential diagnosis of PA, and the fourth part is inactivity, i.e. sitting. Our results demonstrated that medical students participated in all three levels of PA around 1 hour per day, overall 3 hours daily, which is pretty unrealistic. The results were obtained from students who reported some time spent in physical activities contrary to students who reported zero time. A large percentage of students declared participation in vigorous activities (41%), and almost the same number of students (73 % *vs* 74.3 %) stated moderate and low physical activities.

The sedentary lifestyles of students and young people, the lack of time due to studying, the sleepless nights along with psychological changes related to the material and social environments, all make it difficult for the students to be additionally involved in any kind of physical activity[24]. The investigation of participation in leisure time physical activities in Indian medical students found that PA was being practiced by 72.5% of male medical students and 51.3% of female medical students[25]. Data from IPAQ questionnaires obtained from 300 students from different curricula in the schools of Medical University of Silesia, Poland, showed that physical therapy students demonstrated the highest level of physical activity, with 46% demonstrating a high level of physical activity, 54% a moderate level of physical activity. The largest group of students (26%) with a low level of physical activity comprised students from the school of medicine[26]. Promoting healthy dietary and weight management practices in university students might be of great importance when developing health education programs. Although a significant number of our students reported a large amount of time spent in low to heavy level of PA, their body composition characteristics suggested a high prevalence of obesity indicators, body fat mass (BF%) and central abdominal obesity (WHR).

Conclusion

Examination of the students' behavior throughout their academic life is necessary to recognize the factors promoting the practice of physical activity among students. Bioimpedance analysis of body composition derives parameters valuable for diagnosing the obesity level. Female medical students at the beginning of long and necessary period of studying in school of medicine reported comprehensive amount of physical activities. The majority of students, two thirds of them, showed WHR and BF% higher than recommended, which indicates surplus of fat body mass.

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