ORIGINAL ARTICLE

Comparison of the body compositions in obese and nonobese individuals: Can learning body compositions motivate losing weight?

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Abstract

Background: Obesity is one of the leading preventable causes of death worldwide.
Objective: To compare body compositions in obese and nonobese individuals.
Methods: This cross-sectional study constituted of 428 individuals. Body compositions were determined using the Tanita.
Results: Of all the participants, 300 (70.1%) were female. The prevalence of overweight and obesity was 30.8% and 47.7%, respectively. Having low educational level, female gender, not working, being married, and nonsmoker significantly increased more in obese than nonobese ($P < 0.001$). Total body water, visceral fat accumulation, body mass index, resting metabolic rate, fat-free mass, bone mass, and muscle mass were significantly higher in obese when compared to those with nonobese ($P < 0.001$). Thirteen percent of the participants were thinking of changing their diet and lifestyle to lose weight at the beginning. After learning their body compositions, the rate increased to 60% who decided to modify their lifestyle and asked for help to lose weight. This behavior change was significant in especially the overweighted participants ($P = 0.025$).
Conclusion: The changes in body composition are associated with obesity and increased risk for certain cancers, cardiovascular disease, type 2 diabetes mellitus. Learning the health risks can motivate losing weight. Multicentered studies can be illuminating different cultural factors about obesity.

Key words: Body composition, body fat distribution, body mass index, obesity, weight loss

Date of Acceptance: 01-Mar-2016

Introduction

Obesity is a medical condition in which excess body fat has accumulated to the extent that it may have a negative effect on health and leading to reduced life expectancy.[1-3] Obesity is a major cause of mortality and morbidity for associated of metabolic disorders, type 2 diabetes mellitus, obstructive sleep apnea, cancer, and cardiovascular diseases.[4] Recent studies indicate that the global prevalence of overweight and obesity has reached epidemic proportions.[5,6]

Excess body fat has accumulated to the extent that it may have a negative effect on health. Simple, accurate, and noninvasive methods for assessing body composition are needed in many clinical, community, and research settings. The foot-to-foot bioelectrical impedance analysis (BIA)

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Access this article online

Quick Response Code:

Website: www.njcponline.com

DOI: 10.4103/1119-3077.180075

How to cite this article: Kutlu R, Cihan FG. Comparison of the body compositions in obese and nonobese individuals: Can learning body compositions motivate losing weight?. Niger J Clin Pract 2017;20:82-7.

system may be one method of addressing those needs.[7] BIA is easy and a popular method in research laboratories, hospitals, and wellness centers to assess body composition. Tanita is the world's first lightweight, portable, high capacity body composition monitor.[6,7]

In this study, we aimed to compare body compositions in obese and nonobese individuals by using the Tanita. Learning the body composition changes will create awareness and motivate people to weight loss.

Methods

Study design, setting and population

This cross-sectional study was constituted of 428 individuals between October 2012 and February 2014. The study population was chosen randomly from the patients who applied with any problem to Family Medicine Outpatient Clinic. At first, the female and male subjects were matched according to their ages and weights. After calculating their body mass indexes (BMIs), the participants were categorized as nonobese and obese. The study protocol was approved by the Ethics Committee of Medical Faculty. The participants were duly informed and written, and oral consent was obtained from volunteers according to the Principles of the Helsinki Declaration. A questionnaire investigating demographic characteristics (age, gender, occupation, education, and smoking status) was filled by face-to-face interview technique. None of these subjects had a severe chronic illness, endocrinological disorders, or a malignancy. Of all the patients, systolic and diastolic blood pressures (DBP) were measured in the supine position after at least 5 min of resting.

Anthropometric measurements

Before taking the measurements, the participants were asked if they were thinking of changing their diet and lifestyle. Anthropometric parameters including height, weight, and waist circumference (WC) were measured. Weight was measured while subjects wore only light clothing; height was assessed without shoes, back squared against the wall tape, eyes looking straight ahead using a stadiometer. WC (at the smallest point between lower costal and 10th rib border) was determined using a nonelastic fiberglass measuring tape. All of these measurements were done by the same observer with the same device. BMI was calculated as weight (in kilograms) divided by height (in meters) squared based on the World Health Organization (WHO) classification.[2] According to the WHO classification, BMI lower or equal to 18.50 kg/m^2 is defined as underweight, between 18.50 and 24.99 is considered as ideal weight (normal) for individuals. Overweight is defined as BMI between 25.00 and 29.99 kg/m^2, and obesity is defined as BMI above 30 kg/m^2.[2]

Measuring body composition

In this study, we used Tanita InnerScan Body Composition Monitor, Tokyo, Japan. This device is a safe, quick, portable, noninvasive, and monitors with segmental body composition analysis, differentiating fat and muscle. Tanita's accuracy, innovation, and durability are backed by extensive clinical researches and an independent medical advisory board.[6,7] Body compositions were measured in the morning, between 08:30 and 09:30 h while the subjects did not have breakfast, with only light clothing, after removing shoes, socks, and all metal accessories, before giving blood samples.

None of the participants had known their body composition before this study. The participants were informed about their measurements and body compositions afterward and questioned if they had changed their thoughts about regulating their nutrition and lifestyle after learning their body composition.

Biochemical studies

In all subjects, a fasting blood sample was collected in the morning after fasting at least 10 h for analysis of the following biochemical parameters using standard techniques: Total cholesterol (TC), triglycerides (TG), high-density-lipoprotein-cholesterol low-density lipoprotein-cholesterol (LDL-c), fasting blood glucose, creatinine, blood urea nitrogen (BUN), alanin aminotransferase (ALT), aspartat aminotransferase (AST), uric asid.

Ethical considerations

The study protocol was approved by the Ethics Committee of Meram Medical Faculty of Necmettin Erbakan University and written informed consent was obtained from all participants before participation in this study. All of the participants were volunteers.

Data analysis

Statistical analyses were carried out using the SPSS version 20.0 (SPSS Inc, Chicago, IL, USA). Descriptive statistics were used to present subject characteristics. Comparison of the means was performed using Student's *t*-test and categorical variables were analyzed with the Chi-square test or the Fisher exact test, as appropriate. Analysis of variance testing with Bonferroni correction for multiple comparisons was used to analyze the relationship between continuous and categorical variables. Correlation coefficient (*r*) was described as a weak correlation between 0.00 and 0.24, moderate between 0.25 and 0.49, strong between 0.50 and 0.74 and very strong between 0.75 and 1.00. Statistical significance was reported at the conventional $P < 0.05$ level (two-tailed).

Results

Of all the participants, 300 (70.1%) were female, 128 (29.9%) were male, the mean age of the patients was 36.7 ± 12.3 (min = 18, max = 68), 321 (75.0%) married, 155 (36.2%) primary school and lower educated, 273 (63.8%) secondary school and higher educated, 189 (44.2%) housewives, and 148 (34.6%) smokers. The sociodemographic characteristics of the obese and nonobese individuals were shown in Table 1. The prevalence of overweight and obesity was found as 30.8% and 47.7% respectively. Only 92 (21.5%) people were normal weighted. Having low educational level, female gender, not working, being married, and nonsmoker significantly increased more in obese than nonobese ($P < 0.001$) [Table 1]. The frequency of obesity in primary school and lower educated females is the highest. The comparison of some measurements among males and females is demonstrated in Table 2. Thirteen percent of the participants were thinking of changing their diet and lifestyle to loose weight at the beginning. After learning their body compositions, the rate increased to 60.0% who decided to modify their lifestyle and asked for help to lose weight. This behavior change was significant in especially the overweighted participants ($P = 0.025$).

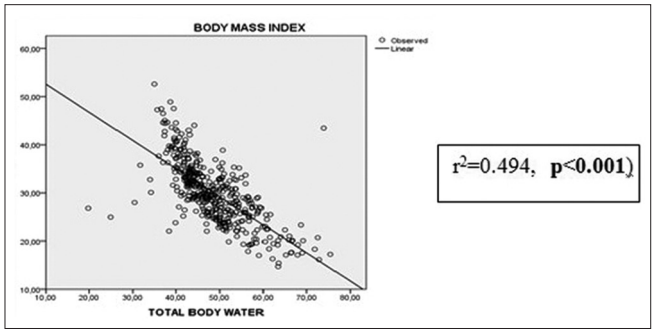

Figure 1: Relationship between total body water and body mass index

Table 1: Sociodemographic characteristic features in obese and nonobese individuals

	Obese *n* (%)	Nonobese *n* (%)	Total *n* (%)	χ^2	*P*
Gender					
Female	164 (54.7)	136 (45.3)	300 (100.0)	19.722	0.000
Male	40 (31.2)	88 (68.8)	128		
Education status					
Primary school and lower	114 (73.5)	41 (26.5)	155	32.760	0.000
Secondary school and higher	51 (39.8)	77 (60.2)	128		
Occupation					
Employed	58 (29.1)	141 (70.9)	199	51.127	0.000
Unemployed/retired	146 (63.8)	83 (36.2)	229		
Marital status					
Married	178 (55.5)	143 (44.5)	321	32.221	0.000
Single	26 (24.3)	81 (75.7)	107		
Smoking status					
Smokers	165 (58.9)	115 (41.1)	289	41.192	0.000
Nonsmokers	39 (26.4)	109 (73.6)	148		

Table 2: Comparison of some parameters according to gender

Parameters	Mean±SD		*t*	*P*
	Female	Male		
Age (year)	36.7±12.1	36.6±12.9	0.057	0.955
Weight (kg)	80.9±17.1	82.5±16.2	−0.880	0.380
Height (cm)	161.1±6.2	173.6±7.5	−17.964	0.000
Fat mass (%)	38.7±8.5	23.7±10.3	15.563	0.000
Metabolic age	47.2±15.1	40.8±18.1	3.767	0.000
Total body water (%)	45.7±6.1	55.3±7.2	−14.149	0.000
Visceral fat (%)	8.1±4.4	8.5±5.3	−0.993	0.321
Bone mass (kg)	2.6±1.9	3.2±0.5	−3.182	0.002
Baseline metabolism (kcal/day)	1539.1±271.6	1868.9±330.8	−10.754	0.000
Muscle mass (kg)	46.3±7.2	59.1±11.4	−13.907	0.000

SD=Standard deviation

As it can be seen in Tables 3 and 4, the measurements were found higher in obese group. The difference was significantly important. The majority of cardiovascular risk factors, especially systolic and DBP, fasting blood sugar, TC, TG, LDL-c, total body water (TBW), visceral fat, BMI, WC, age,

Table 3: Comparison of some parameters in obese and nonobese

Parameters	Mean±SD		*t*	*P*
	Obese group	Nonobese group		
Weight (kg)	93.60±12.38	70.26±11.99	19.800	0.000
Waist circumference (cm)	105.45±14.36	87.56±10.78	14.649	0.000
Body mass index	35.39±4.38	25.19±1.62	26.113	0.000
Age (year)	40.60±11.91	33.15±11.64	6.542	0.000
Systolic blood pressure (mmHg)	132.73±13.82	124.39±12.37	6.656	0.000
Diastolic blood pressure (mmHg)	82.51±9.31	76.45±9.69	6.593	0.000

SD=Standard deviation

Table 4: Comparison of body composition in obese and nonobese individuals

Body composition	Mean±SD		*t*	*P*
	Obese group	Nonobese group		
Fat mass (%)	41.16±8.84	27.87±9.57	14.876	0.000
Metabolic age	54.37±11.81	37.00±15.35	13.185	0.000
Total body water (%)	44.12±5.09	52.59±7.63	−13.605	0.000
Visceral fat (%)	11.23±3.91	5.39±3.51	16.274	0.000
Bone mass (kg)	2.98±2.37	2.59±0.54	2.411	0.016
Baseline metabolism (kcal/day)	1732.92±264.34	1551.11±354.32	5.970	0.000
Muscle mass (kg)	52.43±10.28	47.93±10.23	4.541	0.000

SD=Standard deviation

Table 5: Comparison of lipid profiles in obese and nonobese individuals

Lipid profiles	Mean±SD		*t*	*P*
	Obese group	Nonobese group		
TC (mg/dL)	194.16±43.59	178.55±43.93	3.655	0.000
LDL-C (mg/dL)	122.10±32.86	110.69±37.36	3.326	0.001
HDL-C (mg/dL)	44.84±10.21	45.98±11.57	−1.065	0.287
TG (mg/dL)	146.72±86.91	119.48±67.26	3.606	0.000

TC=Total cholesterol; LDL-C=Low-density lipoprotein cholesterol; HDL-C=High-density lipoprotein cholesterol; TG=Triglycerides; SD=Standard deviation

Table 6: Comparison of some laboratory values in obese and nonobese individuals

Some laboratory values	Mean±SD		*t*	*P*
	Obese group	Nonobese group		
FBG (mg/dl)	100.24±18.19	92.44±13.26	4.985	0.001
TSH (μIU/mL)	2.07±1.30	2.08±3.09	−0.040	0.968
Blood urea nitrogen (mg/dl)	24.69±7.74	23.02±6.22	2.012	0.045
Serum creatinine (mg/dl)	0.73±0.22	0.73±0.12	-0.033	0.974
Uric asid (mg/dl)	4.98±1.33	4.53±1.44	2.732	0.007
AST (IU/L)	18.96±7.20	19.47±8.49	−0.578	0.563
ALT (IU/L)	23.21±15.92	21.80±16.23	0.810	0.418

ALT=Alanin aminotransferase; AST=Aspartat aminotransferase; FBG=Fasting blood glucose; TSH=Thyroid stimulating hormone; SD=Standard deviation

Table 7: Odds ratio of sociodemographic features in obese and nonobese

Parameters	95% CI			*P*
	OR	Lower	Upper	
Gender				
Male	1			0.000
Female	2.653	1.713	4.109	
Marital status				
Single	1			0.000
Married	3.878	6.392	11.631	
Education status				
Secondary school	1			0.000
Primary school	5.654	3.652	8.753	
Smoking status				
Smokers	1			0.000
Nonsmokers	4.010	2.592	6.204	

OR=Odds ratio; CI=Confidence interval

basal metabolic rate, fat-free mass (FFM), bone mass, muscle mass were significantly higher in obese when compared to those with nonobese ($P < 0.001$) [Tables 3-5]. There was not a significant relationship between ALT, AST, TSH, BUN, serum creatinine levels, and obesity ($P > 0.05$) [Table 6].

The frequency of obesity was 2.653 times higher in female gender than male (odds ratio [OR] =2.653, %95 confidence interval [CI]: 1.713–4.109), ($P < 0.001$). The frequency of obesity was 5.654 times higher in low educational level than high educational level (OR = 5.654, %95 CI: 3.652–8.753), ($P < 0.001$) [Table 7]. The correlation of some measurements of the patients is seen in Table 8.

Table 8: Correlations of some parameters in obese and nonobese

Parameters	1	2	3	4	5	6	7
Age							
r	1						
P							
Body mass index							
r	0.336**	1					
P	0.000						
Obesity							
r	0.302**	0.787**	1				
P	0.000	0.000					
Total body water							
r	−0.247**	−0.703**	−0.543**	1			
P	0.000	0.000	0.000				
Visceral fat							
r	0.634**	0.765**	0.619**	−0.452**	1		
P	0.000	0.000	0.000	0.000			
Bone mass							
r	−0.042**	0.141**	0.116*	−0.016	0.102*	1	
P	0.000	0.003	0.016	0.740	0.034		
Fat							
r	0.203**	0.705**	0.585**	−0.817**	0.479**	0.033	1
P	0.000	0.000	0.000	0.000	0.000	0.493	

**Correlations is significant at the 0.01 level (two-tailed); *Correlations is significant at the 0.05 level (two-tailed)

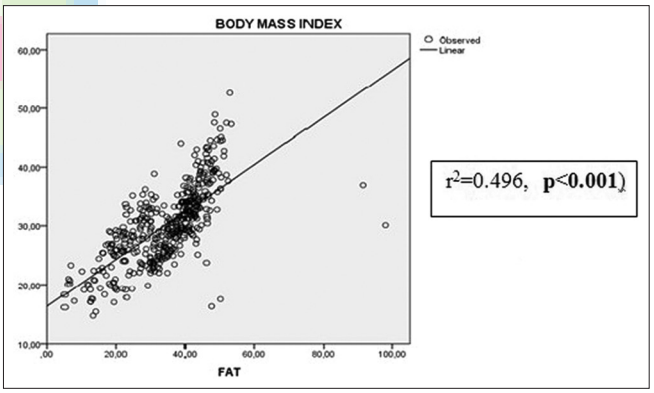

Figure 2: Relationship between fat and body mass index

There was an opposite relationship between TBW and BMI. The 49.4 percent of the increase in BMI is attributed to reduction of TBW ($r^2 = 0.494$, $P < 0.001$) [Figure 1].

There was a direct relationship between visceral fat and BMI. The 58.5 percent of the increase in BMI is attributed to the increase in visceral fat ($r^2 = 0.585$, $P < 0.001$). There was a direct relationship between fat and BMI. The 49.6% of the increase in BMI is attributed to the increase in fat ($r^2 = 0.496$, $P < 0.001$) [Figure 2].

Discussion

Before mentioning the conclusions, the limitations of the study should be considered. Although the overall sample was relatively large, we reached a small group. In addition, although a quite close match, this study group is not entirely representative of the Turkish population. The study includes only the citizens of Konya.

Increased sedentary lifestyle and prevalence of overweight/obesity are common in many countries.[2] In our study, the prevalence of overweight and obesity was 30.8% and 47.7% respectively. Only 92 (21.5%) person was normal weight. The frequency of obesity was higher 2.653 times in female gender than male. The results of the present study showed that having low educational level, female gender, not working, being married and nonsmoker significantly were found higher in obese than nonobese. The frequency of obesity was 5.654 times higher in low educational level than high educational level in our study. According to the research conducted by Visscher *et al*., between 1993 and 1997, the prevalence of obesity among men aged 20–59 year was 8.5% and increased by 0.54 percentage points per year. The prevalence of obesity among women was 9.6% and increased by 0.35 percentage points per year. The increase in the prevalence of obesity in the period 1993–1997 was strongest in men with a relatively low educational level and in women with a high educational level.[8] On the other hand, Molarius *et al*. emphasized that lower education was associated with higher BMI in about half of the male and in almost all of the female populations, and the differences in relative body weight between educational levels increased over the study period.[9] Thus, socioeconomic inequality in health consequences of obesity may increase in many countries.

It is obvious that the frequency of obesity in married females is the highest in this study. In accordance with our results, Nyaruhucha *et al*. state that married adults had higher rate of obesity (27.8%) than the single ones (4.7%).[10] As a result, the majority of cardiovascular risk factors, especially systolic and DBP, fasting blood sugar, TC, TG, LDL-c, TBW, visceral fat, BMI, WC, age, basal metabolic rate, FFM, bone mass, muscle mass were significantly higher in obese when compared to those with nonobese in this study. According to Mirhosseini and friends, the majority of cardiovascular risk factors, especially systolic and DBP, TG concentration, and fasting blood glucose were significantly higher in a group with a high body fat when compared to those with normal and low values.[6] Peppa *et al*. stressed that indices of total adiposity, peripheral fat distribution and lean body mass were not significantly different between "healthy" and "unhealthy" phenotypes.[11] Bozkirli *et al*. in their study, had emphasized, there was a positive correlation between body fat percent and BMI.[3]

In this study, we used Tanita device to evaluate the body compositions in adults. BIA of body composition showed the total body fat in obese groups to be greater than nonobese individuals. The results suggest that it could be a convenient and practical approach for body composition analysis. The research of Ritchie *et al*. revealed that percent body fat estimates from both BIA measures were significantly correlated with WC, BMI, and age.[7] Similarly to our study, Kesavachandran *et al*. had emphasized that body fat percent was measured using a commercially available digital weight scale incorporating a bioelectric impedance analyzer in their study. The Tanita system was highly correlated to other measures of body composition such as WC and BMI.[12] This device has been used safely in several studies.[13-19] Mirhosseini *et al*. stated that BIA provides a direct and precise measure of lean body mass and total fat mass. This method also allows quantification of fat mass in anatomically defined regions of interest, which allows more precise evaluation of the impact of fat distribution.[6] According to the research conducted by LaForgia, BIA measures the impedance associated with the passage of an alternating current through the body which is proportional to TBW and, therefore, can provide expedient estimates of body composition.[13]

Similarly to our findings, Lloret Linares *et al*. also had emphasized that BIA is a safe, quick, noninvasive and easy method of assessing body composition.[20] As a result, we recommend that Tanita is used to assess body composition. Baccioglu *et al*. in their study had emphasized that the body decomposition is important in patients with chronic obstructive pulmonary disease (COPD). Assessment of body composition should be a part of nutritional assessment besides BMI in patients with COPD.[21] Similarly to our study, Korkut *et al*. had stated that as the BMI was increasing, blood glucose, homeostatic model assessment-insulin resistance, insulin levels were increasing also.[22] Inactivity, poor diet, inflammation and hypoxia are suggested as the causes for the deterioration in nutritional status, and it may result in impaired exercise intolerance and poor health status in many patients. If we can measure and explain their body composition changes, this might motivate them to weight loss.

Conclusion

Many health problems are associated with excess levels of body fatness. Healthy food and physical activity provides protection from the health risks of obesity. We should advise our patients setting a realistic goal and maintain a wellness lifestyle to develop a healthy body composition. The changes in body composition are associated with obesity and increased risk for certain cancers, cardiovascular disease, type 2 diabetes mellitus, COPD, and mortality.

In conclusion, Tanita is a cheap, inexpensive and simple method to evaluate the body compositions in adults, and could be a convenient and practical approach for assessment in public health settings and primary health centers. Obese subjects accommodate themselves to their body weight, and most of them do not complain about being obese. When they realized their fat mass, visseral fat ratios were higher, and their TBW was lower, besides their metabolic age was 5–10 years older than their real age, they were convinced to modify their lifestyle and lose weight. It is believed that, in this study, the information about body composition of individuals raised the awareness of this issue, since 85% of overweighted and obese individuals were later directed to the diet clinic voluntarily. The obese people were followed by both departments. Further studies are required to assess motivating factors for losing weight in obese people. Multicentered studies can be illuminating different cultural factors about obesity. The changes in body composition are associated with obesity and increased risk for certain cancers, cardiovascular disease, type 2 diabetes mellitus, and mortality. Learning the health risks can motivate losing weight.

Acknowledgment

We wish to thank all of the participants in the study. We also thank the team working at our Family Medicine Outpatient Clinic.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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