



## ASSOCIATION OF WAIST CIRCUMFERENCE, WAIST HIP RATIO AND BODY MASS INDEX WITH ESSENTIAL HYPERTENSION

### Community Medicine

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### ABSTRACT

**Background:** WHO has recommended BMI as simplest form of defining obesity. Recent studies have focused on Waist Hip Ratio and Waist circumference for prediction of Morbidity and Mortality as they account for regional abdominal adiposity. Present study emphasized to know association of Waist circumference, waist hip ratio and Body mass index with Hypertension.

**Methods:** A cross sectional study was conducted among 202 individuals who screened for Hypertension based on history and examination. Blood pressure, BMI, Waist Hip ratio and Waist circumference were recorded. Data were analyzed using Microsoft Excel 2007 for descriptive statistics.

**Results:** Total 93 (46 %) subjects were found to be hypertensives. Obesity was significantly high in females (75 %, 58 % and 80 %) as compared to males with respect to BMI, Waist hip ratio and Waist circumference respectively. There was a statistical difference in obesity by BMI, WHR and WC. There was highly significant association of Hypertension with Waist Hip ratio ( $\chi^2 = 9.2089$ ,  $P=0.0024$ ,  $p<0.01$ ) and there was significant association with Waist circumference ( $\chi^2 = 5.3914$ ,  $P=0.020237$ ) and with BMI ( $\chi^2 = 5.5347$ ,  $P<0.05$ ).

**Conclusion:** There is significant association of Hypertension with Waist Hip Ratio and Waist circumference. This indicates importance of central adipose tissue in prediction of morbidity.

### KEYWORDS

Hypertension, association, Waist hip ratio

### INTRODUCTION

Obesity has become a major public health concern worldwide and now recognized by major health promotion bodies as a major cardiovascular risk factor. Obesity is now categorized as a 'disease' condition by the World Health Organization (WHO). It has become a major cause of morbidity and mortality even in the developing countries where it has been estimated that up to 75% of the expected increase in the cardiovascular disease burden will come from by 2020.<sup>[1]</sup> WHO has recommended the use of body mass index (BMI) as the simplest form of defining obesity.<sup>[2-4]</sup> Ethnic specific BMI cut off values, especially for Asian populations, have been proposed to address the higher prevalence of diabetes and cardiovascular diseases and the differing associations of BMI with body fat in different populations. Guidelines for obesity and overweight based on body mass indices (BMI) for Asian Indians were revised based on consensus developed through discussions by a Prevention and Management of Obesity and Metabolic Syndrome group. The revised guidelines categorize overweight as BMI of 23.0-24 and obesity as a BMI  $\geq 25$  using values lower than the ethnic specific BMI previously advocated for Asian Indians.<sup>[5]</sup> BMI is a crude index that does not take into account the distribution of body fat, resulting in variability in different individuals and populations.<sup>[6]</sup> Waist-hip circumference ratio, waist-hip ratio (WHR) and waist circumference are commonly used to predict the risk of obesity related morbidity and mortality as they account for regional abdominal adiposity.<sup>[7,8]</sup> The association of excess body fat and elevated BP have been demonstrated in several epidemiological studies.<sup>[9]</sup> There also continues to be a relationship between obesity and hypertension both causal consequentially. Previous studies have shown high prevalence of obesity among subjects with hypertension.<sup>[11]</sup> As body fat distribution is an important contributor to the association between obesity and high BP<sup>[10]</sup>, assessment of Cardiovascular disease risk by estimation of Waist-hip ratio (WHR) and Waist circumference becomes important. Studies in urban Indian population also showed strong relationship between different anthropometric indicators and blood pressure levels.<sup>[11,12]</sup> The present study was undertaken to examine the association between different anthropometric indicators with hypertension.

### MATERIALS AND METHODS

A cross sectional study was conducted by a camp approach at a designated place of Ahmedabad, Gujarat. Information about a health check up camp for adults was given 2 weeks before the camp. Informed consent regarding the study was taken from the participants. Subjects were screened for Hypertension based on previous history and examination or both. Individuals with spinal deformities were excluded from the study. Baseline data, Anthropometric measurements including height, weight, Waist circumference, Hip circumference, were recorded as per standard guidelines<sup>[13]</sup> and the

BMI and waist to hip ratio were calculated. 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 mid expiratory position. Hip circumference was recorded at the widest point over the greater trochanters, and the WHR was calculated. Blood pressure was measured using mercury sphygmomanometer. The subjects currently on anti hypertensive drugs were classified as hypertensive irrespective of their current blood pressure reading.

**Waist circumference:** Indian Cut-off <85cm (men) and <80 cm (women).<sup>[14]</sup>

**WHR:** Cut off <0.90 (men) and <0.85 (women).<sup>[14]</sup>

**BMI classification:** BMI  $\geq 23\text{kg/m}^2$  - overweight and  $\geq 25\text{kg/m}^2$  - obese.<sup>[5]</sup>

### Statistical analysis:

Data was analyzed using Microsoft Excel 2007 for descriptive and analytical statistics for socio demographic data, chi-square ( $\chi^2$ ) to know the association between variables and significance level was set at  $p<0.05$ .

### RESULTS

Total 202 individuals attended health check up camp. Table 1 shows baseline characteristics for subjects. 103 out of 202 were found to be either hypertensive or diabetic or both.(Figure 1) 49(47%) of them were males and 54 females (52%). There was not much difference in morbidity profile of males and females.(Figure 1) Obesity was significantly high in females as compared to males with respect to both waist circumference and W/H ratio but not with BMI. (Figure 2) There was a statistical difference in obesity assessed by BMI, WHR and WC, where in 46 % of the subjects showed high WHR, 72 % showed high WC as compared to 66% by BMI. (Figure 2)

There was significant association between Hypertension and BMI ( $p<0.05$ ), hypertension and waist circumference ( $p<0.05$ ).(Table 2)

There was highly significant association between Hypertension and WHR ( $p<0.01$ ) (Table2)

The risk of developing hypertension in subjects Waist circumference, WHR and BMI  $\geq$  cut off was found to be almost 2 times than the subjects having waist circumference < cut off (Table 2)

### DISCUSSION

Cardiovascular disease is one of the most important problems affecting the community health. 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, WC and WHR. In the present study, percentage of subjects having at risk anthropometric parameters were significantly higher in hypertensives than in non-hypertensive population. These findings are similar to previous studies done in India.<sup>15,16</sup> In the present study we have observed that 66% of the people with Hypertension had high BMI as compared to 46% with high Waist Hip Ratio. The present study showed a significant association between high BMI, high waist circumference and high waist/hip ratio with hypertension. But strongest association ( $p < 0.01$ ) was found between waist hip ratio and hypertension. Similar findings were observed in many studies.<sup>17,18</sup> In the present study there was a statistical difference in obesity assessed by BMI, WHR and WC which may implicate difference in the prediction of risk of cardio vascular diseases. 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.<sup>19</sup> Present study shows high

prevalence of obesity among female subjects with respect to WHR and waist circumference as compared to males. This may be due to gender specific fat distribution in females. Similar findings have been observed in previous studies.<sup>20</sup>

**CONCLUSION**

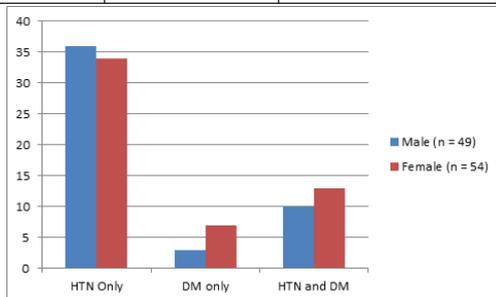
WHR and waist circumference are significantly associated with hypertension which indicates importance of their estimation in assessment of cardio vascular disease risk as compared to only by BMI. Further large population based studies are required to assess the burden of the cardio vascular disease in the population.

**Table 1: Baseline characteristics of study population**

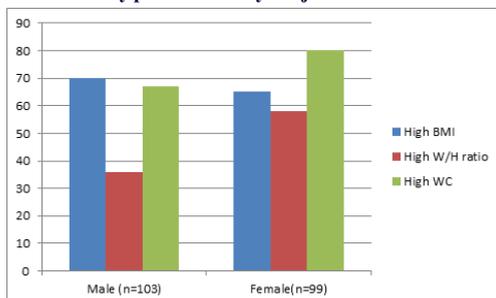
Characteristics	Male	Female
No of Hypertensives	46	47
Age (years)	39.67 ± 9.89	40.12 ± 10.03
BMI (kg/m <sup>2</sup> )	26.54 ± 4.58	27.61 ± 4.36
WHR	0.86 ± 0.07	0.84 ± 0.06
WC (cm)	95.03 ± 11.09	96.27 ± 12.59

**Table 2: Association of BMI, Waist Hip ratio and WC with Hypertension**

		Hypertension Present	Hypertension absent	(χ <sup>2</sup> ) Chi square value	p value	Odds Ratio
BMI	≥ 25	70	65	5.5347	0.018	2.06
	< 25	23	44			
W/H ratio	≥ Cut off value	54	40	9.2089	0.002	2.39
	< Cut off value	39	69			
WC	≥ Cut off value	75	72	5.3914	0.020	2.14
	< Cut off value	18	37			



**Figure 1 Morbidity profile of study subjects**



**Figure 2 Obesity among study population**

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