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According to the normal weight, overweight and obese comparison of bioelectric impedance analysis method with the other methods

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Abstract

Women are faced with the problem of obesity because of over-nutrition, still life and birth weight. To Assess overweight and obesity are used with Body mass index (BMI), waist circumference, waist/hip ratio and skinfold thickness measurement method and Bioelectrical impedance analysis method. The purpose of this study was to compare of the methods used to assess body composition in normal weight, overweight and obese in adults women. In this study participated adult women that the mean age of normal weight 25.70 ± 7.85 (N = 17), overweight 32.47 ± 8.22 (N = 36), obese 38.12 ± 8.95 (N = 40) and total N = 93. Subjects' body composition were evaluated with Body mass index, waist circumference, waist/hip ratio and skinfold thickness measurements and measured using bioelectric impedance analysis. For statically analysis, One Way Anova and Tukey tests were performed. Significance level was accepted as 0.05 for all tests. According to the results of anthropometric measurements was found BMI, waist circumference, and bioelectrical impedance analysis method for all the groups differ ($p < 0.05$), waist / hip ratio values were found to be different between normal weight and obese groups ($p < 0.05$) that participated in the research. Body mass index and bioelectric impedance are important methods to detect of obesity, and the waist circumference be used together these methods to determine the abdominal obesity may be more useful.

Keywords: Bioelectric impedance, obesity, body composition.

INTRODUCTION

Growth and body composition, body weight, body height, body mass index (BMI), diameter and circumference measurements (waist circumference, hip circumference, waist/hip ratio (BKO), arm span, calf circumference, etc.), skinfold thickness (ST), bioelectrical impedance (BIA) measurements, body fat percentage and fat-free body mass determinations are often used anthropometric methods (2,24,26).

In evaluation of obesity, various methods have been used (28). Epidemiological studies have generally applied BMI calculated from height and weight (weight /height^2) to determine who are obese and overweight (8,29). The World Health Organization has suggested using BMI in the classification of both overweight (BMI: 25.0 kg/m^2) and obese (BMI: 30.0 kg/m^2) people (30). Furthermore, one of these different methods used from ancient times has been ST measurement. Also, waist/hip ratio and waist circumference measurement have been done to evaluate especially abdominal obesity (16,17). BMI does not measure body composition directly (8) and always become effective in adults because it is affected by age and gender in any assessment of body fat (10). BKO ratio is an anthropometric method which measures fat distribution in body as being independent from BMI. It is abnormal that BKO ratio is over 0.72, and it cannot be ignorable that fat distribution has complication effects when it is over 1 in males and over 0.9 in females. Waist circumference measurement reflects body fat and does not involve most of bone structures (except for spine), big muscle masses (3). Measuring waist circumference is an effective method in finding out risks. In females 80 cm is normal, 85 cm and over it is dangerous. In

addition to the measurement of more weight, distribution places of fat (coming together) are important risk factors because fat cells have different metabolic activities depending on their locations (19). In recent years, based on the different electrical permeability of fat-free tissue mass and fat tissue, since the developed BIA method gives quick results with a portable device and without any user experience, it has started to be used commonly (18). It is one of the most effective methods in assessing body fat rate (31). This method is based on that fat is easily permeable against electrical flow applied (33). Not only in healthy individuals but also in people with obesity at a medium level, diabetics, chronic renal failure and in other medical conditions it can be a useful technique for the analysis of body composition (12).

This study aimed to compare the efficiencies of the relevant methods used in any evaluation of body composition among the normal weight, overweight and obese adult females.

MATERIAL & METHOD

After the approval of the Board of Committee, the adult females who did not have any health problems and registered in the step-aerobics exercise program within the body of KOMEK (Konya Vocational Courses), participated in the study. Before the exercise program, the subjects' heights and body weights were measured, BMI was estimated with the body weight (kg) / height (m) formula. In accordance with the classification by the World Health Organization, they were regarded as thin (Z: BMI 18.5 kg/m^2 below), normal weighted (NK: BMI 19-24.9 Kg/m^2), overweighed (FK: BMI 25-29.9 Kg/m^2) and obese (O: BMI 30-39.9 Kg/m^2) (32). Totally 93 healthy females of normal weighted ones (N=17) with the age average 25.70±7.85, overweight ones (N=36) with the age average 32.47±8.22 and obese ones (N=40) with the age average 38.12±8.95 voluntarily participated.

To determine body fat percentage, using the Holtain Skinfold Caliper, biceps, triceps, subscapular and suprailiac skinfold thickness were measured as well (12). With the Durning-Womersley formula from anthropometric parameters, body intensity was estimated (7), the Siri formula was used in the estimation of body fat percentage (22). The VYY values were found with the Inbody 720 device measuring with the bioelectrical impedance analysis method.

In estimation and evaluation of data, the SPSS for Windows 11.5 package program was used here. The results of descriptive statistical analysis were summarized as averages and standard deviations (±). For any comparison of the groups, the One Way Anova test and for any determination of differences between the groups the Post Hoc Tukey tests were applied. For all the tests, the significance level was regarded to be < 0.05.

RESULTS

The average and standard deviation values concerning the anthropometric measurements of the adult females participated in the study were given at Table 2. As a result of the statistical analysis, while there were significant differences in all groups in the females' BMI, Waist Circumference and BIA values($p<0.01$), there was a significant difference in Waist/Hip ratio and Fat Percentage values only between normal weighted and obese people ($p<0.05$).

Table 1. The participant adult females' descriptive statistics (Mean ± SD).

Groups	N	Age	Height	Weight
Normal Weighted(A)	17	25.70±7.85	164.32±5.94	61.61±6.75
Overweight (B)	36	32.47±8.22	160.74±6.24	70.20±6.86
Obese (C)	40	38.12±8.95	158.42±4.92	86.98±10.86

Table 2. The participant adult females' anthropometric measurement average-standard deviation values and One Way Anova results.

Variables	Normal (N=17)	Overweight (N=36)	Obese (N=40)	F	P
BMI	22.76±1.52*	27.11±1.26*	34.60±3.64*	148.78	0.000
Waist	75.47±3.90*	82.41±5.15*	95.42±9.69*	54.39	0.000
Waist/Hip	0.76±0.035†	0.78±0.051	0.81±0.064†	4.34	0.016
BIA	28.41±4.08*	33.52±4.42*	42.89±4.53*	78.69	0.000
Fat Percentage	35.62±3.39†	34.00±3.39	33.16±3.17†	3.32	0.041

* Difference between three groups ($p<0.01$)
† Difference between two groups ($p<0.05$)

DISCUSSION

In this study body composition parameters were evaluated in the adult females. In any classification with BMI among the subjects who were included in the groups with normal weight, overweight and obese. The measurement results from their BIA method, waist circumference. Waist/Hip ratio and skinfold thickness showed that there were statistically significant differences in comparisons of the groups (Table 2). 76 of the females participated in this study had 25 kg/m^2 BMI. This result indicated that overweight was an important problem for the adult females registered in the step-aerobics exercise program which was involved in Konya Vocational Courses.

Hortobagyi et al. suggested that BMI sensitiveness was lower but its originality was higher (13). Skinfold thickness measurement in obesity diagnosis has provided any benefits. On the other hand, this one has not been commonly used since some problems may occur especially due to the measurement techniques (9). In particular, Waist/Hip ratio has been used for assessing abdominal obesity (6). However, the waist/hip ratio for predicting visceral adiposity was found to be low (21). In recent years it has been claimed that using waist circumference is more important for this aim (5,23). When compared to the waist/hip ratio values, there was only a significant difference between people with normal weight and obese people, as when compared to waist circumference values. there were significant differences in all groups. Studies support this research as well.

In epidemiological studies BMI has been commonly performed for reviewing the risks of health results associated with body weight at different levels. Some researches show that only Waist Circumference or Waist Circumference with BMI has a stronger relation than only BMI for some health results (1,14).

Bosy-Westphal et al. (22) present that BMI, waist circumference and fat percentage predict metabolic risk factors in an equal way for practical applications in population (4). Data from the research show that 40 adult females had health risks. 36 adult females were candidates for having health risks. Since it is not possible to apply routinely DEXA and other methods which assess body composition and determine fat amount, the bioelectrical impedance method is known to be the most suitable method for this aim (5,23). This study implied that the BIA method was effective on all groups. Skinfold thickness, BIA, BKO and BÇ methods used herein are easy to perform. That's why; many studies have chosen these ones. Some studies informed that fat rate estimated from skinfold thickness had a better relation in comparison with the relevant methods (27). When the BIA method was compared with the other relevant tests, it was observed to be a reliable test in assessing fat rate (11). Another study found that various results could be achieved since there were different formulas and measurements for detecting body fat in accordance with the skinfold thickness. The bioelectrical impedance analysis could give both practical and healthy results when its measurement rules were taken into consideration (20). Thomson et al. compared the bioelectrical impedance analysis with one frequency and multiple frequencies with the DXA providing the determination of fat amount for predicting overweight and obese females' body composition in their study. reported that the bioelectrical impedance analysis method with one frequency and multiple frequencies had more superior results (25). Furthermore, when the efficiencies of body mass index and bioelectrical impedance analysis methods were compared in age and gender in another study, it was stated that the BMI failed in evaluating young people's body compositions. BIA method was more reliable to assessed body compositions and required to be considered especially in clinical and health evaluations (15).

In conclusion, it was determined that there were significant differences in the groups of the subjects involved in the groups with normal weight, Overweight and obesity in accordance with BMI after reviewing body with BMI, waist circumference and BIA method. The bioelectrical impedance showed that the results of fat rate measurement complied with BMI. waist circumference and did not comply with waist hip ratio and fat percentage from DKK. Also, BMI and BIA method were considered to be important for predicting obesity and more beneficial when used with waist circumference in order to determine abdominal obesity.

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