



Relationship between depression, stress and anxiety with anthropometric indices using Bio-Impedance Measure, among overweight/obese and normal subjects

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ABSTRACT

Bioelectrical impedance analysis (BIA) is a simple, inexpensive, quick, and non-invasive technique for measuring body composition and its analysis is used as an alternative to examine muscle mass and body fat percentage. Obesity and depression are two major public health problems among adolescents. Both obesity and depression are very prevalent and associated with numerous health complications, including hypertension, coronary heart disease, diabetes, and increased mortality. The present study was a cross-sectional study on 157 adult females and males from student and staff of Science and Research Branch of Islamic Azad University (SRBIAU) of Tehran that classified in two groups of normal weight and overweight or obese. The proportion of body tissues was determined according to the resistance created. The weight of the subjects was measured and recorded using BIA. Using the DASS-21 Questionnaire for Depression, Anxiety and Stress. Based on the present findings, anthropometric indices such as weight, skeletal muscle mass, body mass index, waist to hip ratio, visceral fat level, whole-body water (L), body fat mass (kg), basal metabolic ratio (kcal), degree of obesity (%), fat percentage analysis (%), muscle weight analysis (kg), muscle percentage analysis were significantly different between the two groups ($P < 0.0001$) and were higher in obese or overweight groups than the normal one. There were no significant differences in anxiety ($p=0.496$), stress ($p=0.407$), and mental health score ($p=0.251$) in both groups. Whereas, depression was significantly higher in the overweight or obese group ($p=0.012$). There was no meaningful relationship between BMI and stress ($CC=0.04$, $P=0.612$), anxiety ($CC=0.052$, $P=0.519$), whereas the positive correlation between BMI and depression ($CC=0.932$, $P=0.035$) was significant. There was a direct relationship between obesity and depression, anxiety, and stress. BMI correlates positively with mental health parameters.

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1. Introduction

Obesity is defined as an excess of body fat. The body mass index (BMI) is the standard measure of overweight and obesity in children 2 years of age and older. The BMI is equal to the body weight divided by the height squared. In adults, a BMI between 25 and 30 is regarded as overweight and a BMI greater or equal to 30 is regarded as obese. Obesity around the world has almost tripled from 1975 to 2017 increasing obesity and obesity among adults and children in advanced countries puts health care at risk (4). In individuals with normal weight, fat tissue contains fat cells, but in obese people, fat tissue is

loaded with macrophages, cells that ingest pathogens and other foreign materials and release inflammatory hormones such as TNF-alpha and interleukin-6 that constantly activate the immune system at a low level, therefore contributing to a chronic inflammatory (5,6). Obesity and depression are two major public health problems among adolescents. Both obesity and depression are very prevalent and associated with numerous health complications, including hypertension, coronary heart disease, diabetes, and increased mortality. Obesity and depression increase the potential of precipitating the occurrence of other chronic diseases (7). In recent decades, the prevalence of both depression and obesity has increased at

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an accelerating rate among adults of both genders and across all ethnicities (8,9). Globally, more than 1.9 billion adults aged 18 years and older were overweight. Of these, over 650 million adults were obese (4). While depression affects over 264 million people. More women are affected by depression than men (10). The US ranks ninth in obesity in the world, and approximately 7% of US adults experience a major depressive disorder. Social isolation due to the stigma attached to obesity might trigger depression (10, 11). Many studies have identified several similar risk factors that contribute to the development of excess body weight and depression adults, which could be due to the interaction of the modern and urbanized environment (7). Usually, depression is accompanied by symptoms of anxiety and is considered the leading cause of one's inability to take care of him- or herself, as well as resulting in a high risk of suicide. Depression criteria include depressed mood, fatigue, feelings of guilt or worthlessness, a persistent feeling of sadness, thoughts of death, changes in sleep and appetite, or psychomotor activity (12). The American Psychiatric Association's Diagnostic Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) classifies the depressive disorders into Disruptive mood dysregulation disorder, Major depressive disorder, Persistent depressive disorder, Premenstrual dysphoric disorder, Depressive disorder due to another medical condition, DSM-IV-TR criteria for MDD requires that five of the nine depression criteria must be present for most of the time over 2 weeks (13). A plethora of research that obese teens have a higher incidence of mental health problems such as depression, anxiety, and poorer self-esteem than non-obese teens (14). Therefore, we investigated the relationship between depression, stress, and anxiety with anthropometric indices among obese and non-obese subjects.

2. Materials and methods

2.1. Sample collection and preparation

This study was a cross-sectional descriptive-analytic case-control study. The subjects were normal weight and overweight or obese adults who were randomly selected from among the students and staff of the Science and Research Branch of Islamic Azad University (SRBIU) of Tehran. All the basic required information, including BMI, were available in the University Electronic Health Clinic Database. After choosing eligible samples from the main data bank, they were invited to be a volunteer in this study. Based on the sample size formula, 64 subjects were required for each group and with a 10% probability of falling in each group, 70 individuals in each group were considered. The inclusion criteria were: willingness to cooperate, BMI>18.5, and age range 18-65 years. Exclusion criteria included pregnancy, menstruation, unwillingness to cooperate, as well as unwillingness to cooperate during the study and leaving more than 50% of the food frequency questionnaire (FFQ) empty. At first, eligible subjects have thoroughly explained the purpose of the study and the method of its implementation and then were asked to

sign a written consent if they wish to cooperate. On the day of referral to the SRBIU Clinic, information about basic characteristics including age, sex, and smoking were obtained through face-to-face interviews by valid questionnaires.

2.2. Mental health status

Using the DASS-21 Questionnaire for Depression (15), Anxiety and Stress, expressions related to symptoms of negative emotions, depression, anxiety, and stress were constructed. Depression measures include expressions that measure unhappy people, lack of confidence, hopelessness, the worthlessness of life, lack of interest in engaging in things, lack of enjoyment of life, and lack of energy and power. The Anxiety Scale contains expressions that attempt to assess physiological arousal, fears, and anxiety, and the Stress Scale included expressions such as difficulty in achieving relaxation, nervous tension, irritability, and restlessness (13).

2.3. Measuring Bio-Impedance

Bio-impedance analysis was made according to standard protocol (1). The proportion of body tissues was determined according to the resistance created. The weight of the subjects was measured and recorded using the INBODY Model 270 BIA with an accuracy of 100 g (0.1 kg). Individuals' height was measured with an accuracy of 0.1 cm using the INBODY Model BSM370 automatic standing and shoe-free position while the shoulders were in normal condition. BMI was calculated by dividing the weight in kg by the square of height in meters.

2.4. Statistical analysis

The mean (standard deviation) or median (mid-quartile range) was used to describe the quantitative variables according to the conditions, and for the qualitative variables, frequency reporting (percent) was used. To compare the mean of quantitative outcomes between the two groups, independent t-test or nonparametric test, Mann-Whitney test and compare the results before and after the intervention within each group, paired t-test or its non-parametric equivalent, Wilcoxon test was used. Chi-square and Fisher exact tests were used to compare the qualitative factors between the two groups. SPSS software version 25 was used for data analysis and P-value <0.05 was considered statistically significant.

3. Results

In the present study, Relationship between depression, stress, and anxiety with anthropometric indices using Bio-Impedance Measure were evaluated. In obese or overweight population and normal weight population, with a mean age of 38.73±9.65 years in both genders were evaluated. After calculating the sample size and simple random sampling, 180 adults, 90 obese, and 90 normal weight were enrolled based on inclusion and exclusion criteria. Of these, 23 subjects were

excluded because of incomplete questionnaires (more than half of the items were not completed) and more or less food reporting cases. Finally, the study began with 71 normal weight and 86 overweight and obese subjects. A comparison of anthropometric indices in normal and overweight or obese groups is shown in Table 1. Except for height, all indicators, including weight, skeletal muscle mass, body mass index,

waist to hip ratio, visceral fat level, whole-body water (L), body fat mass (kg), basal metabolic ratio (kcal), degree of obesity (%) , fat percentage analysis (%), muscle weight analysis (kg), muscle percentage analysis were significantly different between the two groups (p<0.0001) and All anthropometric indices were higher in obese or overweight groups than the normal one.

Table 1. Comparison of anthropometric indices in two groups of normal weight and overweight or obese.

Variable	Normal weight (n=71)	Overweight or obese (n=86)	P-value
Weight (Kg)	73.45±10.66	90.05±13.22	0.0001
Height (Cm)	172.4±7.58	172.50±8.33	0.789
Skeletal Muscle Mass	30.93±5.87	34.83±6.77	0.0001
BMI (Kg/m ²)	24.57±2.32	30.28±3.16	0.0001
WHR	0.090±0.04	0.95±0.06	0.0001
Visceral fat	7.55±2.10	12.30±3.59	0.0001
TBW (L)	39.94±8.25	44.91±7.88	0.0001
BFM (Kg)	19.76±10.76	28.77±7.48	0.0001
BF%	2.14±0.78	3.14±2.77	0.0001
BMR (Kcal)	1537.58±265.00	1693.59±232.81	0.0001
Obesity degree	112.20±10.23	138.12±14.42	0.0001
Analyzed fat percentage	217.26±54.59	345.75±85.75	0.0001
Analyzed muscle percentage	98.71±6.8	103.11±6.98	0.0001

According to the findings from Table 2, the health status of psychological indicators was compared between the two groups. There were no significant differences for anxiety

(p=0.496), stress (p=0.407), and mental health score (p=0.251) in both groups. Whereas, depression was significantly higher in the overweight or obese group (p=0.012).

Table 2. Comparison of Mental health in two groups of normal weight and overweight or obese.

Mental health variable	Normal weight (n=71)	Overweight or obese (n=86)	P-value
Anxiety	19.93±5.42	21.25±2.12	0.496
Depression	18.83±5.45	36.75±6.09	0.012
Stress	22.91±6.98	25.00±5.13	0.407
MHS	61.68±15.295	74.00±10.309	0.251

According to the findings in Table 3, we examined the correlation between BMI with anxiety, stress, and depression. There was no meaningful relationship between BMI and stress (CC=0.04, p=0.612), anxiety (CC= 0.052, p=0.519), whereas the correlation between BMI and depression (CC=0.932, p=0.035) was significant and direct.

Table3. Correlation between BMI and anxiety, depression, and stress.

Variable	CC	P-value
Anxiety	0.041	0.612
Depression	0.932	0.035
stress	0.052	0.519

4. Discussion

The study attempted to show the relationship between depression, stress, and anxiety with anthropometric indices using Bio-Impedance Measures. We showed, Anthropometric indices were significantly different between the two groups and were higher in the obese or overweight group. Similarly, all of the mental health was higher in the obese and overweight groups, and only depression was significantly higher in the obese or overweight subject than normal one which means that the relationship between depression and obesity could be bilateral. We also found a positive correlation between BMI and mental health parameters. BMI had a significant

relationship with depression. Some studies have suggested that it has been assumed for years that there is a relationship between obesity and depression in the general population is largely coincidental. A recent meta-analysis by LUPPION and colleagues (8) found that the effect of obesity on the development of depression was the strongest in American studies. They highlighted the possibility of a biological link between overweight, obesity, and depression with an obesity-related inflammatory state. Inflammation has also been associated with depression, which is perceived as a stressful life event in which the brain responds similarly as it responds to a medical illness, leading to elevated pro-inflammatory cytokines. Based on previous studies (7), in a meta-analysis, the authors attempted to explain their findings with this fact that overweight and obesity were associated with depression for all subjects and especially among women. Several theories can explain the relationship between excess body weight and depression (8,16). Restrictive diets for weight control are associated with repeated failures and cyclical weight loss that could cause unsuccessful weight control attempts, leading to the occurrence of binge eating, weight gain, depression, and mood swings. On the other hand, the researchers found, with the rise of obesity and overweight in addition to depression other chronic diseases like diabetes, hypertension, and coronary heart disease are associated (17). In conclusion, we found a direct relationship between obesity and depression,

anxiety and stress, and BMI correlate positively with mental health parameters.

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