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Assessment of body composition of young women (18-30 years) through bioelectrical impedance analysis

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ABSTRACT

The present study was conducted on a sample of 33 young women in the age group of 18- 30 years to assess the nutritional status using anthropometric measurements, to assess the body composition of the subjects chosen for study and to find the correlation between Body Mass Index and fat per cent as well as fat percentage and water percentage in the body. The analysis of body composition was done using body composition analyser Tanita BC 420 MA. A complete study of the body composition helped to understand the proportion of different components of the body and helped to decipher the make up of the individual's body and make subsequent suggestions for diet and lifestyle to be followed. The results revealed that (54.54%) subjects had Body Mass Index less than normal, while (42.42%) subjects had body mass index within the normal range.Only a single subject was overweight.In reference to the fat mass per cent values (57.57%) subjects had fat mass percent within the normal range while (42.42%) had fat mass per cent less than the required. The water percentage was normal for all the subjects. The metabolic age was less than the actual age for majority of the subjects.Almost all the subjects (93.93%) had ideal body weight greater than present weight. The degree of obesity was negative for 31 subjects (93.93%). The visceral fat rating was minimum that is 1 for almost all the subjects. Around (54.54%) subjects had bone mass values between the ranges of 2-3 kg which is appropriate for this age. In reference to values of correlation, Body Mass Index was found to be positively related to fat per cent.The correlation coefficient was found to be +0.9. Other than this water percentage and fat percentage were found to be negatively correlated with a correlation coefficient of -0.9.

Key Words : Young women, Bioelectrical impedance analysis, Ideal body weight, Fat tissue

INTRODUCTION

Accurate, non-invasive and easy to use field methods for assessing body composition are needed in clinical, community, and research settings to properly identify a client's health risk of excessively high or low body fatness. One of these methods, Bioelectrical Impedance Analysis (BIA), is a growing technique that ranks similar to skinfold measurement in its accuracy, precision and objectivity (Houtkooper *et al*., 1996).BIA is based on the principle of resistance to the flow of electrical current due to differences in water content of fat and lean tissue (Wagner and Heyward, 1999). Lean tissue contains large amounts of water and electrolytes and is a good conductor of

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electrical current. Fat tissue, on the other hand, is anhydrous and a poor conductor; therefore, the larger the fat tissue, the higher the resistance to electrical current and the higher the adiposity.During adulthood a considerable dimorphism in body composition between males and females is established (Wells, 2007). This typical human sexual dimorphism in body composition is characterized by a substantially higher amount of body fat and a substantially lower amount of lean body mass among women (Sylvia Kirchengast, 2010). There has been a significant decrease in the level of people's physical activity in modern civilization. The trend of a sedentary lifestyle was conditioned by the occurrence and improvement of technological developments (Philipson and Posner, 2003). When health and fitness are taken into account, the main interest is to establish the relative amount of the fatty tissue in relation to the non-fatty one, as well as the distribution of fat in the body, along with the changes that occur in those components. Physical inactivity is one of the main causes of the increased amount of fat in the body (Cokorilo *et al.,* 2012). Excessive body fat is associated with increased metabolic risk, and its measurement is important in implementing curative and preventive health measures (Vasudev *et al.,* 2004).

Thus the study was undertaken with the objective to assess the Nutritional Status using Anthropometric Measurements (Weight, Height and BMI) to conduct an analysis of body composition of the subjects, and find the correlation for BMI and fat per cent and water percentage and fat percentage for the present subjects.

METHODOLOGY

Selection of area :

The subjects were chosen from an institution in the urban area of Ajmer city.

Selection of sample :

A total number of 33 girls in the age group of 18-30 years formed the sample for the study.

Anthropometric measurements:

Weight and Height measurements of the subjects were taken. Height of the subjects was measured using an inch tape. The weight was checked on the body composition analyser itself.

Analysis of body composition:

An analysis of the body composition of the subjects was done through a body composition analyser namely Tanita BC 420 MA. The machine operates on the principle of Bioelectrical Impedance which is the latest non-invasive technology for the analysis of body composition.

RESULTS AND DISCUSSION

The results for anthropometric measurements and body composition are discussed hereunder:

Anthropometric measurements :

Weight:

The mean weight of the subjects was 46.63± 5.61 kg. The range was found to be between 38.4 to 58.7 kg (Table 1)

Table 1: Anthropometric measurements of the subjects

Anthropometric measurement	Mean	Range	±SD
Weight (kg)	46.63	38.4-58.7	5.61
Height (cm)	160.6	152-171	5.73
BMI (kg/(m)^2	18.12	13.5-24.3	2.36

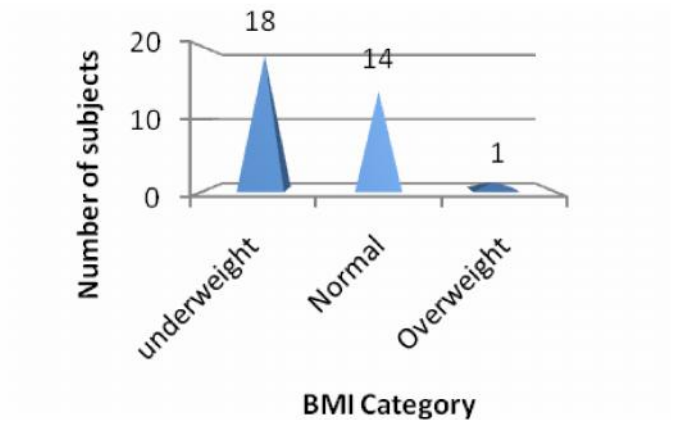

Fig. 1 : Assessment of nutritional status using BMI

Height :

The height of the subjects was measured using an inch tape. The mean values for height were 160.6 ±5.73 cm, while the range was 152 to 171 cm (Table 1).

Body Mass Index (BMI) :

The mean value for BMI was found to be 18.12±2.36 kg/ (m)^2. A total number of 18 subjects (54.54%) had BMI less than 18.5 kg/ (m)^2 that is they were undernourished with respect to BMI.A total number of 14 subjects (42.42%) had BMI within the normal range. Only a single subject was overweight. None of the subjects were obese (Table 1).

Body composition parameters:

Fat mass percentage:

Amount of body fat as a proportion of body weight is called fat mass percentage. Fat mass per cent between 21-33 % is considered normal for the age group of 20-40 years. The mean for fat mass per cent was found to be 21.63±5.34% (10.30±3.57 kg). The range for fat mass percent was found to be 6.7-34% (2.6-19.1 kg). A greater number (19, 57.57%) had fat percentage between the normal ranges of 21-33%, while 14 subjects (42.42%) had fat percent less than 21% (Table 2).

Total body water per cent :

The normal body water content for females ranges between 45-60%. All the subjects had body water per cent in the normal range of 45-60%.The mean value for body water percentage was 52.46± 2.79% (24.35 ±1.98 kg). The range for body water percentage fell between 45.8-59.6% (20.4-28.7 kg) Table 2).

Table 2 : Body composition parameters of the subjects

Body composition parameters	Mean	Range	± SD
Fat %	21.63	6.7-34	5.34
Fat mass (kg)	10.30	2.6-19.1 kg	3.57
Fat free mass (kg)	36.33	31.1- 43.4	2.90
Muscle mass (kg)	34.31	28.9- 40.8	2.66
Total body water (kg)	24.35	20.4-28.7 kg	1.98
Total body water per cent	52.46	45.8- 59.6	2.79
Bone mass (kg)	2.02	1.6-2.6.	0.24
Metabolic age (years)	18.15	14-31	3.43
Visceral fat rating	1.5	1-5	1.002
Ideal body weight	56.81 kg	50.8-64.3	4.07
Degree of obesity	-16.6	-38.5 ±10.4	12.13

Metabolic age :

This parameter indicates the average age associated with the metabolism of the individual. Thus it is specific for each individual. Metabolic age greater than the actual age indicates that one needs to improve his/her metabolism. This can be done through exercise. In the study the mean for metabolic age was found to be 18.15 ± 3.43 years. Majority of the subjects (87.87%) had metabolic age less than the actual age. Only for two subjects (6.06%) metabolic age was equal to the actual age and for another two subjects the metabolic age was greater than the actual age. The range for metabolic age was found to be 14-31 years while the range for actual age was 18-23 years (Table 2).

Visceral fat rating :

Visceral fat is the fat surrounding the vital organs of the body. The subjects chosen for study had low fat levels and as such the visceral fat level was minimum that is 1 for majority of the subjects (23, 69.69%). Mean value for visceral fat rating was 1.5 ± 1.002. The range was 1 to 5 (Table 2).

Ideal body weight :

Ideal body weight is the weight for which the BMI is 22.Only 2 subjects (6.06%) had ideal body weight less than the present weight while 93.93% (31) had ideal body weight greater than the present.The mean value for ideal body weight was 56.81±4.07 kg, while the range was 50.8-64.3 kg (Table 2).

Degree of obesity:

Degree of obesity is the parameter that indicates if fat deposition is leading to obesity in the concerned person. It may be positive or negative. The degree of obesity was negative for 93.93% (31) subjects while positive degree was found for 6.06% (2) subjects. According to the BMI classification however these subjects could be classified as overweight. The mean was -16.6±12.13 for degree of obesity while the range was -38.5- +10.4 (Table 2)

Bone mass :

It indicates the mineral amount in the bones of the body. The mean value for bone mass was

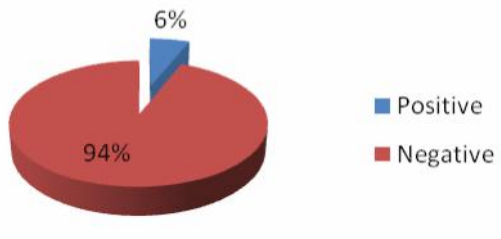

Fig. 2 : Classification of subjects according to degree of obesity

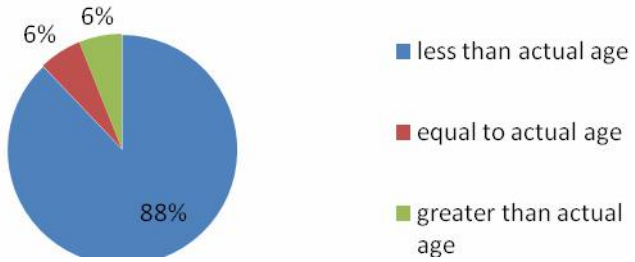

Fig. 3 : Classification of subjects according to metabolic age

2.02 ±0.24 kg, while the range was 1.6-2.6 kg. A total number of 18 subjects (54.54%) had bone mass values between the ranges of 2-3 kg which is appropriate for this age (Table 2).

Muscle mass :

The mean value for muscle mass was 34.31±2.66 kg. The range for muscle mass values was 28.9- 40.8 kg (Table 2).

Lean body mass (fat free mass):

This means the muscle mass and the bone mass in the body.The mean value for fat free mass 36.33 ±2.90 kg. The range was found to be 31.1- 43.4 kg (Table 2).

Correlation coefficient:

Body Mass Index was found to be positively related to fat per cent.The correlation coefficient was found to be +0.9. Other than this water percentage and fat percentage were found to be negatively correlated with a correlation coefficient of -0.9.

Summary and conclusion:

In the study some subjects were undernourished with respect to Body mass Index, while others fell in the normal category.Since for majority of the subjects as the BMI increased the Fat percentage increased, fat percentage and BMI were positively correlated to each other. Only in some very few cases the BMI was more but the fat percentage was less where the differences in BMI could be attributed to the difference in muscle mass. None of the subjects were obese, and as such the degree of obesity was negative for almost all, and the visceral fat rating was minimum for majority. The body water percentage was normal for all, and the fat percentage was negatively

correlated to water percentage.This implies that as the fat content in the body increased the water percentage decreased.

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