

CORRELATION OF BODY MASS INDEX WITH FREQUENCY OF HIGH BLOOD PRESSURE

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Contribution

All the authors contributed significantly to the research that resulted in the submitted manuscript.

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ABSTRACT

Objective: To determine Correlation of Body Mass Index with frequency of Hypertension.

Methodology: This cross sectional study was performed in urban areas of Peshawar. A total of 2548 participants, of either gender or age above 18 years were randomly recruited from various occupational groups of Peshawar Heart Study (PHS) and data collected. Subjects were divided into obese and non-obese on the basis of BMI. Participants with BMI of 25 and above were taken as obese and those less than 25 were considered as non-obese. Systolic and diastolic blood pressures were defined on the basis of published guidelines. Pearson Rank Correlation (\bar{Y}) was used to determine correlation between the variables.

Results: Of the total study population, 1015 (39.6%) were non-obese and 1533 (60.4%) were obese. In non-obese group, 16.7% of individuals had systolic hypertension and 25.7% had diastolic hypertension. In obese group 36.3% had systolic hypertension and 51.1% had diastolic hypertension. Mean systolic BP in non-obese was 120.8 ± 32.7 mmHg (80-220) while it was 130.7 ± 38.2 mmHg (80-230) in obese subjects. Mean diastolic BP was 78.8 ± 18.9 mmHg (50-130) in non-obese while it was 85.7 ± 20.1 mmHg (50-140) in obese individuals. Pearson rank correlation was weakly positive, i.e; +0.2.

Conclusion: Systolic and diastolic hypertension has weak positive correlation with obesity.

Key Words: BMI, Systolic Hypertension, Diastolic Hypertension

INTRODUCTION

The relevance of both hypertension and obesity, as important public health challenges, is increasing worldwide. Developing countries are increasingly vulnerable to the worldwide epidemic of obesity, which affects all segments of the population, including men, women and now children.^{1,2} The prevalence of obesity and overweight is increasing. The obesity is estimated to be a major leading cause of mortality and morbidity, causing an estimated 2.6 million deaths worldwide and 2.3% of the global burden of disease.³ The growing prevalence of obesity is increasingly recognized as one of the most important risk factors for the development of hypertension and increased cardiovascular risk.^{2,4-9}

Obesity is measured by body mass index (BMI), which is determined by weight and height (calculated as weight in kilograms divided by height in meters squared).¹⁰ Normal BMI is 20-25, overweight is 25-29,⁹ and obese is greater than 30.¹¹ Because of the observed differences between populations, the International Association for the Study of Obesity and the International Obesity Task Force have suggested a lower BMI cutoff values for the definitions of overweight (23.0-24.9 kg/m²) and obesity (25.0 kg/m² or greater) in Asian populations.¹²

The percentage of obese people in the United States is increasing and in a survey from 1999 to 2000, the percentage of obese people in the United States was 33.5%.¹³ Obesity is now estimated to be the second leading cause of preventable death after cigarette smoking in the United States.¹⁴⁻¹⁶ Worldwide, Indo-Asian people are among the populations at highest risk for cardiovascular disease.¹⁷ In Pakistan the prevalence of obesity is 30% in male and 56% in female.¹⁸ The prevalence is 2 to 2.6% higher in urban as compared to rural areas and more common in women than men.¹⁹

With the significant rise in obesity in this last decade comes a corresponding increase in the prevalence of hypertension. Almost 30 percent of the population is hypertensive having a blood pressure (BP) greater than 140/90 mmHg or using antihypertensive medications. There are 58 to 65 million adults who have hypertension in the United States.^{11,20} Obesity is also associated with hypertension in childhood.²¹ The prevalence of hypertension is much higher in obese as compared to non-obese children (13.7% vs. 0.4%).²² The increase in blood pressure is closely related to the magnitude of weight gain, and even moderate weight gain is associated with an increased risk of developing hypertension. Weight loss is considered to be the most effective non-pharmacological therapy for lowering BP in obese hypertensive individuals. There is a dose-response relation between the degree of weight loss and the reduction in BP that is independent of sodium intake. Even modest

weight loss of 5-10 percent of body weight is associated with clinically significant reductions in BP.^{23,24}

In case of both men and women, the incidence of hypertension increases with age in individuals who are overweight.²⁵ It has been shown that the prevalence of hypertension in obese and overweight is from 23 to 45%.²⁶ Separating HTN into systolic and diastolic subtypes not only provides clues to hemodynamic mechanisms but carries important prognostic implications. Using data from the Framingham Heart Study, Franklin et al, demonstrated that diastolic blood pressure is superior to systolic blood pressure as an indicator of coronary heart disease risk in young adults, and therefore, IDH should not be regarded as a benign condition in younger and middle-aged individual.²⁷ The aim of this study was to determine correlation of body mass index with frequency of hypertension.

METHODOLOGY

This was cross sectional study involving people from different occupational groups recruited in Peshawar Heart Study (PHS). There were 2548 participants from different groups like doctors, nurses, secretariat employees, meat-related professions, low income group, lawyers, journalists, confectioners, prisoners, dairy workers and teachers.

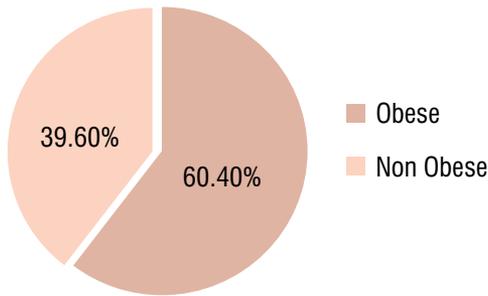
All participants were interviewed in detail including family history, past medical history, smoking history and medication history. Dietary habits were explored. Radial pulse was counted for one minute. Family history of CAD was considered positive if first degree relative had CAD at the age (men <50 and women <60 years). Blood pressure was checked using mercury sphygmomanometer in sitting position with supported left arm. A 12-Lead ECG was performed using BTL-085 machine. Random blood sugar was checked using Accutrend GC portable device by finger prick method.

Hypertension was defined according to the JNC 7 criteria. Diabetes was defined according to WHO criteria. History of smoking was considered to be positive if ≥ 5 cigarettes were smoked per day for >6 month. Hypercholesterolemia was defined according to ATP III guidelines.

Data was analyzed for cardiovascular risk factors like hypertension, diabetes, smoking, body mass index, waist: hip ratio, exercise, hypercholesterolemia and family history using SPSS version 16. Pearson rank correlation was used to know correlation between BMI and Hypertension.

RESULTS

A total of 2548 population was included in the study. Males were 1989(78.1%) while 559(21.9%) participants were females. Mean age in years was 37.4 ± 11.5 years (range:

Figure 1: Percentage of Obese and Non Obese in Total Population

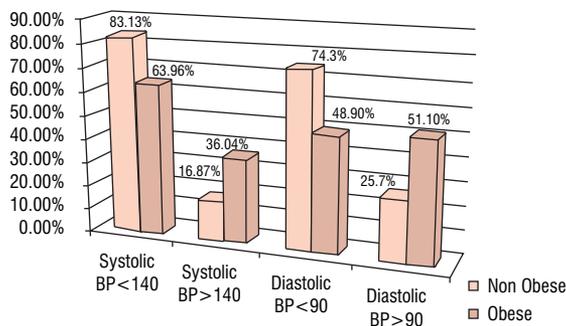
12-85), 40.5 ± 9.2 in obese and 33.9 ± 7.9 years in non-obese. Mean height of population was 163.81 ± 12.5 cm, weight 71.28 ± 13.5 kg, RBS 112 ± 16.1 mg/dl, mean cholesterol 168 ± 23.7 mg/dl and mean BMI 26.89 ± 3.7 kg/m².

In total study population 1015 (39.6%) were non-obese and 1540 (60.4%) were obese (Figure 1). Systolic BP of < 140 mmHg was noted in 71.74% (1828) while 28.26% (720) had systolic BP ≥ 140 mmHg. When analyzed for diastolic blood pressure 59.06% (1505) had diastolic BP < 90 mmHg and 40.94% (1043) had diastolic BP ≥ 90 mmHg.

In non-obese group 83.13% (838) had systolic BP less than 140 mmHg and 16.87% (170) had a systolic BP of 140 mmHg and above. Regarding diastolic BP in non-obese subjects, 74.30% (749) had diastolic BP of less than 90 mmHg and 25.7% (259) had ≥ 90 mmHg. Pearson rank correlation between obesity and hypertension was positive, $r = +0.2$ (Figure 2).

In obese subjects 63.96% (985) had systolic BP less than 140 mmHg and 36.3% (555) had 140 mmHg and above. Regarding diastolic BP in obese, 48.9% (753) had BP less than 90 mmHg and 51.1% (787) had ≥ 90 mmHg (Table 1).

Mean systolic BP in non-obese was 120.8 ± 32.7 mmHg

Figure 2: Systolic and Diastolic Blood Pressure in Obese and Non Obese

(80-220) while it was 130.7 ± 38.2 mmHg (80-230) in obese subjects. Mean diastolic BP was 78.8 ± 18.9 mmHg (50-130) in non-obese while it was 85.7 ± 20.1 mmHg (50-140) in obese individuals. (Table 1).

DISCUSSION

This study was based on large population of 2548 people. The study was carried out in various occupational groups working in Peshawar. In this study, frequency of obesity was 60.4%. Such a high prevalence of obesity was also supported by Khan et al, who showed that the prevalence of obesity is 60% in a study done in Peshawar on patients of coronary artery disease.²⁸

The overall frequency of hypertension in our study was 28.26% for systolic and 40.94% for diastolic hypertension. These findings are consistent with various studies that show that diastolic hypertension is more common than systolic hypertension.²⁹

In this study the frequency of systolic hypertension in obese individuals was 36.04% and diastolic hypertension was 51.1%. In non-obese this prevalence is 16.87% and 25.7% respectively which clearly shows that obese people are more prone to hypertension as compared to non-obese. This data is supported by Julio et al, that prevalence of systolic hypertension is 38.8% which is very close to our findings of 36.04%.²⁹ Moreover Clarice et al, also showed that prevalence of hypertension increases from 25% to 42% from non-obese to obese.²⁶

In our study it is also clear that mean systolic and diastolic blood pressure is more in obese than non-obese. Mean systolic blood pressure was 130.7 ± 38.2 mmHg in obese versus 120 ± 32.7 mmHg in non-obese and diastolic blood pressure was 85.7 ± 20.1 mmHg in obese versus 78.8 ± 18.9 mmHg in non-obese. These findings also

Table 1: Systolic, Diastolic and Mean Blood Pressure in Obese and Non Obese

Variables	Non Obese n (%)	Obese n (%)
Systolic Blood Pressure		
< 140 (mmHg)	838 (83.13)	985 (63.96)
≥ 140 (mmHg)	170 (16.87)	555 (36.04)
Diastolic Blood Pressure		
< 90 (mmHg)	749 (74.30)	753 (48.9)
≥ 90 (mmHg)	259 (25.70)	787 (51.1)
Mean Blood Pressure		
Diastolic (mmHg)	78.8 ± 18.9	85.7 ± 20.1
Systolic (mmHg)	120.8 ± 32.7	130.7 ± 38.2

support that obese people are more prone to hypertension than non-obese, which is also supported by Clarice et al, who demonstrated that systolic blood pressure was about 9 mm Hg higher in obese (131 ± 39.8 vs. 121 ± 34.1 mmHg). In present study it was 130.7 ± 38.2 vs. 120.8 ± 32.7 mmHg. They also demonstrated that, the difference in diastolic blood pressure between the highest BMI category and the lowest BMI category was about 7 mmHg which is also 7 mmHg in our study (85.7 vs. 78.8 mmHg).²⁶ Boris et al, also demonstrated that the mean systolic blood pressure is 128 ± 35.1 mmHg and diastolic blood pressure is 85 ± 19.7 mmHg in obese which is nearly same as found in our study.³⁰

CONCLUSION

Both systolic and diastolic hypertension has weak positive correlation with obesity.

REFERENCES

- Friedrich MJ. Epidemic of obesity expands its spread to developing countries. *JAMA* 2002;287:1382-6.
- Galal OM, Hulett J. Obesity among schoolchildren in developing countries. *Food Nutr Bull* 2005;26:261-6.
- Majid E, Martin H, Skjod S, Hoorn SV. Trends in national and state level obesity in the USA after correction for self-report bias: analysis of health surveys. *J R Soci Med* 2006;99:250-7.
- World Health Organization. Obesity: preventing and managing the global epidemic: report of a WHO consultation of obesity. Geneva, Switzerland: World Health Organization; 2000.
- Calle EE, Thun MJ, Petrelli JM, Rodriguez C, Heath CW. Body mass index and mortality in a prospective cohort of US adults. *N Engl J Med* 1999;341:1097-105.
- Must A, Spadano J, Coakley EH, Field AE, Colditz G, Dietz WH. The disease burden associated with overweight and obesity. *JAMA* 1999;282:1523-9.
- Manson JE, Willett WC, Stampfer MJ, Colditz GA, Hunter DJ, Hankinson SE, et al. Body weight and mortality among women. *N Engl J Med* 1995;333:677-85.
- El-Atat F, Aneja A, McFarlane S, Sowers J. Obesity and hypertension. *Endocrinol Metab Clin North Am* 2003;32:823-54.
- Wenzel UO, Krebs C. Management of arterial hypertension in obese patients. *Curr Hypertens Rep* 2007;9:491-7.
- Brown CD, Higgins M, Donato KA, Rohde FC, Garrison R, Obarzanek E, et al. Body mass index and the prevalence of hypertension and dyslipidemia. *Obes Res* 2000;8:605-19.
- Burt VL, Welton P, Roccella EJ, Brown C, Cutler JA, Higgins M, et al. Prevalence of hypertension in the US adult population. Results from the Third National Health and Nutrition Examination Survey, 1988-1991. *Hypertension* 1995;25:305-13.
- Choo V. WHO reassesses appropriate body-mass index for Asian populations. *Lancet* 2002;360:235.
- Ogden CL, Carroll MD, Curtin LR, McDowell MA, Tabak CJ, Flegal KM. Prevalence of overweight and obesity in the United States, 1999-2004. *JAMA* 2006;295:1540-55.
- Kuczmarski RJ, Flegal KM, Campbell SM, Johnson CL. Increasing prevalence of overweight among US adults. The National Health and Nutrition Examination Surveys, 1960 to 1991. *JAMA* 1994;272:205-11.
- Mokdad AH, Serdula MK, Dietz WH, Bowman BA, Marks JS, Koplan JP. The spread of the obesity epidemic in the United States, 1991-1998. *JAMA* 1999;282:1519-22.
- Allison DB, Fontaine KR, Manson JE, Stevens J, VanItallie TB. Annual deaths attributable to obesity in the United States. *JAMA* 1999;282:1530-8.
- Jafar TH, Jafary FH, Jessani S, Chaturvedi N. Heart disease epidemic in Pakistan: women and men at equal risk. *Am Heart J* 2005;150:221-6.
- Zahid N, Meyer HE, Kumar BN, Claussen B, Hussain A. High levels of cardiovascular risk factors among Pakistanis in Norway compared to Pakistanis in Pakistan. *J Obes* 2011;2011:163749.
- Nanan DJ. The obesity pandemic--implications for Pakistan. *J Pak Med Assoc* 2002;52:342-6.
- Fields LE, Burt VL, Cutler JA, Hughes J, Roccella EJ, Sorlie P. The burden of adult hypertension in the United States 1999 to 2000: a rising tide. *Hypertension* 2004;44:398.
- Malnick SDH, Knobler H. The medical complications of obesity. *Q J Med* 2006;99:565-79.
- Verma M, Chhatwal J, George SM. Obesity and hypertension in children. *Indian Pediatr* 1994;31:1065-9.
- Schillaci G, Pasqualini L, Vaudo G, Lupattelli G, Pirro M, Gemelli F, et al. Effect of body weight changes on 24-hour blood pressure and left ventricular mass in hypertension: a 4-year follow-up. *Am J Hypertens* 2003;16:634-9.

24. National Task Force on the Prevention and Treatment of Obesity. Overweight, obesity, and health risk. Arch Intern Med 2000;160:898-904.
25. Zulfiqar S. Age-related association between body mass index and blood pressure in normal adult males. Proceeding Shaikh Zayed Postgrad Med Inst 2004;18:73-6.
26. Clarice D, Karen A, Frederick C, Nancy D. Body mass index and the prevalence of hypertension and dyslipidemia. Obes Res 2000;605-19.
27. Franklin SS, Larson MG, Khan SA, Wong ND, Leip EP, Kannel WB, et al. Does the relation of blood pressure to coronary heart disease risk change with aging? The Framingham Heart Study. Circulation 2001;103:1245-9.
28. Khan SB, Hameedullah, Hafizullah M, Gul AM, Awan ZA. Prevalance of hyperlipidemia in obese and non obese in coronary artery disease patients. J Postgrad Med Inst 2011;25:24-8.
29. Julio A, Stanley S, Raymond R. Body mass index and hypertension hemodynamic subtypes in the adult US population. Arch Intern Med 2009;169:580-6.
30. Boris AKG, Huguette YMC, Laure NJ, Oben JE. The effect of body weight on the incidence and prevalence of hypertension in Yaoundé. J Diabetes Endicronol 2010;1:6-12.