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Correlation of Waist Hip Ratio and BMI with Hypertension and Diabetes Mellitus in an Urban Area of Bangalore City

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ABSTRACT

Background and Objective: BMI and WHR are most widely used measures to define obesity and predict its complications, such as diabetes and hypertension. Hence study emphasized to know correlation among above parameters.

Methods: A Cross sectional study conducted among 240 adults who screened for Hypertension, DM based on history and examination or both. Anthropometric measurements, Blood pressure, random blood glucose levels and ECG was recorded for individuals with suspected complications of cardiovascular diseases. Data was analyzed using SPSS 18 for descriptive, analytical statistics χ^2 (P value) and Pearson's correlation co-efficient.

Results: 240 individuals attendant health checkup, 87 of them found to be hypertensives and/ or diabetic. Obesity was significantly high in females (65.2%, 95.6%) as compared to males (41.5%, 61%) with respect to both BMI and W/H ratio respectively. There was a statistical difference in obesity by BMI and WHR, where in 79% of the subjects showed high WHR as compared to only 54% by BMI. Similarly significant association was observed between Hypertension (X^2= 4.09, P=0.04) and Waist Hip Ratio (X^2=6.35,P=0.01). Complications were more common among obese patients as compared to non-obese patients.

Conclusion: That there is correlation between WHR, BMI with hypertension and DM type 2 and also with cardiovascular complications. The significant association of WHR with HTN is an indication of importance of central adipose tissue in study population.

Key words: Diabetics, Hypertensives**,** Waist hip ratio, BMI

INTRODUCTION

Body mass index (BMI) and waist hip ratio (WHR) are the most widely used measures to define obesity and predict its complications, such as diabetes mellitus (DM) and hypertension. The relationship between excess weight and diseases has been recognized over time.[1] Overweight and obesity are important determinants of health and lead to adverse metabolic changes, including increase in blood pressure, unfavorable cholesterol levels, hypertriglyceridaemia, increased resistance to insulin, low high density lipoprotein (HDL) and greater prevalence of metabolic syndrome.[2] The prevalence of obesity is increasing in both developed and developing countries.[3] Body mass index or BMI (weight in kilograms

divided by the square of the height in meters) is promulgated by the World Health Organization as the most useful epidemiological measure of obesity. It is nevertheless a crude index that does not take into account the distribution of body fat, resulting in variability in different individuals and populations.[3]Waist-hip circumference ratio, waist-height ratio (WHtR) and waist circumference are commonly used to predict the risk of obesity related morbidity and mortality as they account for regional abdominal adiposity.[4-6] Studies in urban Indian population also showed strong relationship between different anthropometric indicators and blood pressure levels. [5-7] The present study was undertaken to examine the relationship between different anthropometric indicators with hypertension and diabetes in urban population of Bangalore north.

OBJECTIVE

The objectives of the study were to determine the difference in assessment of obesity by BMI and Waist hip ratio and to determine the correlation of waist hip ratio and BMI with Hypertension and Diabetes in an urban area of Bangalore city.

MATERIALS AND METHODS

A Cross sectional study was conducted in the month of June 2011 in urban field practice area of M S Ramaiah Medical College Bangalore, Karnataka. House to house visit was done and information regarding a health camp for adults was given. On a designated day health check up was conducted in a health centre in the area. Informed consent regarding the study was taken from the participants. 240 adults attended health check up, after screening 87 of them were found to be either Hypertensives or Diabetics or both based on previous history and examination or both. Individuals with spinal deformities (Khyphosis and Scoliosis) were excluded from the study. Data was collected using a pre tested, semi structured questionnaire. Baseline data, Anthropometric measurements including height, weight, Waist circumference, Hip circumference, were recorded as per standard guidelines,[8]and the BMI and waist-to-hip ratio were calculated. Blood pressure and random blood glucose levels were estimated using mercury sphygmomanometer and glucometer respectively. ECG was recorded for those individuals with suspected complications of cardiovascular diseases.

Instrumentation

Inelastic tape measure graduated in centimeters (0-150) was used to measure the waist and hip circumferences. Waist circumference was measured at the level of the umbilicus with the subject in midexpiratory position. Hip circumference was recorded at the widest point over the greater trochanters, and the waist-to-hip ratio was calculated.

Height metre: A vertical wooden bar calibrated in centimetres (0-200) with a movable horizontal bar which could be adjusted to touch the vertex of the participant's head was used to measure the height of the participants. Height was measured to the nearest of centimeter.

Weighing scale: A portable bathroom weighing scale, calibrated from 0-120 kg was used to measure body weight to the nearest kilogram.

BMI calculation: Weight (kg)/[height (m)]^2 and categorized according to WHO classification.[8] (Adapted from WHO 2004).

Sphygmomanometer : A mercury-in-glass sphygmomanometer calibrated in millimeters of

mercury from 0 - 300 mmHg was used to measure the blood pressure of participants in sitting position to the nearest 2 millimetre of mercury with the aid of a Littman stethoscope.

Random sugar levels were estimated by capillary method using glucometer (One Touch®)

12 lead resting **ECG** was recorded for suspected complications of cardiovascular diseases viz. Angina, Myocardial Infarction, Congestive Heart Failure.

Ethical clearance was taken by the Institutional Ethics Committee before starting the study.

Statistical analysis: Data was analyzed using SPSS 18 for descriptive and analytical statistics for sociodemographic data, chi-square (χ^2) to know the association between variables and significance level was set at $p < 0.05$ and Pearson's correlation co-efficient used to assess correlation among different parameters used .

RESULTS

Out of 240 individuals who attended the health check up 87 of them were found to be hypertensives and/ or diabetic. Majority of them (54%) were between 60-70 years. 41(47%) of them were males and 46 females (52.9%).

More than three fourth of the patients were hypertensives and comorbidity of diabetes mellitus and hypertension was around 35%. There was not much difference in morbidity profile between males and females. However complications were higher among females (23.9%) as compared to males (14.6%).(Table 1)

Obesity was significantly high in females as compared to males with respect to both BMI and W/H ratio. There was a statistical difference in obesity assessed by BMI and WHR, where in 79% of the subjects showed high WHR as compared to only 54% by BMI. (Table 2)

There was no significant difference in BMI and WHR between diabetics and non-diabetics. However there were statistically higher number of obese individuals among hypertensives measured by BMI ($p<0.04$). Similarly significant association was observed between Hypertension and Waist Hip Ratio (Table 3). Complications were more common among obese patients as compared to non-obese patients; however the difference was not statistically significant. (Table 4)

Table 1: Morbidity profile of the study subjects

Morbidity	Male (n=41)	Female (n=46)	Total (n=87)
Hypertension only	19(46.4)	22(47.8)	41(47.1)
Diabetes mellitus only	8(19.5)	8(17.4)	16(18.4)
Both HTN and DM	14(34.1)	16(34.8)	30(34.5)
With complications	6(14.6)	11(23.9)	17(19.5)

Figure in parenthesis indicate percentage.

Table 2: Obesity among study population

Obesity	Male (n=41)	Female (n=46)	Total (n=87)
High BMI	17(41.5)	30(65.2)	47(54)
High W/H Ratio	25(61)	44(95.6)	69(79)

Figure in parenthesis indicate percentage.

Table 3: Correlation of Diabetes mellitus and Hypertension with W/H ratio and BMI

		Diabetes mellitus			Hypertension		
		Present (n=46)	Absent (n=41)	P value	Present (n=71)	Absent (n=16)	P value
BMI	**High**	23(50)	24(58.5)	0.42	42(59.2)	5(31.2)	0.04
	Normal	23(50)	17(41.5)		29(40.8)	11(68.8)	
W/H Ratio	**High**	35(76.1)	34(82.9)	0.43	60(84.5)	9(56.2)	0.01
	Normal	11(23.9)	7(17.1)		11(15.5)	7(43.8)	

p value significant at <0.05; Figure in parenthesis indicate percentage

Table 4: Correlation of BMI and W/H ratio with complications

Complications	BMI			W/H Ratio		
	Normal (n=40)	High (n=47)	P value	Normal (n=18)	High (n=69)	P
Absent	34(85)	36(76.6)	**0.32**	16(88.9)	54(78.3)	0.31
Present	6(15)	11(23.4)		2(11.1)	15(21.7)	

p value significant at <0.05; Figure in parenthesis indicate percentage

DISCUSSION

Cardiovascular disease is one of the most important problems affecting the community health and is a burden on health economy. Better understanding of the risk factors has been the top priority. Obesity being one of the commonest risk factors of chronic Non Communicable Diseases like Hypertension and Diabetes Mellitus, it is generally measured in terms of Body Mass Index. However it has been noticed in Indian population, Hypertension and Diabetes are widely prevalent in people with normal BMI. This could be attributed to central obesity which needs other measures like, Waist Circumference and Waist Hip Ratio. In the present study we have observed that 54% of the people with Hypertension and/or diabetes had high BMI as compared to 79% with high Waist Hip Ratio. Similar findings were obtained in many studies. In a study done at Chennai,[9] 98% of diabetics with normal BMI had high W/H ratio. In another study done by Kaur P etal,[10] it was noticed that W/H ratio had the highest relative risk with diabetes mellitus as compared to BMI and waist circumference. The present study showed a significant correlation between high BMI and waist/hip ratio with hypertension. Similar findings were observed in many studies.[11-12]

However in the present study there was no significant correlation between BMI and W/H Ratio with DM. This could be due to small number of diabetics present in the study. Ambiguous results have been obtained in various studies with

reference to obesity and diabetes. In a meta-analysis done using 17 studies[13], five studies had inconsistent results and other studies showed increased association with waist circumference and WHR as compared to BMI. Some Studies showed good correlation between BMI, WHR and diabetes mellitus.[10,12]In the present study only 19.5% of the study population had one or more of the cardiovascular complication with angina pectoris, myocardial infarction etc .due to this small number no significant correlation was found between obesity and complication of CVD. However many studies have shown that cardiovascular disease increases with obesity especially WHR .[14] In a study done at Auckland, the increase in the risk of IHD with high WHR was 36% as compared to 17% with high BMI.[15]

To summarize, the present study highlights the importance of estimating WHR for assessing CVD risk factor as compared to only BMI.

CONCLUSION

Further the significant association of WHR with HTN is an indication of importance of central adipose tissue in study population. Further large population based studies are required to assess the burden of the problem in the population and to institute corrective measures.

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