Relationship between Body Mass Index and Percent Body Fat among Females of Raipur City

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Authors' contributions

This work was carried out in collaboration between three authors. Author AS designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript and managed literature searches. Authors AJ and VV further managed the literature searches. All authors read and approved the final manuscript.

ABSTRACT

Obesity is the major risk factor for the development of many diseases. BMI is widely used as a deputy measure of obesity, but underestimates the prevalence of obesity, defined as an excess of body fat. The aim of this study was to investigate the relationship between body mass index (BMI) and body fat percentage (BF%) in females. The study was a cross-sectional design. A selected sample of 70 females aged 25-50 years participated in a detailed height and weight measurement were taken using standard methodology and body fat percent estimated by bio - electrical impendence analysis (BIA). Results to the present study body fat were found to be higher in female subjects and 70 percent of subjects had body fat more than 30 percent. According to BMI 68 percent subjects were found to be overweight and obese subjects were having lower range increased the percent BF of subjects also increased.

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1. INTRODUCTION

Obesity can be defined as the generalized accumulation of fat in the body [1]. It is a state of generalized accumulation of excess adipose tissue in the body leading to more than 20% of desirable weight [2].

Anthropometry is one of the most basic classification for assessing nutritional status, whether over nutrition or under nutrition. A variety of methods are available to measure body fatness and body thinness. The most frequently used tools in public health evaluations and clinical screening are anthropometric-based measurements such as skin fold-thickness or circumference measurements or various height- and weight-based indexes such as weight-for-height, body mass index [wt (kg)/ht (m^2)] [3].

WHO Expert Consultation (2004) decided to retain the universal BMI cut-off points of 25 kg/m^2 for overweight and 30 kg/ m^2 for obesity [4].

The rising prevalence of overweight and obesity need for accurate method of assessment of obesity. Currently, there are many measures for diagnosing obesity at population level but most frequently used diagnostic tool in the current classification system of obesity is body mass index. It was confirmed by various scientist [5-7] that the use of BMI as a measure obesity can introduce misclassification problem because it does not provide information about the respective contributions of fat mass and fat free mass to body weight. However, it is difficult to accurately measure body fat mass, because this requires new technologies that are available.

It seems that true body fatness may be better evaluated by assessment of body fat and fat-free mass [8]. Therefore, much research has recently examined the believable role of body composition measurements [9,8-10].

Until now, bioelectrical impedance analysis (BIA) has been considered as the simplest, most reliable and low cost method for body composition evaluation in clinical practice, and it showed high accuracy and excellent correlation with dual-energy X-ray absorptiometry (DXA) in assessing BF% [11,12]. Therefore, BIA is considered the most cost-effective and possible replacement for DXA in assessing body composition. BF% has been most commonly used in practice. However, the accuracy of BF% measurements is dependent on height and cannot be evaluated independently from fat free mass [13].

The WHO's 2004 call for more research to be conducted in diverse populations seems quite important and necessary if the relationships between BMI, body fat and chronic disease are to be better defined. Along with measures of anthropometry and body composition, it is important to better understand both the genetic relationships between populations and the environments in which they are living.

Hence the present study was designed to determine the relationship between body mass index (BMI) and body fat percentage (BF %) in females.

2. MATERIALS AND METHODS

The present cross - sectional study was taken to assess the prevalence of obesity among 70 females between the age groups of age 25 to 50 years. The study was carried out in Raipur city Chhattisgarh. All the subjects were apparently healthy, without any signs and symptoms of physical abnormality. Only those subjects who gave written consent were included in this study. Personal information about age, demographic profile, dietary pattern and activity level were collected through a well designed pre tested questionnaire. Pregnant, Diabetic, and patient with chronic renal failure were excluded from this study. Females suffering from thyroid were also excluded from the study as thyroid mal function affect body weight and fat percent. Each subject was contacted personally at their residence. The study protocol was approved by the Institution Ethical Review Committee of the Department of Home Science. Two anthropometric measurements height and weight was taken by standard techniques Percent body fat was estimated by bio-electrical impendence analysis (BIA) technique using. BIA involves passage of a very weak alternating current across the foot and thumb. As mentioned in instructions of the equipment, right hand and foot was selected for experiment. BIA is based upon the principle that electric current flows through body at different rates depending upon its composition.

The assessment of obesity was carried out by using BMI and PBF .BMI was calculated from measured values of height and weight for each subject. In general, BMI=weight (kg)/height (m^2) for the assessment of overweight and obesity following BMI criteria of WHO (2000) used.

Nutritional status	WHO criteria BMI cut -off
Underweight	<18.5
Normal	18.5 -24.9
Overweight	25 -29.9
Pre-Obese	-
Obese	>30
Obese type 1 (obese)	30 -40
Obese type 2 (morbid obese)	40.1 -50
Obese type 3 (super obese)	>50

Similarly, PBF was used for assessment of overweight and obesity by using criteria according to WHO, females having percent bf above 30 were considered obese and those having per cent BF below or equal to 30 as normal.

2.1 Statistical Analysis

The Statistical Analysis of data was entered into the computer using MS-Excel program. Mean and Standard deviations for various parameters was computed.

3. RESULTS

Mean age of sample was 37 years. They all belonged to upper middle income group and followed a sedentary pattern of life style.

Table 1 shows the basic characteristics of the studied sample. It is apparent from this table that there is wide variation in minimum and maximum values of the studies.

Table 1. Basic characteristics of the females

Variable	Mean N=70	SD	Minimum value	Maximum value
Age (yrs.)	37.50	11.93	25.0	50.0
Height (cm)	155.42	4.09	150.0	159.0
Weight (kg)	68.14	14.29	45.0	98.0
BMI (kg/m^2)	28.16	5.62	18.5	37.1
Percent body fat	38.35	10.30	19.3	50.5

Table 2 showed that 38 percent subjects had BMI between 30 to 40 with mean 33.9±1.87 and 30 percent of subject had percent of BMI between 25- 30 with 27.19±1.18 while 27 percent 20-25 and 7 percent 18.5-20 of subjects had mean BMI 23.79±1.01 and 19.36±0.46 respectively.

3.1 Percent of Body Fat

According to percent BF as who classification 70 percent of subjects were found to have high

percent BF with mean 40.78±6.94 while only 30 percent of subject had normal percent BF below 30 with mean 23.31±3.30.

Table 3 body mass index and percentage of body fat of Subject who were overweight (BMI: 25-30) had mean percent BF 39.02±3.86 while obese BMI ((30-40) had mean percent BF 46.07±3.53. subjects who came in normal category according to BMI had mean percent BF 23.98±1.30. On the other hand subjects whose BMI range was 18.5-20 had mean percent BF 21.36±2.25 results show that in every category of BMI subjects had some higher percent body fat but as the BMI increased their mean percent BF also increased. Only 34.28 percent of subjects had normal BMI and High percent BF. Thirty five percent subjects had high BMI with very High BF.

Table 2. BMI, percent of the females

Details	Number of subjects	Percentage	Mean±SD
BMI			
30-40	25	38%	33.90±1.87
25-30	21	30%	27.19±1.18
20-25	19	27%	23.79±1.01
18.5-20	5	7%	19.36±0.46

Table 3. Body mass index and percentage of body fat among females

BMI	Number of subjects N= 70	Mean and standard deviation percent bf
30-40	25	46.07±3.53
25-30	21	39.02±3.86
20-25	19	23.98±1.30
18.5-20	5	21.36±2.25

4. DISCUSSION

Recent studies show the two labels of indicator for BMI, first label is overweight with cut off 25 and second obesity with cut off 30 kg/m2 [14] suggested the degree of fatness and overweight do not fit in the same criteria, but with our research and analysis we found out that contradicting result that BMI was a relatively good predictor to examine the level of body fat. It is important to remember that although BMI correlates with the amount of body fat, they vary parallel and in uniform way. It forgoing analysis associated with greater mean levels of body fat is more in women as compare to men's and proceed towards increment. BMI cut points for clinical risk assessment due to the marked

difference in the BMI-per cent fat relation observed in men and women across the entire range of BMI. BMI is just one indicator of potential health risks associated with being overweight or obese. For assessing someone's likelihood of developing overweight- or obesity-related diseases, [15,16] shows the result that, atherosclerosis and diabetes patient are more in greater risk factor as they consume excess of body fat rather than body weight. This was relatively straightforwardly suggested to measure body fat directly to get the precise result on labels overweight and obesity.

The purpose of the present science advisory is to briefly review the increase in mortality with loss of weight or BMI indeed. Others have argued through their study by [17,18] that the measuring body composition, loss of body fat decreased mortality rate. A large number of prospective studies have paid attention to the relationship between degree of overweight/obesity) and mortality.

Taking sex and age into account BMI and per cent body fat (% fat) differs by age and gender. The extent to which age and gender effect the relationship between BMI and % fat among more severely obese individuals is less known. A report presented by [19] described the relationship between BMI and BF% in males and females in different age categories. In recent years, accumulating evidence has suggested that the relationship between BMI and BF% differs between ethnic groups [20].

Different data are emerging from different position across the globe. using DXA, showed that higher BF% compared of Caucasians age matched to 'Asians' living in the New York and adding more they have lower BMI, these were the conclusion prepared by [21]. Recently, [22] reported higher BF% levels at lower BMI in Japanese when compared to Caucasians (from the United States and the UK) and American Blacks. For the two or more different communities BMI / BF% are ranging different, as the most significant factor leading this is physical activity [23] showed with different sample from places like Nigeria (in Blacks), Jamaica and the United States.

Prior studies are done in factor related to genetic evolution, hormonal variation, environment surrounding. These majorly affect women's. Again physical activity keeps important role, question is to determine the activity types and

daily activity habits. It is widely acknowledged that being overweight is associated with an amplified risk of disease, and majorly due to insufficient physical activity level [24] this was also observed in present study. According to BMI 66 percent subjects were found to be overweight and obese subjects with high percent of body fat percent when enquired about food hobbits 50% subjects' very irregular intake of hobbits particularly fats and extra calories intake in a day and no physical activity, only 16% percent subjects reveled that they were genetic problem.

Which accounts the total energy intake and utilized? One of the advantages of using BMI to define obesity was the availability of national data sets which could be used to establish standards, such as the 85th percentile of BMI in [25] designating overweight and the 95th percentile was designating obesity.

There is, however, a series of recent analyses that attempt to look at changes in body weight and body fat over the last few years., but no record of large national data sets and no consensus on acceptable body fat; suggested upper limits range from 25 percent to 33 percent for women and from 20 percent to 25 percent for men [26]. Few data are available but not imposed on paper about the composition in NHANES in 1988-1991 in which BIA method was adopted.

Numerous techniques have been used to estimate body composition. None of the methods currently used actually measure %BF; the only way to truly measure the volume of fat in the body is BIA some methods are incredibly inaccurate to measure, so one need to adopt that method which give precise result to find BMI AND Body Fat %, it is a relatively accurate and inexpensive method, about the reliability BIA derived estimates of body composition at the extremes of body fat distribution. Clearly, in the present study we were confronted with erroneous estimates of body fat among extremely lean individuals in the Nigerian and Jamaican samples .Some investigators have raised concerns about the use of BIA in epidemiologic research [27,28] requirements for the standardization of protocols [29] profusion of predictive equations in the literature [27] and inconsistencies between analyzers from different manufacturers [30]. We believe it is currently the best option for measuring body composition in the field. Knowing these characteristics will help you decide wisely when choosing the method for body composition assessment.

5. CONCLUSION

In conclusion, our finding show that body fat were found to be higher in female subjects and 70 percent of subjects had body fat more than 30 percent. According to BMI 66 percent subjects were found to be overweight and obese subjects were having lower range increased the percent BF of subjects also increased. This shows positive relationship between BMI and percent BF. This proves that the figures are alarming among females. The purpose of this study prevention and control of this problem because obesity is the root of various diseases in adult life.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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