



## Investigation of Obesity Tendency of University Students with Bioelectric Impedance Body Analyzer

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**ABSTRACT:** In this study, it was aimed to investigate the obesity tendency of the students of Bitlis Eren University with a Bioelectrical Impedance Body Analyzer. A total of 400 students volunteered comprised of 200 males and 200 females were enrolled in the study. According to Body Mass Index (BMI) values were found that 19.5% of the female 1 students were Underweight, 68.5% of them were normal weight, 11.0% of them were overweight and 1.0% of them were obese, 4.5% of the boy students were weak, 71.0% of them were normal weight, 22.0% of them were overweight and 2.5% of them were obese. The result of body fat ratio was indicated that while 48.0% of the female students were in the obese category, 40.0% of them were determined in the obesity tendency risk group, 56.0% of the boy students were in the obesity tendency risk group and 26.0% of them were obese. According to the waist/hip ratio were revealed that 95.5% of the girl students were in the obesity tendency group and 4.0% of them were obese, 85.5% of the boy students were in the obesity tendency group and 4.0% of them were obese. A significant difference was found between age and gender, fat ratio, waist/hip ratio, and BMI values ( $p < 0.05$ ). University students participating in the study were evaluated. The overweight (Pre-obese) rate was found to be high in students (Female: 11%; Male: 22%).

**Keywords:** Obesity, Obesity tendency, Body mass index, Body fat ratio, Waist/hip ratio.

### 1. INTRODUCTION

Overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health [1, 2]. Although the causes of obesity, which the World Health Organization (WHO) regards as an important public health problem, are not yet fully known, it is thought to be a complicated health problem caused by environmental and genetic factors [3]. It is known that obesity triggers cardiovascular diseases, causes degenerative effects on muscles, bones, and joints, and causes diseases such as dyslipidemia, hypertension, diabetes, arthritis, osteomalacia, osteoporosis, depression, and cancer [4-10]. The increase in the tendency to consume fast-food due to today's technology and especially the fact that the time spent actively is shortening invites obesity [11].

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### 1.1. Body Mass Index (BMI)

The most common criterion that is utilized for obesity is Body Mass Index (BMI), which is accepted by the World Health Organization and can be used as a criterion for all individuals without the gender difference [12]. BMI is calculated by dividing body weight in kg by the square of height in meters ( $\text{kg}/\text{m}^2$ ) [13].

**Table 1.** BMI Classification in Adults

Classification	BMI ( $\text{kg}/\text{m}^2$ )
Underweight	<18.5
Normal range	18.5–24.9
Overweight (Pre-obese)	25.0–29.9
1st degree obese	30.0–34.9
2nd degree obese	35.0–39.9
3rd degree obese	$\geq 40$

### 1.2. Waist/Hip Ratio

The waist/hip ratio is expected to be below 0.80 for females and below 0.95 for males [14]. According to WHO should the waist/hip ratio surpass 0.85 in women and 1.0 in men, it is considered as android type obesity [15].

### 1.3. Body Fat Ratio

The body fat ratio is between 18-24% in adult males and between 25-31% in adult females. This ratio surpassing 25% in men and 32% in women constitutes obesity [16].

### 1.4. Body Muscle Weight and Total Body Water

The muscle weight of the body is not a criterion for defining obesity. Although a high body muscle weight increases BMI, especially in athletes, it cannot be asserted that it demonstrates a tendency to obesity. WHO reports that obesity stems from the accumulation of excess adipose tissue and that this excess fat prompts diseases [16]. On the other hand, excessive body muscle weight provides flexibility, endurance, and dynamism to the body instead of causing diseases. And due to the water retention feature of creatine stores in muscle tissue [17], an increase in total body water is also observed in parallel with the increase in the body muscle.

### 1.5. Basal Metabolic Rate (BMR)

BMR, which is the energy needed for the circulation, respiration, and the continuation of body temperature while the individual is in the full resting state, may vary according to the factors such as body weight, the ratio of muscle and fat in body components, race, age, and genetics [18]. It decreases calorie expenditure via shortening the duration of physical activity of the individual and accordingly causes obesity by decreasing the basal metabolic rate [19].

## 2. MATERIAL AND METHODS

To this study; A total of 400 volunteer students, 200 female and 200 male, who studied at Bitlis Eren University between February and May 2015, were included in the study. Participants were informed about the measurement at least one day prior, and the measurement devices were introduced to them. The measurements were made at 09:30 in the morning while the students were hungry. The height measurements of the students were performed via a digital-display Ultrasonic Harpenden Stadiometer (ADE / Hamburg MZ10020) device with a precision degree of 0.1 cm, and no accessories or items that would affect the measurement were allowed [20]. Measurements were performed in the Inbody230 (MW160) Bioelectrical Impedance Body Analyzer [21] through the entrance of height, gender, and age values, and the measurements were made while the students were in a state of complete rest, while they were wearing nothing other than shorts, and at least 12 hours after the students ate the meal. As a result of the conducted measurement, BMI, body fat ratio, waist/hip ratio, body muscle weight, total body water, and basal metabolic rate values were determined.

The data obtained were analyzed through the utilization of IBM SPSS Statistics 20 package program, and Pearson chi-square test was performed to put forth whether the observed values were compatible with expected values, and the Spearman rank correlation coefficient test was utilized to determine the direction of the relationship between variables. Statistical significance level was accepted as  $p < 0.05$  for the evaluation of the results.

## 3. RESULTS AND DISCUSSION

The number of female and male students participating in the study has been kept equal; A total of 400 (200F + 200M) volunteers, consisting of healthy students whose ages, diets are close to each other, participated in the study. The age range of the students is 18-25, and the mean age is  $21.0 \pm 1.65$ . In the study in which 400 students participated in total, 2.5% of the students (10 people) were 18 years old, 16.0% (64 people) of them were 19 years old, 25.5% (102 people) of them were 20 years old, 23.0% (92 people) of them were 21 years old 14.0% (56 people) of them were 22 years old, 9.75% (39 people) of them were 23 years old, 5.5% (22 people) of them were 24 years old, and 3.75% (15 people) of them were 25 years old.

Considering the distribution of BMI values of the students who participated in the study, of the female students, 19.5% (39 people) of them were underweight 68.5% (137 people) of them were normal, 11% (22 people) of them were slightly obese, 1% of them were obese; and of the male students, 4.5% (9 people) of them were thin, 71% (142 people) of them were normal, 22% (44 people) of them were slightly obese, and 2.5% (5 people) of them were obese. There was a significant difference ( $p < 0.05$ ) between the gender of the students participating in the study and their value of BMI, and the correlation ( $r: 0.246$ ) between this difference was weak. Accordingly, it can be asserted that BMI values of female students participating in the study were more normal and lower than those of the male students (Table 2).

**Table 2.** Percentage distribution of Body Mass Index by gender

Parameters		Gender		p	r
		F	M		
BMI	<18.5	n	39	p<0.05	r: 0.246
		%	19.5		
	18.5-24.9	n	137		
		%	68.5		
	25.0-29.9	n	22		
		%	11.0		

There was a significant difference ( $p < 0.05$ ) between the gender of the students who participated in the study and their body fat ratio ( $r: 0.891$ ), waist/hip ratio ( $r: 0.979$ ), total body water ( $r: 0.823$ ), muscle weight ( $r: 0.826$ ), and BMR ( $r: 0.819$ ), and the correlation between this difference was immensely strong. According to this, while the body fat ratio and waist/hip ratio of the female students who participated in the study was concentrated above normal values compared to the male students, male students' muscle weight, total body water, and BMR values were concentrated above normal values compared to female students (Table 3).

**Table 3.** Percentage distribution of body fat ratio, waist/hip ratio, total body water, muscle weight and BMR by gender

Parameters			Below Normal Value	Normal Value	Above Normal Value	p	r
Body Fat Ratio	F	n	24	80	98	$p < 0.05$	$r: 0.891$
		%	6.0	20.0	24.5		
	M	n	36	112	50		
		%	9.0	28.0	12.5		
Waist/Hip Ratio	F	n	1	191	8	$p < 0.05$	$r: 0.979$
		%	0.3	47.8	2.0		
	M	n	21	171	8		
		%	5.3	42.8	2.0		
Total Body Water	F	n	39	139	22	$p < 0.05$	$r: 0.823$
		%	19.5	69.5	11.0		
	M	n	9	147	44		
		%	4.5	73.5	22.0		
Muscle Weight	F	n	71	126	3	$p < 0.05$	$r: 0.826$
		%	35.5	63.0	1.5		
	M	n	23	146	31		
		%	11.5	73.0	15.5		
BMR	F	n	65	129	6	$p < 0.05$	$r: 0.819$
		%	32.5	64.5	3.0		
	M	n	29	160	11		
		%	14.5	80.0	5.5		

There was a significant difference ( $p < 0.05$ ) between the age of the students who participated in the study and their BMI ( $r: 0.204$ ), body fat ratio ( $r: 0.255$ ), and waist/hip ratio ( $r: 0.248$ ), and the correlation between this difference was weak. No significant difference ( $p > 0.05$ ) between age and muscle weight, total body water, and BMR was found. When female and male students are grouped by age, it can be said that although BMI, body fat ratio, and waist/hip ratios are greater in the group of older students, they demonstrate similar distributions because the age groups are very close to each other and that they are associated with a weak correlation (Table 4).

According to the data gathered from the study, it can be interpreted by only looking at BMI values that overweight (pre-obese) rate was found to be high in students (Female: 11%; Male: 22%) (Table 2). In a similar study, it was reported that male students have higher BMI values than female students [22]. However, in different studies, it was found that adipose tissue was more in females than in males; more than average and muscle mass was significantly higher in boys than girls [23, 24]. Although BMI is a simple criterion used in the definition of obesity, it is not an adequate criterion [25].

**Table 4.** Change in BMI, body fat ratio and waist/hip ratio by age

Parameters / Classification			Age								p	r	
			18	19	20	21	22	23	24	25			
BMI	<18.5	n	2	10	16	9	6	2	3	0	p<0.05	r: 0.204	
		%	20.0	15.6	15.7	9.8	10.7	5.1	13.6	0.0			
	18.5-24.9	n	7	50	72	64	37	28	13	8			
		%	70.0	78.1	70.6	69.6	66.1	71.8	59.1	53.3			
	25.0-29.9	n	1	4	12	18	12	6	6	7			
		%	10.0	6.2	11.8	19.6	21.4	15.4	27.3	46.7			
	30-34.9	n	0	0	2	1	1	3	0	0			
		%	0.0	0.0	2.0	1.1	1.8	7.7	0.0	0.0			
Body Fat Ratio	Female Students	<%25	n	2	4	8	6	2	1	1	0	p<0.05	r: 0.255
			%	20.0	6.2	7.8	6.5	3.6	2.6	4.5	0.0		
		%25-31	n	4	19	22	15	11	7	2	0		
			%	40.0	29.7	21.6	16.3	19.6	17.9	9.1	0.0		
		≥%32	n	1	14	31	28	11	9	3	1		
			%	10.0	21.9	30.4	30.4	19.6	23.1	13.6	6.7		
	Male Students	<%18	n	1	3	11	5	5	7	3	1		
			%	10.0	4.7	10.8	5.4	8.9	17.9	31.8	6.7		
		%18-24	n	1	20	21	28	21	7	7	7		
			%	10.0	31.2	20.6	30.4	37.5	17.9	31.8	46.7		
		≥%25	n	1	4	9	10	6	8	6	6		
			%	10.0	6.2	8.8	10.9	10.7	20.5	27.3	40.0		
Waist/Hip Ratio	Female Students	<0.75	n	0	0	1	0	0	0	0	0	p<0.05	r: 0.248
			%	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0		
		0.75-0.85	n	7	36	60	44	23	14	6	1		
			%	70.0	56.2	58.8	47.8	41.1	35.9	27.3	6.7		
		>0.85	n	0	0	0	4	1	3	0	0		
			%	0.0	0.0	0.0	4.3	1.8	7.7	0.0	0.0		
	Male Students	<0.80	n	0	4	6	4	1	5	1	0		
			%	0.0	6.2	5.9	4.3	1.8	12.8	4.5	0.0		
		0.80-0.90	n	3	24	34	39	30	14	14	13		
			%	30.0	37.5	33.3	42.4	53.6	35.9	63.6	86.7		
		>0.90	n	0	0	1	1	1	3	1	1		
			%	0.0	0.0	1.0	1.1	1.8	7.7	4.4	6.7		

This study along with similar studies [26] shows that using only BMI in the definition of obesity will not be sufficient. It can be said that body analysis devices are also important in this context. Because, according to the body analysis of the students, it was revealed that the number of females with a higher body fat ratio than normal was higher in those of male students. It is seen that the high BMI values in male students come from muscle mass [22, 26].

Although there are several studies on the prevalence of obesity in Turkey, the most comprehensive studies show that levels of obesity are higher in the female population than the male population [27-31].

It should not be forgotten that obesity is a complicated health problem and body composition is affected by factors such as dietary habits, levels of physical activity and social environment. Also, it is known that the hydration status of individuals in measurements made with bioelectrical impedance analysis devices is also a factor that can affect the measurements [32,

33]. Body analysis is an important criterion for healthy weight loss in the treatment and prevention of obesity and obesity-related diseases [34].

The fact that the students are away from the family environment during their university years results in them facing difficulties in terms of nutrition and health. Studies on university students have shown that students face significant problems when it comes to these issues. Fast food products consumed fondly by university students also cause obesity [35]. Fast-food foods are high in saturated fat and very low in fiber and nutrient content.

Besides, reasons such as irregularity in the nutrition, skipping meals or overeating at meals, consumption of junk food instead of meal, and eating disorders [36] are also among the causes of obesity of university students who stay away from the family environment.

#### 4. CONCLUSIONS

In conclusion, obesity emerges as the main cause of most diseases at every stage of life, which can manifest itself since childhood. In this research, it was shown that methods other than the calculation of BMI values such as Bioelectric Impedance Body Analyzer by determining waist/hip ratio, body fat ratio, total body water, muscle weight and BMR values, obesity tendencies of university students were demonstrated more comprehensively. In chronological studies done within the university students in Turkey noted an increased prevalence of obesity and the results of our study were observed to be similar. Considering that the causes of obesity are dietary habits, levels of physical activity and social environment and genetic, it is clear that more enlightening information will be obtained with detailed studies about the nutritional status of university students and obesity status. The university students gaining the habit of sufficient and balanced nutrition and being directed to regular physical activity will be effective in reducing the prevalence of obesity among university students.

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