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Correlation study between body anthropometric measurements with body fat in adult

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Abstract
Introduction: The purpose of this study is to assess the validity of Bioelectrical Impedance Analysis (BIA) to characterize the body fat percentage and its correlation with anthropometric indices.
Materials and Methods: The following indices were carried out: weight, height, body mass index (BMI), waist-hip ratio (WHR) taken random samples of 100 subject. The body fat percentages were assessed by bioelectrical impedance analysis.
Results: Positive Correlation between body anthropometric indices with body fat.
Conclusion: That study concluded that body fat was strong positive correlated with BMI and fair positive correlated with WHR means body fat increased that leads to waist hip ratio and body mass index.

Keywords: Bioelectrical impedance, body fat, BMI, anthropometric indices, fitness

Introduction
Is bioelectrical impedance valid for using in large epidemiological studies? How accurate is bioelectrical impedance to measure body fat? These are most controversial questions in terms of the accurate measurement for percentage body fat which is strongly associated with the risk of several chronic diseases. Bioelectrical impedance analysis (BIA) is a relatively simple, quick and non-invasive technique to measure body composition. These devices are easy to use and require little to no technician/user experience. Furthermore, the BIA estimates total body fat by sending a low electrical current throughout the body using a four electrodes model. However, it measures body fat accurately in controlled clinical conditions but its performance in the field is inconsistent [1]. Due to this limitation, segmental BIA appears to have a potential for assessing the composition of body segments in children, as obtained using dual energy X-ray absorptiometry (DXA) [2]. The studies indicate that visceral fat (waist size) is more important in the disease process than subcutaneous fat or anywhere else in the body. The results indicate that the current clinical guidelines recommend using regional fat distribution instead of body mass index (BMI) for overweight and obesity which represent major risk factors for increased morbidity and mortality [3]. Hence, an obvious question that arises relates to whether these methods are valid in determining the regional body fat or not. Many anthropometric indices, such as waist circumference (WC), hip circumference (HC), have been widely used to predict total and regional body fat [4, 5]. Probably, the most widely used method is measuring the waist circumference. There is a variety of techniques available to determine body fat ration using specific devices.
The most accurate techniques involve underwater weighing, bioelectrical impedance analysis (BIA), computed tomography (CT) and DXA, but these are rarely used except for in scientific studies. However, the fundamental BIA method has advantages over anthropometry for measuring lower limb tissue composition in healthy individuals [6].
In light of the high needs for convenient methods to assess the body's composition in obesity and its suitability for use in daily clinical practice, and in view of the lack of a practical and low-cost method to verify the total distribution of fat in the body, it is important that such values are estimated by anthropometric Indices. Thus, the objective of the present study is body fat using the method of the bioelectrical impedance analysis for the various body segments rather than simply that of the whole body as well as their correlations with WHR.

Method

A cross-sectional study was conducted on 100 adult that aged 32-85 years. In study, there was no pregnancy period and no specific medical problems reported in these subjects. Before taking the tests, all subjects had been informed that data would be used for a research. To assess fat distribution used body composition analyser. For anthropometric measurement waist circumference (WC) was measured at the midway point between the iliac crest and the lowest rib. Hip circumference (HC) was measured at the widest part of the buttocks to the nearest 0.1 cm [7] for calculating waist-to-hip ratio (WHR) by the simple division of WC/HC. Body Fat percent was assessed using two BIA devices. The measurements have been carried out as follows first, the required personal information such as age, gender, weight and height of a person is inputted, and then grips the device handles (hand-to-hand). Electrodes in the hand sensor pads send a low and safe signal through the body and so BF content and BMI are automatically calculated in seconds. This device also analyzer foot-to-foot or leg-to-leg. Based on this BIA device measures impedance across the lower limbs and the four electrodes are in the form of stainless steel foot pads mounted on the top surface of platform scale. While the subject stands barefoot on the scale for simultaneous of body weight and impedance and meanwhile with manual inputting of the subject's gender and height into the system via a digital keyboard, the subject's percentage body fat is displayed immediately.

Statistical analysis

All data were analyzed using the SPSS 20. Descriptive data were expressed with use of standard deviations as means ± standard deviation (mean ±SD) values. Pearson correlation analysis was done to see the linear relationship between anthropometric variables and segmental body fat obtained by BIA. The results were drawn by scatter plots.

Result

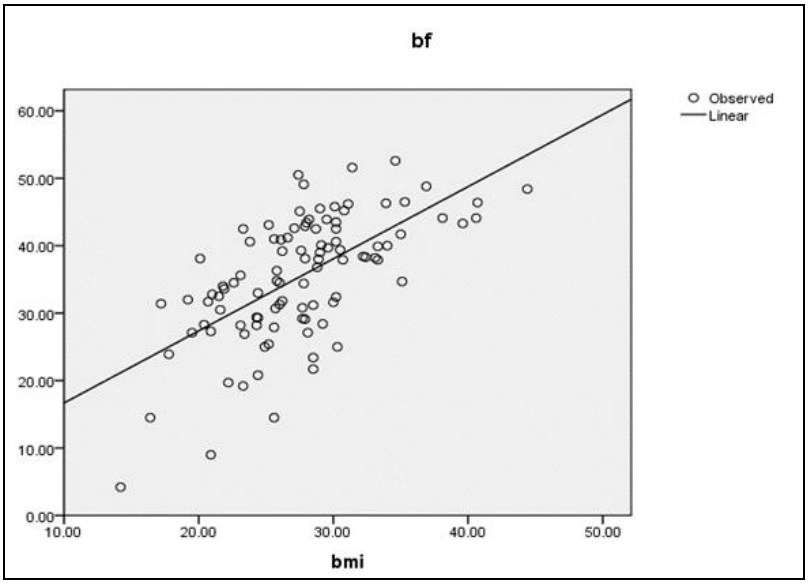
This present study taken 100 adult body anthropometric values and body fat value. In body anthropometric variables, body mass index (BMI), waist hip ratio (WHR) included in study. And that BMI and WHR correlated with Body fat (BF). Respectively, BMI Mean ± SD was 27.4588±5.39956. WHR Mean ± SD was 35.2310± 9.31265.and BF Mean ± SD was .9284± .07641.show all details in Table 1. Person correlation test was applied in these correlations through the linear regression curve with a rise in this study. Total body fat showed a statistically significant correlation with BMI and WHR. Body fat showed strong correlations with BMI. And Body fat also show fair correlations with WHR. Both correlations were statistically significant. Person correlation value were WHR (r= 0.683), BMI (r=0.629), BF (r=0.560). Body fat positively correlate with body mass index and waist hip ratio. Show all details in Table 2. Linearly correlation showed in graph 1 and 2.

Table 1: Descriptive statistic of anthropometric variable.

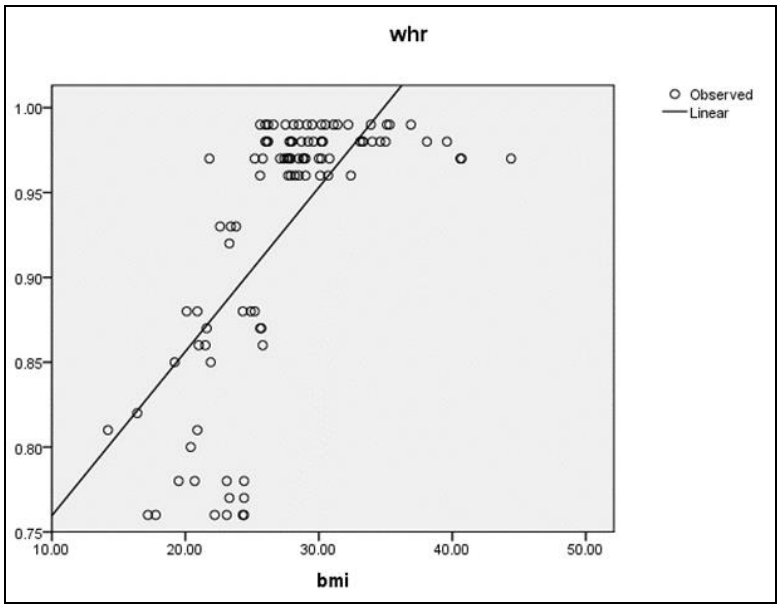
	Mean	Std. Deviation
bmi	27.4588	5.39956
bf	35.2310	9.31265
whr	.9284	.07641

Table 2: Pearson correlation coefficients of BF %, WHR (cm), and BMI.

		bmi	bf	whr
bmi	Pearson Correlation	1	.629**	.683**
	Sig. (2-tailed)		.000	.000
	N	100	100	100
bf	Pearson Correlation	.629**	1	.560**
	Sig. (2-tailed)	.000		.000
	N	100	100	100
whr	Pearson Correlation	.683**	.560**	1
	Sig. (2-tailed)	.000	.000	
	N	100	100	100



Graph 1: Correlation between BF and BMI



Graph 2: Correlation between WHR and BF

Discussion

The present study investigated the correlation between total BF measured by BIA techniques and anthropometric indices in adult with different levels of adiposity. The results showed that the body fat was strong positive correlated with BMI and fair positive correlated with WHR means body fat increased that leads to waist hip ratio and body mass index. This is in line with Pereira *et al*. [8] which reported that the central fat represented by WC and the peripheral fat indicated by HC. Similar to this study, the results obtained here indicated that WHR had a strong association with central fat, represented by the upper body fat distribution observed [9]. Body mass index strongly correlate with body fat estimated by bioelectrical impedance, in this sub population of south asian adults. In this there was a strong and significant positive correlation [10].

It is known from diseases, such as growth hormone deficiency and hypercortisolism which predispose to increase fat deposition, which abnormal fat distribution often occurs in a central or visceral distribution.

Conclusion

That study concluded that body fat was strong positive correlated with BMI and fair positive correlated with WHR means body fat increased that leads to waist hip ratio and body mass index.

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