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Association between BMI, waist circumference and Prehypertension among adults.

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ABSTRACT… Objective: To know the association between different anthropometric parameters for overweight and obese individuals to prevalence of prehypertension. **Study Design:** Correlational study. **Setting:** Vicinity of Kharian and at Outpatient Department, CMH Kharian Cantt. **Period:** February 2019 and January 2020. **Material & Methods:** Correlational study carried out in the vicinity of Kharian by employing different anthropometric measurements in accordance with guidelines to look at how blood pressure figure behaves in overweight, obese and morbidly obese population and further is there a difference in overall outcome if we use waist circumference rather than BMI and its significance in targeting preventive strategies. **Results:** Our results show a staircase pattern of increase in blood pressure, initially lying in different phases of prehypertension among normal weight (BMI 23±1.65; waist circumference (WC): 86.45±8.78; Systolic BP:127±11.99; Diastolic BP:80.44 ±9.45), overweight (BMI 27.35 ±1.23; WC:100±5.32; Systolic BP:128.72 ±11.29; Diastolic BP:80.05 ±6.66) and obese individuals (BMI 31.97 ±1.45; WC:112.12±9.22; Systolic BP:138.06 ±21.61; Diastolic BP:87.56 ±9.78), while this trend shifted to full blown hypertension among morbidly obese individuals (BMI 39.88 ±4.30; WC:120.38±12.84; Systolic BP:145 ±17.64; Diastolic BP:89.23 ±10.95) **Conclusion:** We conclude that prehypertension is already prevalent among normal weight and overweight individuals, and intensive follow up and lifestyle intervention strategy should be employed earlier at this level and waist circumference is a better predictor of cardiovascular disease than BMI and should be routinely done in local primary health care set up to prevent the onset of complications associated with this silent killer.

Key words: BMI, Waist Circumference, Prehypertension.

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INTRODUCTION

Hypertension is prevalent in low income countries.[1] Owing to lack of organized health facilities number of people with undiagnosed, untreated and uncontrolled hypertension is higher as compared to high income countries.[2] Unhealthy diet combined with passive lifestyle and exposure to persistent stress are mainstay of etiological factors of hypertension.[3]

Obesity, a central parameter of metabolic syndrome is outcome of unhealthy lifestyle, and predisposes to a plethora of cardiovascular, metabolic and endocrine disorders.[4]

Constellation of these metabolic derangements leads to both prehypertension and hypertension. Prehypertension predisposes to increased cardiovascular accidents, is more prevalent in obese young population, but vicious cascade of inflammation and prediabetes target not only obese and morbidly obese individuals, but also overweight and individuals with BMI in higher side of normal range. However risk is more pronounced in stage 2 prehypertension (130-139/85-89) as compared to those in stage 1 (120-129/ 80-84).[5]

Early identification of young adults fulfilling at least 2 criteria's of metabolic syndrome will help

to devise a lifestyle changing intervention and follow up plan in order to reduce cardiovascular morbidity and mortality.

MATERIAL & METHODS

The correlational study was carried out in the vicinity of Kharian in the time period of February 2019 till January 2020, approved by college ethical committee. A total of 101 healthy individuals (not using any antihypertensive and not diagnosed as hypertensive before, non-diabetic and not on any specific medication causing secondary diabetes), aged between 22-70 years participated in the study. Individuals were subdivided into subgroups based on BMI (n=30 in normal weight group; n=30 in overweight group, n=25 in obese group and n=16 in morbidly obese group). Study was undertaken after ethical approval from Institutional review committee and data was collected and further anthropometric measurements were taken from individuals after informed consent.

Patients were recruited by visiting a local hospital and outdoor of combined military hospital CMH Kharian Cantt. The age, sex, weight (kg), height (m), waist circumference (cm), blood pressure (mmHg) of the subjects were recorded after taking consent. Weight was measured by using digital weighing machine, height was measured manually by using stadiometer with individual standing upright, barefooted without a cap.

Waist circumference was measured by employing measuring tape at a midpoint between lower rib and anterior superior iliac spine.[6] Measurement was taken in individual standing upright with feet together, arms hanging on side at the end of expiration. Waist circumference cut off values used were in accordance with ADA guidelines outlined for Asian population; 88 cm for Asian male and 80 cm or below for Asian female in order to reduce the risk of metabolic syndrome.[7]

BMI was calculated by using formula weight in kg/ height in meter^2. WHO BMI cut off values were used to categorize body weight as follows: overweight as 25.0-29.9kg/m^2 and obese with BMI of 30.0 kg/m^2 or greater.[8]

Blood pressure was measured by using Aneroid BP apparatus (Certeza^R) with adult cuff size 25.4-40.6cm, in the subjects sitting calmly and allowing those 15 minutes to settle down. Minimum 2 values were recorded and last value was registered. Following cut off values were used to allocate individuals in stage 1 and 2 of prehypertension: Stage 1 Prehypertension (Systolic: 120-129mmHg; Diastolic: 80-85mmHg); Stage 2 Prehypertension[9] (Systolic: 130-139; Diastolic: 85-89mmHg).

Categorical and quantitative variables were presented as mean and standard deviation. (SPSS software is used)

Variables	Age	Weight (Kg)	BMI (weight in Kg/Height in m^2)	Waist Circumference cm	Systolic blood pressure (mmHg)	Diastolic blood pressure (mmHg)
Normal weight N=30	38.55+-9.31	58.7+-9.28	23.00+-1.65	86.45+-8.78	127+-11.99	80.44+-9.45
Overweight N=30	44.27+-11.79	77.33+-9.59	27.35+-1.23	100+-5.32	128.72+-11.29	80.05+-6.66
Obese N=25	39+-11.10	89.06+-10.59	31.97+-1.45	112.12+-9.22	138.06+-21.61	87.56+-9.78
Morbidly obese N=16	39.92+-7.78	109.32+-14.22	39.88+-4.30	120.38+-12.84	145+-17.64	89.23+-10.95

Tabe-I. Anthropometric and blood pressure record

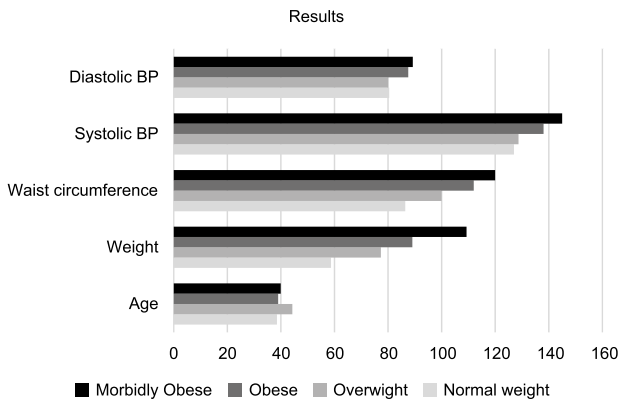

Figure-1. Comparison of groups

RESULTS

Our results show a staircase pattern of increase in blood pressure, initially lying in different phases of prehypertension among normal weight (BMI 23±1.65; waist circumference (WC): 86.45±8.78; Systolic BP:127±11.99; Diastolic BP:80.44 ±9.45), overweight (BMI 27.35 ±1.23; WC:100±5.32; Systolic BP:128.72 ±11.29; Diastolic BP:80.05 ±6.66) and obese individuals (BMI 31.97 ±1.45; WC:112.12±9.22; Systolic BP:138.06 ±21.61; Diastolic BP:87.56 ±9.78), while this trend shifted to full blown hypertension among morbidly obese individuals (BMI 39.88 ±4.30; WC:120.38±12.84; Systolic BP:145 ±17.64; Diastolic BP:89.23 ±10.95)

DISCUSSION

Metabolic syndrome got a central stage in causing type 2 diabetes and coronary heart disease among Asian population.[10] In primary health care system worldwide and especially in the subcontinent recommended criteria for diagnosing metabolic syndrome is mostly overlooked. Despite the fact that BMI alone cannot be a sole predictor of central adiposity and is known for decades, many guidelines worldwide are committed in devising recommendation that BMI alone can be used as a measure of obesity related morbidity and risk of death.[11]

In the current study we found prevalence of stage 2 prehypertension (both systolic and diastolic) in obese individuals. However deranged systolic values are seen already in overweight individuals. That might be related to increased mean age (44) in this group as compared to obese and morbidly obese groups, as age related arterial and arteriolar stiffness might contribute to isolated systolic hypertension.[12]

Although increment in both SBP and DBP predisposes increased risk of death from CHD, raised isolated hypertension increases this risk even more.[12]

In addition average waist circumference which depicts central adipose tissue is around 100cm in overweight group, well above the recommended criteria to reduce the risk of cardio metabolic disease (<88 for men & <80 for women) for Asian population.

It is evident from the literature that there is no identifiable cause of hypertension in most adults and it develop over a period of many years, called idiopathic hypertension.[13] Central abdominal adiposity predisposes to low grade inflammation in the body. It is documented that inflammatory process is involved in fibrotic change in various disease processes. Inflammatory markers are potent stimulators for increased expression of cell adhesion molecules on vessel wall.[14] Ataam documented that abnormal endothelial cell in chronic thromboembolic pulmonary hypertension is attributed to increased expression of intracellular cell adhesion molecule -1 (ICAM-1).[15]

Further increment in weight with a parallel rise in waist circumference in obese group is associated with increase in both systolic and diastolic blood pressures. Although not in the range to be labelled as hypertensive but both values lie in stage 2 prehypertension.

Prehypertension no doubt is an intermediate stage between hypertension and normal blood pressure but is associated with subclinical atherosclerosis and target organ damage.[16]

Keeping in view the increased genetic predisposition of Asian population to metabolic syndrome, the new American College of

Cardiology/American Heart association has lowered the definition of hypertension by defining a normal B.P of < 120/80 mmHg.[17]

Among the limitations of the study is small sample size owing to poor patient compliance secondary to lack of knowledge about their health led to many overweight and obese individuals to withdraw from the study or not take part at all. Need to be addressed at National level, primary health care and basic health units by arranging small groups' seminars to raise awareness among population.

Future studies to categorize the health beliefs of individuals at local community level might help in changing behavior in favor of healthy lifestyle.

CONCLUSION

Prehypertension is already identified in overweight individuals categorized on the basis of BMI, however waist circumference in this group clearly shows central obesity which could have been easily overlooked by looking at BMI. Physicians in primary health care need to rely more on waist circumference than BMI, as waist circumference is a better predictor of cardio metabolic disease.

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