International Journal of Biomedical and Advance Research
ISSN: 2229-3809 (Online); 2455-0558 (Print)
Journal DOI: https://doi.org/10.7439/ijbar
CODEN: IJBABN

Original Research Article

Assessment of central obesity among medical students with different BMI groups- A cross sectional study

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***Article History:**
Received: 12/02/2018
Revised: 27/02/2018
Accepted: 30/02/2018
DOI: https://doi.org/10.7439/ijbar.v9i7.4641

Abstract

Background: The normal body mass index range, as defined by the WHO is quite wide. The population within this range may have excessive central fat accumulation and elevated metabolic risks. The study intended to measure central obesity by anthropometric variables to identify the subjects who are at a higher metabolic risk in different BMI categories.
Objectives: To study anthropometric parameters of central obesity among medical students with different Body Mass Index.
Methods: In the present cross sectional study 137 students were recruited based on inclusion and exclusion criteria which included 53 male students and 84 female students. On the basis of body mass index, the students were divided into three groups according to WHO cut off values. Waist circumference, hip circumference, abdominal skinfold thickness were measured to know central obesity. Waist hip ratio and waist height ratio were calculated using the standard equations.
Results: Waist hip ratio was normal in all three categories of BMI, whereas hip circumference, abdominal fold thickness and waist circumference was more in all three categories of BMI with p value <0.001 and F value is 73.280, 37.440, 83.147 respectively. Female students had increased waist circumference (76.7±10.8), waist hip ratio (16.1%) and abdominal fold thickness (26.9±10.05). P value <0.001 was considered as significant.
Conclusions: Anthropometric variables such as waist circumference, hip circumference, waist hip ratio, waist height ratio and abdominal fold thickness are independent risk factors even in individuals with normal BMI.
Keywords: Waist circumferences, Hip circumference, Abdominal fold thickness, Medical Students, central Obesity.

1. Introduction

The cause and effect relationship of obesity and cardio vascular disease has always been a concern across all age groups. World Health Organization defines Obesity and overweight as abnormal or excessive fat accumulation that may impair health. Obesity are linked to more deaths worldwide than underweight. The worldwide prevalence of obesity is more than doubled between 1980 & 2014. Nearly half of the children under the age 5 who are overweight /obese live in Asia. Obesity in children is a cause for concern because it may predict adult obesity and increased risk of coronary heart disease in adult life. [1] It is currently estimated that 1.4 billion individuals are overweight and 500 million people are obese globally but many of them are seen in developing nations. [2]

Body Mass Index is simple index that is commonly used to classify overweight and obesity in adults. It provides the most useful population level measure of overweight and obesity as it is same for both the sexes and for all ages of adults. Generally, utilization of anthropometric data has been employed by local and international bodies for judging nutritional conditions e.g., Obesity. Height, Weight and Body Circumferences are examples of such anthropometric data. They are used for assessing obesity and other related nutritional epidemic. Several clinical anthropometric measures have been used to assess overweight and obesity but BMI is identified as most useful epidemiological measure of obesity by WHO.[3]

In recent years indices of abdominal obesity (waist–hip ratio [WHpR] and waist circumference [WC]) have increasingly been associated with higher cardio metabolic risk in both cross sectional and prospective studies [4]. Body mass index (BMI) is often used as a surrogate marker, but it does not provide an accurate

assessment of body fat [5]. Thus, skinfolds can be considered a "midway" marker that is more sensitive than BMI in determining body fat and is more useful for both clinical applications and epidemiological studies [6,7]. Additionally, skinfold thickness determines nutritional status and assesses disorders related to malnutrition and obesity. This study was carried out among first year medical students in context to their ignorance towards health/fitness, health effects of academic stress and to further make them aware about the role of anthropometric measures which can be used as risk indicators especially of cardiac vascular system.

2. Materials and methods

The cross sectional study was conducted on Ist year medical students aged 18 to 20 years. The study was undertaken after the ethical clearance obtained by the Institutional Ethics committee for Human Subjects Research

2.1 Selection criteria

The students were given a proforma containing a set of questions about the name, age, sex, nativity, diet & medications. Baseline heart rate and Blood Pressure was measured. Based on these criteria 137 healthy medical students studying in I phase aged between 17 to 20 years were recruited for the study after obtaining written informed consent from them. The students with history of any chronic medical illness or on any long term medication were excluded from the study.

2.2 Data collection-

All students were screened for height and weight. Body weight was measured by the digital scale with an accuracy of +100 gm. Standing heights were measured without shoes by using commercial stadiometer. Then BMI was calculated using Quetelet index.

On the basis of BMI students were classified according to "WHO technical series 584 recommended cut off values for the adolescents" [8]. It is as follows

1. <50th percentile-Underweight(UW)
2. 50th -85th percentile-Normal
3. >85th percentile-Overweight(OW)

2.3 Measurement of anthropometric variables

An inelastic tape, graduated in centimetres (0-150) was used to measure the waist and hip circumferences. The waist circumference (WC) was taken within 1mm mid-way between the lowest rib and the iliac crest. Hip circumference (HC) was measured at the level of the greater trochanters [9]. Waist hip ratio (WHR) and waist height ratio (WHtR) were calculated using the standard equations. Abdominal skinfold thickness (Parathoracic/Abdominal site-that is, midway between the axilla and iliac crest) was measured with Harpenden's calipers and recorded to the nearest 01 mm. All anthropometric measurements were performed by a single observer.

2.4 Statistical analysis

Waist, hip circumferences, waist hip ratios &abdominal fold thickness were compared and analysed with gender and different BMI category by using unpaired t test and F test respectively.

3. Results

Total of 137 students participated in the study which included 52 male and 85 female students. Statistically significant difference in waist circumference, hip circumference, and abdominal fold thickness was observed among all 3 BMI categories. The waist circumference values in underweight category is 69±5.65, in normal weight category is 76.7±7.51 and in overweight category is 92.5±9.60. The hip circumference values in underweight category is 86.7±5.63, in normal weight category is 93.5±6.86 and in overweight category is 106.9±8.34. The abdominal fold thickness in underweight category is 16.2±8.16, in normal weight category is 25.5±8.61, in overweight category is 34.3±8.32. Significant increased values are seen in over weight category.

As expected waist hip ratio was more among overweight group (23.5%) compared to normal BMI group (15.7%) and underweight group (9.1%). Waist circumference and hip circumference were higher in females (76.7± 10.69, 94.1±11.13), as compared to males (82.1±11.93, 96.9±7.90) the difference of waist circumference being statistically significant. None of the male students had increased Waist Hip ratio however 16.1% of females were found to have increased value. P value was <.001. Abdominal fold thickness was more in females (26.9±10.05) as compared to males (22.9 ±10.83) with significant p value 0.029.

Table 1: Gender differences among three different BMI categories

Sex	Under-weight	Normal weight	Over weight	Total
Male	17(32.1)	22(41.5)	14(26.4)	53
Female	16(19)	48(57.1)	20(23.8)	84
	33(24.1)	70(51.1)	34(24.8)	137

X^2=3.933 DF=2

p=0.140

Table 2: Gender differences and waist – hip ratio

Sex	Increased	Normal	Total
Male	00	53(100%)	53
Female	22	62(73.8%)	84
	22(16.1%)	115(83.9)	137

X^2_1=16.536

p<0.001*

Table 3: Waist hip ratio in three different BMI categories

Weight category	Increased	Normal	Total
Under weight	3(9.1)	30(90.9)	33
Normal weight	11(15.7)	59(84.3)	70
Over weight	8(23.5)	26(76.5)	34
	22	115	137

X^2_2=2.602
p=2.72

Table 4: Gender differences and hip circumference

Sex	n	Hip circumference(mean ±SD
Male	53	96.9±7.90
Female	84	94.1±11.13

t=1.656 DF=13.5
P=0.135
95%CI - 0.6 to 6.35

Table 5: Hip circumference in three different BMI categories

BMI	n	Hip circumference
Under weight	33	86.7±5.63
Normal weight	70	93.5±6.86
Over weight	34	106.9±8.34

F=73.280
P<0.001
Underweight with normal weight P<0.001
Underweight with overweight P<0.001
Normal weight with overweight P<0.001

Table 6: gender differences and abdominal fold thickness

Sex	n	Abdominal fold thickness (Mean ±SD)
Male	52	22.9±10.83
female	84	26.9±10.05

t=2.201 DF=134
P=0.29
95%CI 0.4 to7.6

Table 7: Abdominal fold thickness in three different BMI categories

BMI	n	Abdominal fold thickness mean±SD
Under weight	33	16.2±8.16
Normal weight	70	25.5±8.61
Over weight	33	34.3±8.32

F=37.440 p<0.001
Benteronni positive test p adjusted at 0.0166
Under weight with normal weight p<0.001
Under weight with overweight p<0.001
Normal weight with underweight p<0.001

Table 8: Gender difference and waist circumference

Sex	n	Waist circumference (mean±SD)
Male	53	82.1 ±11.93
Female	84	76.7± 10.69

t=2.773 DF=135 P=0.006
95%CI 1.6 – 9.3

Table 9: Waist circumference in three different BMI categories

BMI	N	Waist circumference (mean±SD)
Under weight	33	69±5.65
Normal weight	70	76.7±7.51
Over weight	34	92.5±9.60

F=83.147
p<0.001
Under weight with normal weight p<0.001
Under weight with overweight p<0.001
Normal weight with overweight p<0.001

4. Discussions

In this present study students of normal BMI group also had abnormal anthropometric variables indicating that variable indices such as waist circumference, hip circumference, waist hip ratio and abdominal fold thickness are independent risk factors.[15]

There is a simple message saying that 'Keep your waist circumference to less than half your height'. In our study females showed all anthropometric variables increased as compared to male students. The female hormone estrogen is one of the reasons why females tend to be obese than males. On the average, women have more body fat than men. This could be attributed to impact of estrogen which reduces their ability to burn energy after eating which results in increase storage of fat in the body [11]. Mechanism which says that amongst women, oestrogen exposure is known to cause weight gain, primarily through thyroid inhibition and modulation of the hypothalamus [11,12]. Aside from a simple matter of caloric intake and estrogen there appears to be other characters in the story of weight gain, the influence of soy on contributing to weight gain has been recently established [13]. Authors of this finding have cited xenoestrogens contained within soy products as a likely culprit.

The significant difference of the mean and standard deviation of Waist Circumference, Waist Hip Ratio & abdominal fold thickness between males and females, suggests that these may be a better predictive tool of abdominal obesity for females which is supported by the previous study concluded that anthropometric variables like waist circumference, waist hip ratio, hip circumference are the predictors of cardiovascular risk factors& measurements of skinfold thickness at various sites contribute marginally to the prediction of subsequent IHD [14].

Ideally, it would be most advantageous to determine the relationship between these anthropometric cut-off points and coronary events or other health outcome. In the meantime, public health policy recommending the use of cut-off points for anthropometric variables might be beneficial in prevention and management of these intermediary risk factors. Family physicians and other health care providers can incorporate the measurement of

WC, WHR, and abdominal fold thickness into routine clinical examinations or screenings. Patients should be advised of the health risks associated with a high waist measurement and the benefits of waist reduction. Global awareness of the health risks associated with a large WC should be promoted at the community level, but with appropriate guidelines for interpretation and management.

5. Conclusion

Anthropometric variables such as waist circumference, hip circumference, waist hip ratio, waist height ratio and abdominal fold thickness are independent risk factors even in individuals with normal BMI. Females are more prone to obesity than males. Anthropometric variables like waist circumference, hip circumference, waist hip ratio, abdominal fold thickness could be a better predictive parameter of obesity in females since fat is not generously deposited in all the regions of the body. It is a good practice to consider anthropometric variables which measure central obesity than only measuring BMI for determining health risks.

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