

OVERWEIGHT AND OBESITY RISK ASSESSMENT – TWO METHODS, DIFFERENT RESULTS

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Abstract. *Purpose:* the purpose of this study was to verify if there is any significant difference between body fat assessment by calculating body mass index and by using bioelectrical impedance analysis. *Materials:* subsequently we determined the ratio between body fat and muscular mass percentage in a sample of 156 university girl students. *Results:* BMI and muscle mass percentage seem to have similar variance and trends, while body fat exceeded in numbers and percents the highest levels of BMI. While by calculating BMI the found number of overweight and obese subjects was 23 from the total of 156, (14 %); by measuring body fat percentage that number increased to 67 (43%) of girl students in the sample. The t test showed significant difference between BMI values and the body fat percentage for the study sample: $t(155) = 2.37, p < 0.01$. *Conclusions:* this study supports the idea that BMI results may be insufficient for correct assessment of overweight and obesity risk. Body composition adds useful information about health and fitness. A few concluding recommendations, regarding beneficial effects of exercise, have been made aiming to provide students of all body parameters with meaningful, relevant and positive physical education and health knowledge.

Key words: Body composition, girl students, body fat, fitness, health.

Introduction

A report of Organization for Economic Cooperation and Development (OECD) entitled ‘Health at a Glance: Europe 2012’ says that more than half (52%) of the total adult population across the European Union are now overweight or obese [22]. Explanation implies balance between sedentary behavior and physical activity and the changes in people’s nutrition habits after the half of the 20th century. In this postindustrial society, technology development replaced human work force with machines reducing gradually people’s physical labor. Nurturing habits and customs did change, and they were influenced in many different ways by urbanization, technology progress and globalization. This three factors have often resulted in diets, in which an important percentage of energy intake comes from industrial processed food, associated with an increased consumption of sugar, fats, and salt [14].

Poor eating is leading to a range of physical health problems and some psychological after effects as well. Overweight problems of children and young people are associated with asthma, type 2 diabetes, depression, being bullied, learning difficulties, low self confidence and social reluctance; the greater body mass index is, the greater are risks to health and precarious quality of life.

In spite of wide interest to body weight assessment and physical appearance, most individuals are not aware of how much fat they deposit in their bodies. The most used equation for approximate the body fat is body mass index (BMI). A report by World Health Organization (1995) warned that raw BMI data might create confusion between muscularity and overweight. De Lorenzo et al. (2001) suggested that BMI reliability for measuring body fat is questionable, and recommended direct measurement of body fat for an accurate diagnosis of overweight and obesity.

The purpose of this study is to verify if there is any significant difference between body fat estimation by calculating body mass index and by using bioelectrical impedance analysis. Subsequently we studied the ratio between body fat and muscular mass percentage in a sample of young Romanian women.

Material and methods

The objective issues of weight management tackled in this paper are weight, body mass index and body composition. The study sample consisted of 156 girl students, between 19 and 24 years’ age, randomly selected from those who attended weekly physical education sessions. For objective data collection we used anthropometrical measurements – height and weight – which enable us to calculate Body Mass Index (BMI) and body composition.

BMI is a measure of body fat based on height and weight; its normal range is usually considered as 18.5 to 24.99 kg/cm²; with it, values 25 are considered as overweight and over 30 – as obese. Body composition was assessed with a bioelectrical impedance analysis technology. It showed data about body fat and muscle mass percentage.

Body fat (BF) percentage, referred to as relative body fat, was obtained by dividing fat mass by total body weight. Average BF percentage was 15 for men and 23 for women. Obesity, which may be defined as an excessive

amount of total body fat for a given body weight, was identified as excessive body fat 25% for men and 32% for women. *Wilmore, Buskirk, DiGirolamo & Lohman* (1986) indicated some referential values for body fat assessing:

Essential fat	<8
Minimal fat	15%
Most athletes	12–22%
Optimal health	18–30%
Optimal fitness	16–25%
Overweight & Obesity	>30%

Adapting the standards to our sample characteristics we compared body fat percentage data in our study with the Standards of Fitness for Women in Percent Body Fat [10]. It considered the average as 23% and also a normal interval between 9 and 22% (below average) and between 24 and 31.9% (above average). Body fat values below 8% represent a risk of diseases and disorders associated with wrong eating and above 31% are a marker of diseases associated with obesity.

Beside descriptive statistic analysis, the paired-samples “t” test was calculated for comparison between data sets.

Results

Average weight of adult person is 62 kg according to a league table of the world's 'fattest' nations from London School of Hygiene & Tropical Medicine [18]. In this table Romania has a middle range: 95 from 177 countries with an average weight of 66.4 kg. Girl students in our sample had average weight of 58 kg, with 1.65 m average height, resulting in average BMI value of 21.2 kg/m², corresponding to a slender feminine silhouette. In the next table we present descriptive statistic data for three studied variable:

Table 1. Descriptive statistic

Variable	BMI	Body fat	Muscle mass
Mean	21.2	28.75%	29%
Median	20.45	28.6	28.85
Mode	18.5	28.6	29
SD	3.54	8.2	3.85
Sample variance	12.57	67.27	14.82
Minimum	15.1	8.9	15.6
Maximum	36.6	51.1	44.7
Count	156	156	156

Taking into account BMI values and its corresponding classification we obtain the following results:

Table 2. BMI results

	Underweight >18.5 kg/m²	Normal weight 18.5 – 24.9	Overweight 25 – 29.9	Obese < 30 kg/m²
units	37	97	19	4
%	23.6%	61.78%	11.46%	2.55%

According to BMI values almost 62 % of the subjects are in the normal weight group, 14 % are overweight and obese and the rest 23.6 % are underweight.

Body fat percentage measurement showed different results:

Table 3. Body fat results

	Minimal fat >15 %	Optimal fit 15 – 24.9%	Optimal health 25 – 29.9%	Overweight & Obese < 30 %
units	5	45	39	67
%	3%	29 %	25%	43%

From this point of view the number of subjects presenting an important percentage of body fat surpasses by far optimistic result of BMI calculated previously.

Table 4. Muscular mass results

	< 35 %	34.9 – 30%	25 – 29.9%	< 25 %
units	8	41	95	12
%	5 %	26.4 %	61%	7.7 %

The muscular mass percentage mean value in our sample was 29%, i.e. higher than the reference mean value of 23%. We consider it normal, given the homogenous sample of very young women and being known that lean body mass is decreasing with age.

Discussion

The ratio body fat percentage of muscle/mass, measured in the research sample, revealed that in 81 of subjects muscle mass percentage is bigger than body fat percentage; in 2 cases those two variables were equal and in 73 subjects body fat percentage was higher than muscle mass. Fat tissue contains no water and has bigger volume comparative with muscle tissue, which has higher density. The higher is the percentage of body fat, the higher the overall body volume is. Body fat percentage also directly correlates with increased health risk, especially in respect to metabolic and cardiovascular diseases [3, 5, 16].

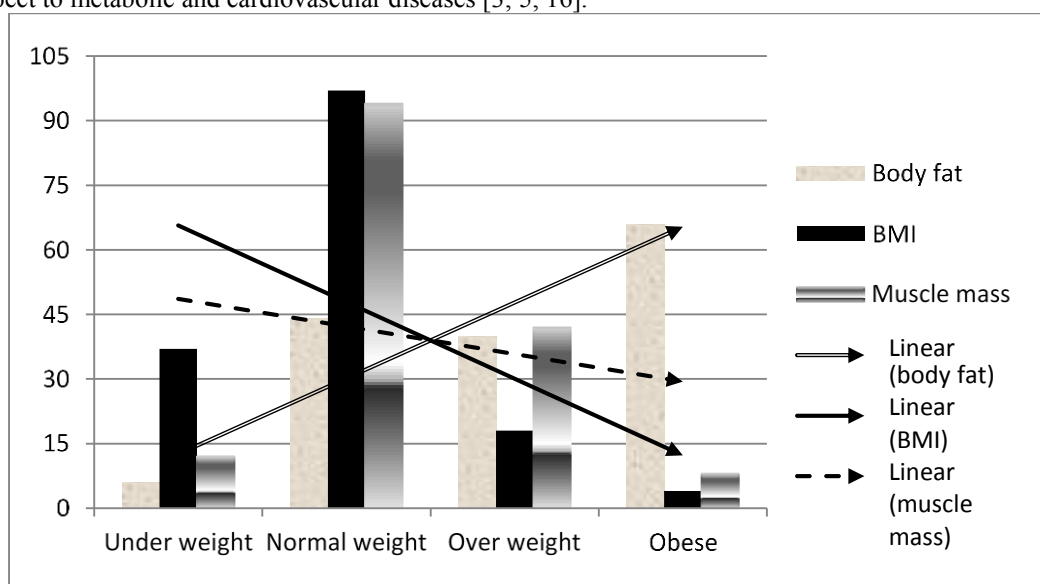


Fig. 1 Data distribution and trend lines for 3 variables

As the figure above shows, there is significant difference between the variance of three variables presented in this research: BMI and muscle mass percentage seem to have similar variance and trends, while body fat exceeded in numbers and percents the levels of BMI of the obese.

Calculating BMI, the determined number of overweight and obese subjects was 23 from the total of 156, (14%), while by measuring body fat percentage that number increased three times (43%) of girls students in our sample. In other words 20% of girl students were in normal weight group, because of high body fat percentage, could be considered actually overweight. “T” test showed significant difference between BMI values and body fat percentage in the studied sample: $t(155) = 2.37, p < 0.01$. While BMI may give an individual a general idea of increased risk of obesity-related health problems, it fails to distinguish the composition of that weight [8].

In most countries the rise in obesity has affected all population groups, regardless gender, age, race; income or education level. Evidences from a number of countries, including Austria, England, France, Italy and Spain, indicate that obesity tends to be more common among individuals in disadvantaged socio-economic groups, being particularly strong among women [15]. There is also a relationship between the number of years, spent in full-time education and obesity, with the most educated individuals displaying lower rates; with it the gradient of obesity is stronger in women than in men [21]. “Educational achievements correlate with higher earnings through access to

better job opportunities and social networks, which in the long term are expected to translate into higher health expenditures and thus better health” [7].

Physical activity has an indubitable beneficial effect on some aspects of quality of life. In the past years of 21-st century mounting research has shown how lifestyle changes, including exercise, stress management, and diet can prevent almost ninety percent of chronic illnesses in our society [4].

Regarding the effect of exercise, localized in a specific body part Anikieiev (2015), analyzing a number of studies, concluded that contribution of fat oxidation to muscles functioning energy supply is extremely little [2]. Actually only main metabolism can be supplied by fat oxidation [17] and consecutively the skin fold thickness will not decrease in that specific spot because the surrounding muscles work out. Fat loss comes down not due to targeted exercises, but owing to the basic principle of how many calories you expend versus how many you take in [12]. Combining cardiovascular exercise with weight training and correct eating seems to be right approach to more fat than weight loss [19].

Conclusion

BMI results may be insufficient for a correct estimation of overweight and obesity risk. The body composition adds useful information about health and fitness status.

Physical education and sport instructors should have supporting and encouraging attitude and motivate students for physical effort. Satisfaction, gained from exercising, can eventually become a motivation in itself, especially when the effort has positive effects on enhancing perceptions of health and overall well-being.

A few concluding recommendations can lead to an enhancement of vigor and health for students of all ages and body parameters:

- To encourage young people to set realistic and feasible goals and motivate them to keep weight under control by combining eating and physical activities;
- To establish a good relationship between effort and recovery and, at the same time, to make clear that individuals are responsible for their own success or failure;
- Exercise enjoyment is positively associated with motivation for physical effort. Physical education instructors can enhance enjoyment by creating good working climate, by adding variety to workouts, and by ensuring that the fitness programs are physically challenging and meet the subject’s preferences and personal goals;
- To provide all young people, of allbody parameters, with meaningful, relevant and positive physical education and health knowledge and eventually to deliver healthy, valuable graduates for society.

Integrating physical and health education in preventative strategies would have better effect in reducing overweight and obesity among university students and co-morbidities associated with these later, during life [14].

Conflict of interests

The author has no conflict of interests to declare.

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