

ORIGINAL ARTICLE

TO ASSESS THE CORRELATION OF BMI, WAIST CIRCUMFERENCE AND HIP CIRCUMFERENCE IN OBESE, NON OBESE AND OVERWEIGHT POPULATION

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ABSTRACT:

Background: There are multiple associated diseases that may be due to obesity such as chronic heart disease (CHD), hypertension etc. The association between mortality and body weight throughout the range of weight has been described. The present study was conducted to assess which parameter correlated more significantly with BMI on non obese, over weight and obese subjects. **Materials & Methods:** This study was conducted in the department of physiology in year 2016. It consisted of 375 subjects (males- 200, females- 175) between 18- 65 years of age. In all subjects, weight, height, Waist circumference (WC), Hip circumference (HC), waist hip ratio, systolic and diastolic blood pressure was measured. All the subjects were divided into 3 groups (1) non-obese, (2) over weight and (3) obese. Following was considered - BMI >30 kg/m²- obese. BMI < 25 kg/m² - non obese and BMI 25-29.9 kg/m² - over weight. **Results:** Out of 375 subjects, male were 200 and female were 175. The difference was non-significant (P- 0.2). 75 were non obese, 210 were overweight and 90 were obese. The difference was non - significant (P- 0.351). Average weight in non obese group was 60.52 kg, in over weight group was 71.68 kg and in obese group was 82.36 kg. Height was 162.22, 160.14 and 158.9 cm in non obese, over weight and obese group respectively. The difference was significant (P < 0.05). Waist circumference was 88.43 cm 98.12 cm and 102.75 cm in three groups respectively. Hip circumference was 92.25 cm, 101.25 cm and 109.75 cm in three groups respectively. Waist hip ratio was 0.92, 0.95 and 0.98 respectively. The difference was significant (P < 0.05). Systolic blood pressure was 130.26, 134.58 and 136.44 mm Hg in three groups. The diastolic blood pressure was 90.22, 88.64 and 92.46 mm Hg respectively. The difference was non - significant (P > 0.05). In non obese subjects the body mass index was positively correlated with the weight, waist circumference, hip circumference, waist hip ratio and diastolic blood pressure. However, there was no significant correlation with height and systolic blood pressure. Similarly, among the overweight subjects the body mass index was positively correlated with the weight, waist circumference, hip circumference, but negatively correlated with systolic blood pressure. Among the obese subjects the body mass index was positively correlated with the weight, waist circumference, hip circumference and a mild negative correlation with the height observed. **Conclusion:** The anthropometric marker BMI, WC, HC and WHR were independently associated with Obesity. However, large scale studies are required to substantiate the results.

Key words: Hip circumference, obesity, waist circumference

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This article may be cited as: Tiu DN, Anjulika. To assess the correlation of bmi, waist circumference and hip circumference in obese, non obese and overweight population. J Adv Med Dent Scie Res 2017;5(5):25-28.

Access this article online	
<p>Quick Response Code</p> 	Website: www.jamdsr.com
	DOI: 10.21276/jamdsr.2017.5.5.6

INTRODUCTION

Obesity is defined as a disease in which excess body fat has accumulated in such a way that health may be negatively affected. The WHO survey estimated that more than 200 million men and approximately 300 million women were obese. The prevalence of obesity is increasing rapidly in the world as well as in India.¹ There are multiple associated diseases that may be due to obesity such as chronic heart disease (CHD), hypertension etc. The association between mortality and body weight throughout the range of weight has been described as being J-shaped, U-shaped, inverse, positive, and absent. Various factors such as cigarette smoking, inappropriate control for

physiologic effects of disease risk factors, and failure to control for loss of weight due to subclinical disease at baseline, have claimed a significant, direct relation between body weight and overall mortality.²

Anthropometric measures for assessing adiposity-related risk and central obesity are body mass index (BMI; weight in kilograms divided by square of height in meters), hip circumference (HC), waist circumference (WC), waist hip ratio, waist stature ratio and body adiposity index. Out of them BMI or WC is most commonly used to measure the central obesity.³

Body mass index (BMI) was utilized as an indicator of relative weight, with all-cause mortality as the primary

outcome. Since there is no reason to assume that BMI is related to all diseases to the same degree, the relations between BMI and specific causes of death.⁴ The present study was conducted to assess which parameter correlated more significantly with BMI on non obese, over weight and obese subjects.

MATERIALS & METHODS

This study was conducted in the department of physiology in year 2016. It consisted of 375 subjects (males- 200, females- 175) between 18- 65 years of age. All were informed regarding the study and written consent was obtained. Subject information such as name, age, gender, etc was recorded in case history performa.

Digital weighing machine was used for measuring weight. Height was measured using stadiometer with the help of a fixed scale. Body mass index was calculated as; weight (kg)/height (m²). Waist circumference (WC) was measured mid-way between iliac crest and lowermost margin of the ribs. Hip circumference (HC) was measured at the maximum protruding part of buttocks at the level of the greater trochanter while keeping the feet together with the subjects wearing minimal clothing. Waist hip ratio was calculated as WC (cm.)/HC (cm.).

In all subjects, blood Pressure was measured by a manual mercury sphygmomanometer and stethoscope using auscultatory method. All the subjects were divided into 3 groups (1) non-obese, (2) over weight and (3) obese.

Following was considered - BMI >30 kg/m²- obese. BMI < 25 kg/m² - non obese and BMI 25-29.9 kg/m² - over weight. Results were tabulated and subjected to statistical analysis for correct inference. P value < 0.05 was considered significant.

RESULTS

Table I shows that, out of 375 subjects, male were 200 and female were 175. The difference was non- significant (P- 0.2). Table II shows that 75 were non obese, 210 were overweight and 90 were obese. The difference was non -

significant (P- 0.351). Graph I shows that average weight in non obese group was 60.52 kg, in over weight group was 71.68 kg and in obese group was 82.36 kg. Height was 162.22, 160.14 and 158.9 cm in non obese, over weight and obese group respectively. The difference was significant (P< 0.05). Graph II shows that waist circumference was 88.43 cm 98.12 cm and 102.75 cm in three groups respectively. Hip circumference was 92.25 cm, 101.25 cm and 109.75 cm in three groups respectively. Waist hip ratio was 0.92, 0.95 and 0.98 respectively. The difference was significant (P< 0.05). Graph III shows that systolic blood pressure was 130.26, 134.58 and 136.44 mm Hg in three groups. The diastolic blood pressure was 90.22, 88.64 and 92.46 mm Hg respectively. The difference was non - significant (P > 0.05).

Table III shows that in non obese subjects the body mass index was positively correlated with the weight, waist circumference, hip circumference, waist hip ratio and diastolic blood pressure. However, there was no significant correlation with height and systolic blood pressure. Similarly, among the overweight subjects the body mass index was positively correlated with the weight, waist circumference, hip circumference, but negatively correlated with systolic blood pressure. Among the obese subjects the body mass index was positively correlated with the weight, waist circumference, hip circumference and a mild negative correlation with the height observed.

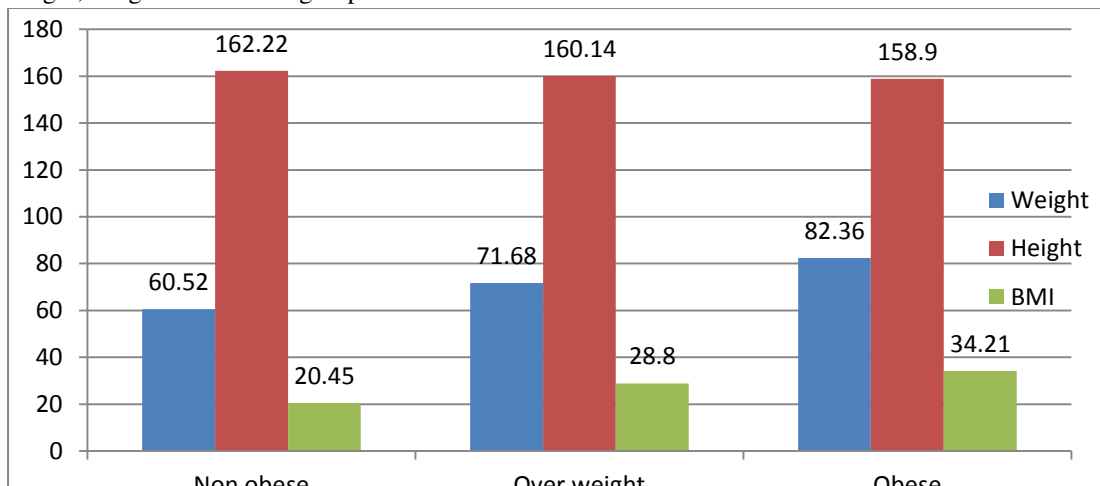
Table I Distribution of Subjects

Total- 375		
Male	Female	P value
200	175	0.2

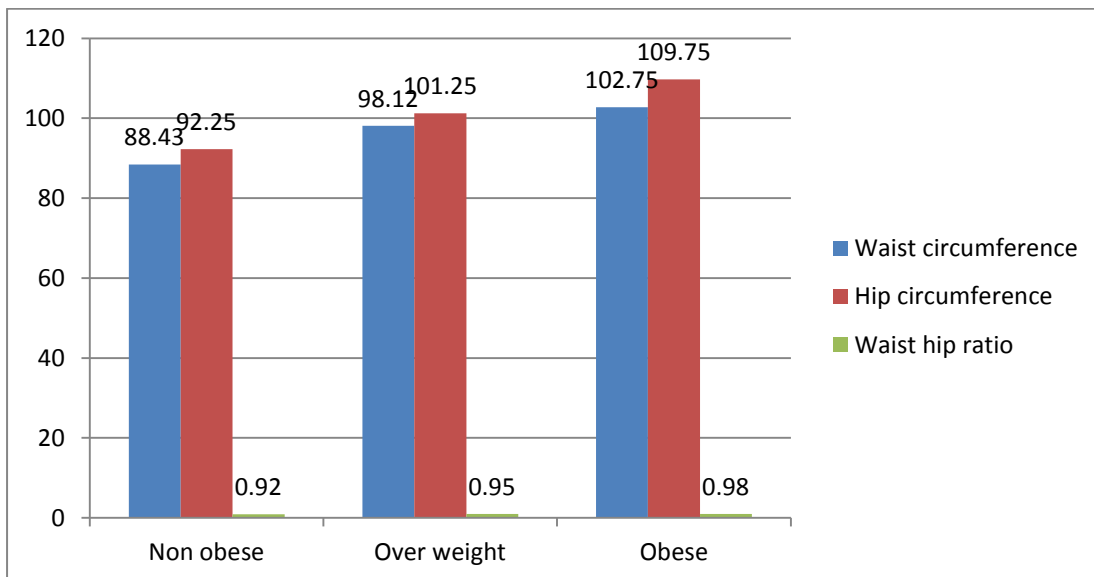
Table II Distribution of subjects based on BMI

	Non-obese	Over weight	Obese	P value
Number	75	210	90	0.351

Graph I Weight, Height and BMI in groups



Graph II Waist circumference, Hip circumference, waist hip ratio in groups



Graph III Blood pressure in all groups

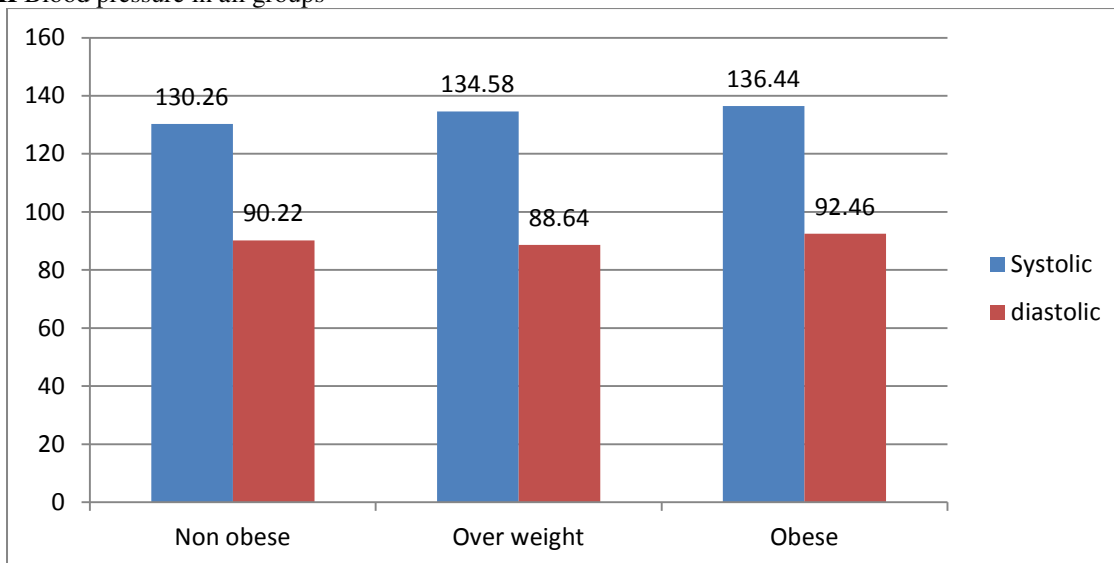


Table III Correlation of BMI with anthropometric parameters in all groups

Parameter (P value)		Non obese	Over weight	Obese
Weight	R value	0.06	0.05	0.21
	P value	0.001	0.03	0.01
Height	R value	0.543	0.426	-0.411
	P value	0.24	0.12	0.02
Waist circumference	R value	0.432	0.24	0.347
	P value	0.001	0.001	0.001
Hip circumference	R value	0.245	0.264	0.298
	P value	0.001	0.01	0.005
Waist hip ratio	R value	0.34	0.01	0.001
	P value	0.002	0.24	0.523
Systolic blood pressure	R value	0.2	-0.154	0.001
	P value	0.82	0.02	0.788
Diastolic blood pressure	R value	0.2	-0.01	-0.01
	P value	0.03	0.21	0.45

DISCUSSION

Obesity is the biggest challenge in the health management as it is an important risk factor for cardiovascular disease. Therefore, it is important to ascertain which anthropometric measurements are better predictors of obesity.⁵

The present study was conducted to assess which parameter correlated more significantly with BMI on non obese, overweight and obese subjects.

In this study, out of 375 subjects, male were 200 and female were 175. Out of which, 75 were non obese, 210 were overweight and 90 were obese. This is in accordance to Manson JE et al.⁶ We found that average weight in non obese group was 60.52 kg, in overweight group was 71.68 kg and in obese group was 82.36 kg. Height was 162.22, 160.14 and 158.9 cm in non obese, overweight and obese group respectively. The study conducted by Dorn⁷ found that weight in non obese and obese group was 62.87 kg and 67.66 kg respectively while height in non obese and obese group was 156.11 and 154.58 cm respectively.

We found that waist circumference was more in obese group as compared to other groups. Similarly, hip circumference was more in obese group as compared to other groups. This is in accordance to Yind X et al.⁸

We found that in non obese subjects the body mass index was positively correlated with the weight, waist circumference, hip circumference, waist hip ratio and diastolic blood pressure. However, there was no significant correlation with height and systolic blood pressure. Similarly, among the overweight subjects the body mass index was positively correlated with the weight, waist circumference, hip circumference, but negatively correlated with systolic blood pressure. Among the obese subjects the body mass index was positively correlated with the weight, waist circumference, hip circumference and a mild negative correlation with the height observed. This is in accordance to various studies.^{9,10}

CONCLUSION

The anthropometric marker BMI, WC, HC and WHR were independently associated with Obesity. However, large scale studies are required to substantiate the results.

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Source of support: Nil

Conflict of interest: None declared

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