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Original Article

Title:

Total Body Fat Assessed by Bioelectrical Impedance Analysis among University Students

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Abstract

There are a number of methods and devices (used) to determine the body fat percentage including bioelectrical impedance analysis (BIA) Tanita which is regarded as the most reliable field assessment tool. The aim of this study, therefore, was to assess body fat percentage by using a BIA Tanita scale in 75 male Sport Sciences and Physical Activity students (body mass index = 22.54 ± 3.86 kg/m^2; age = 22.68 ± 1.23 year) at Taibah University in Madinah. Body weight was measured by using a Seca digital scale, and height was measured by using a portable stadiometer (Seca). Body fat percentage was measured by using a BIA Tanita scale (Type BC-418MA). The results of the current study showed that the mean value of total body fat (%) measured by BIA Tanita was 15.57%, ranging from 5.3% to 32.9%. Among male university students, only 4% of them were classified as overweight/obese based on their body fat percentage (> 25%). It is concluded that body fat percentage was within the normal range and the overweight/obesity status is low among Sport Sciences and Physical Activity students at Taibah University in Madinah.

Keywords :

Physical Fitness; Sport; Exercise; Physical Activity; Obesity

Introduction

Obesity is recognized as a significant risk factor of non-communicable diseases and is considered to be one of the leading factors of global mortality (Boutayeb and Boutayeb 2005; Buttar, Li and Ravi 2005). It is also regarded as a major public health problem with a high prevalence worldwide (Hruby and Hu 2015; Seidell and Halberstadt 2015; Tiwari and

Balasundaram 2022), and is associated with chronic diseases such as type 2 diabetes, cardiovascular disease, nonalcoholic fatty liver disease, and elevated cancer death risk (Bendor et al. 2020; Piché, Tchernof and Després 2020; Powell-Wiley et al. 2021). In Saudi Arabia, the prevalence of obesity and overweight status is alarming, and it has increased dramatically in recent decades to become one of the highest overweight status and obesity prevalence rates worldwide (DeNicola et al. 2015; Habbab and Bhutta 2020).

It is very well known that the evaluation of obesity is important for potential interventions and policies (Bray 2003; Ganz 2003). There are a number of methods and devices used to determine the body fat percentage and to increase the accuracy of obesity measurement, including computed tomography (CT), magnetic resonance imaging (MRI), and dual-energy x-ray absorptiometry (DXA) (Fang et al. 2018). However, these are expensive methods associated with the risk of radiation exposure, and they are not applicable to be used in large scale studies (Hung et al. 2017).

Bioelectrical impedance analysis (BIA) is an alternative method. It is a noninvasive method based on the electrical properties of tissues. It has also been used to assess body fat percentage and is described as an easy-to-use tool for adults and children (Norman et al. 2012). DXA is considered as the gold standard method to measure body composition (Scafoglieri and Clarys 2018). Body fat percentage assessed by BIA was highly correlated to those determined by DXA or magnetic resonance imaging with r values ranged between 0.92 and 0.96 (Bosy-Westphal et al. 2008)

In Saudi Arabia, few recent studies have used BIA scales for the estimation and classification of body fat percentage in children (Alkutbe et al. 2021; Shaikh et al. 2016) and in university students (Alahmadi 2021; Albaker et al. 2021). However, there are different BIA devices to measure body fat percentage such as Seca, Inbody, Tanita, and Omron (Bosy-Westphal et al. 2008). It has been suggested that the Tanita instrument is the most reliable field assessment device (Lee et al. 2017; Núñez, Munguía-Izquierdo and Suárez-Arrones 2020; Prins et al. 2008). In fact, BIA Tanita showed no statistical differences compared to the gold standard method (i.e. DXA) with a low bias (Núñez, Munguía-Izquierdo and Suárez-Arrones 2020). To the best of our knowledge, there are only two studies conducted in Riyadh city that have used BIA Tanita to determine total fat percentage (Abulmeaty, Almajwal and Hassan 2016; Muhanna and Abulmeaty 2018). Therefore, the aim of the current study was to assess total body fat percentage by using BIA Tanita among university students at Taibah University in Madinah, Kingdom of Saudi Arabia.

Material and Methods

In total, 90 university students (Body mass index (BMI) = 22.54 ± 3.86 kg/m^2; age = 22.68 ± 1.23 year) participated in this study. The male students were selected and randomly chosen from Taibah University in Madinah city, western Saudi Arabia, during the first semester of the 2018 - 2019 academic year. All male students were studying the Sport Sciences and Physical Activities program, a four-year bachelor's degree offered by the Department of Physical Education

and Sport Sciences, College of Education at Taibah University. The study protocol and procedures conform to the ethical guidelines, and all participants signed an informed consent form.

Anthropometric measurements:

Body weight was measured by using a Seca digital scale to the nearest 0.1 kg. Height was measured by using a portable stadiometer (Seca) to the nearest 0.5 cm with the head in horizontal Frankfort plane. BMI was defined as weight in kilograms divided by height in meters squared.

Body fat percentage

The assessment of body fat percentage was measured by using a Tanita scale (Type BC-418MA, TANITA Corporation, Tokyo, Japan) which is based on BIA. The Tanita is a device that uses 8 electrodes with a measurement frequency of 50 kHz. BIA measurements were carried out according to the manufacturer's manual (TANITA). Students were wearing light underwear in standing position and were measured in the early morning in a fasted state and an empty bladder. Students' age, gender, height, and physical activity status were entered for each measurement. Once the body weight and impedance measurements were completed, the overall body fat percentage was shown at the bottom of the display. A complete body composition analysis was provided in less than 30 seconds. The body fat percentage indicates the proportion of fat to the total body weight. All students were asked to wear minimal underwear, and all body fat and anthropometric measurements were measured in private. Body fat percentages of 25% or greater were classified as obese in accordance with the World Health Organization (WHO).

Statistics

The data were analyzed using the statistical software package SPSS, version 21. Descriptive statistics are presented as mean values and standard deviation (SD).

Results

In total, 90 university students at Taibah University in Madinah were included in the study. Descriptive information of the study population is given in Table 1. The results of the present study showed that the mean value of total body fat (%) measured by TANITA was 15.57%, ranging from 5.3% to 32.9%. The results of our study also showed that only 4% of male students were classified as overweight/obese based on their body fat percentage (> 25%).

Table 1. Characteristics of participants

	M±SD
Age (years)	22.68 ± 1.23
Height (cm)	172.80 ± 5.41
Weight (kg)	66.73 ± 13.75
BMI (kg/m^2)	22.54 ± 3.86
Total body fat (%)	15.62 ± 5.54

BMI= body mass index

Discussion

In this study, we used BIA Tanita to assess body fat percentage for young male university students. Our tool, BIA Tanita, was revealed to be an easy and accurate practical evaluation method for the assessment of obesity. BIA, as the criterion method, was used in the current study to assess body fat percentage, and BIA estimates were found to be highly correlated with total body fat determined by DXA and MRI (ranged from 0.92 to 0.96) (Bosy-Westphal et al. 2008).

A recent study conducted in university students found that 61.1% of male university students had excess body fat measured by BIA (InBody), recommending to implement healthy lifestyle initiatives, particularly among male students and those who are overweight or obese (Nuñez-Leyva et al. 2022). On the contrary, we found that body fat percentage among Saudi male university students in the current study is considerably normal (mean± SD= 15.62 ± 5.54%) and within healthy ranges that fell below the level of 25% for males according to the American Council on Exercise (Gallagher et al. 2000). This normal range of body fat percentage is expected because the participants are highly active students since they were recruited from the Sport Sciences Department. It is known that low body fat percentages are commonly seen in very active people such as athletes (Abe et al. 2020). Interestingly, when body fat percentage was estimated by BIA in athletic participants, the results demonstrated acceptable correlations between body fat percentage compared to the reference methods such as DXA and air displacement plethysmography (ADP) (Hartmann Nunes et al. 2020).

The prevalence of obesity and overweight status in Saudi Arabia is worrying, and it has risen rapidly in recent decades to become one of the world's highest rates of overweight status and obesity prevalence (DeNicola et al. 2015; Habbab and Bhutta 2020). In a recent cross-sectional study conducted among medical and dentistry students (mean age 22 year) in Saudi Arabia, 23.7 % of those who took part were overweight, and 11% were obese (Makkawy et al. 2021). However, the study used BMI as an instrument to classify obesity. It is very well known that concerns have been raised whether BMI is the most accurate diagnostic tool (Adab, Pallan and Whincup 2018). For example, BMI is reported to be less accurate classifying males than females (Burkhauser and Cawley 2008). BIA, a tool used in the current study, is recognized as one of the most accurate direct measures of the amount and distribution of fat tissue. The body fat percentage cut-off points for obesity suggested by the WHO are 25% for men and 35% for women, corresponding a BMI of 30 kg/m2 (WHO 1995). Our study indicated that 4% of male students were categorized as overweight/obese based on their body fat percentage (> 25%).

Conclusion(s)

This study provides an accurate assessment for body fat percentage measured by BIA Tanita among university students. It is concluded that body fat percentage of our participants was within the normal range. It is also concluded that the overweight/obesity status is low among Sport Sciences and Physical Activity students at Taibah University in Madinah.

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