ORIGINAL ARTICLE

Comparison of Systolic and Diastolic Blood Pressure of Healthy Individuals with Different BMI Ranges

RUBINA BASHIR, SOBIA IMTIAZ, NADIA MAHMOOD*, *MUHAMMAD YASIR, SYED MOHSIN ALI SHAH, MUHAMMAD SHAKIL*

ABSTRACT

Background with Aims and Objectives: Obesity and in particular the central obesity have been linked to hypertension. The objective of the present study was to compare systolic and diastolic blood pressure (B.P) of control, overweight and obese healthy individuals.
Study Design: Analytical cross-sectional. Materials and Methods: Eighty one (81) healthy subjects, both males and females (ages 18-60 years) were selected from the general population. Blood pressure was measured by mercurial sphygmomanometer. Body mass index (BMI) was calculated as weight (kilogram) divided by square of height (meters squared). We divided the participants into control, overweight and obese according to their BMI. In the next step we categorized our study subjects according to gender and BMI. Group I included fifty four (54) male subjects comprising of 18 controls, 18 overweight and 18 obese subjects. Group II included twenty seven (27) female subjects comprising of 09 controls, 09 overweight and 09 obese subjects.
Results: Results of the present study reveal a significantly higher systolic as well as diastolic B.P in overweight and obese subjects as compared to controls except in male controls and male overweight subjects where the difference in systolic B.P was found to be statistically insignificant.
Conclusion: We can conclude that an increase in weight seems to be associated with an increase in systolic and diastolic B.P.
Key words: Body Mass Index (BMI), Central obesity, Diastolic blood pressure, Hypertension, Obese, Obesity, Overweight, Systolic blood pressure.

INTRODUCTION

Excess body weight is the sixth most important risk factor contributing to the overall burden of disease world wide. More than one billion adults and 10% of children are now classified as overweight or obese.[1] In the U.S. population, 30% of adults are obese and another 35% are over weight, as defined in terms of body mass index (BMI), calculated as weight (in kilograms) / height (in meters)^2.[2]

The growing prevalence of obesity is increasingly being accepted as one of the most important risk factors for the development of hypertension.[3] Obesity and in particular central obesity have been linked to hypertension. It has been reported that at least two-thirds of the prevalence of hypertension can be directly attributed to obesity[4].

MATERIALS AND METHODS:

The study was conducted in department of Biochemistry, LM&DC, Lahore from 2007-2008. Eighty one (81) healthy subjects, both males and/ female (ages 18-60 years) were selected from the general population. We excluded known hypertensives. Moreover, we excluded the patients suffering from renal diseases, diabetes mellitus and other systemic diseases. We also excluded pregnant women.

Informed consent of all the study subjects was obtained and relevant history was recorded in proformas. Height was measured in centimetre (cm) on a standard height scale and weight was measured in kilograms on Camry weight scale. Body mass index was calculated as weight (kilogram) divided by square of height (meters squared). The study subjects with a BMI of 20-24.9 kg/m^2 were labelled as controls, whereas subjects with a BMI of 25-29.9 kg/m^2 and >30 kg/m^2 were categorized as overweight and obese respectively.

Blood pressure was measured by mercurial sphygmomanometer after the participant rested for at least 05 minutes in sitting position. Although it has been recommended that the diagnosis of hypertension should be made only after elevation is noted on three readings on different occasions, over a period of several months, the purpose of the present study was to compare the B.P of people with different BMI ranges and not the diagnosis of hypertension, so we relied on the single reading.[5]

Biochemistry Department, Lahore Medical and Dental College Lahore
**Pathology Department, CMH Lahore Medical College Lahore*
Correspondence to Dr. Rubina Bashir, Associate Professor

Initially, we divided the total study population according to the BMI into control, overweight and obese. In the next step we categorized our study subjects according to gender and BMI. Group I included fifty four (54) male subjects. There were 18 controls, 18 overweight and 18 obese subjects in this group. Group II included twenty seven (27) female subjects. There were 09 controls, 09 overweight and 09 obese subjects in this group (Table 1).

Statistical Analysis: Data was entered and analyzed using SPSS 15.0. Mean, standard deviation (SD), and standard error of mean (SEM) were calculated for the systolic and diastolic B.P of controls, overweight and obese, male controls, male overweight and male obese, female controls, female overweight and female obese subjects.

Paired sample t-test was used for the comparison of group means. *p-v*alue less than 0.05 (5%) was regarded as significant.

RESULTS

Mean, SD and SEM for systolic and diastolic B.P for the total study population (Group I+ Group II) are given in Table 2. Mean, SD and SEM for systolic and diastolic B.P for Group I subjects are given in Table 3. Mean, SD and SEM for systolic and diastolic B.P for Group II subjects are given in Table 4.

In the total study population (Group I and II) we compared the systolic and diastolic B.P of controls with over weight and obese subjects. There was significant difference between the mean systolic B.P of controls and over weight (117.59 ± 9.74 vs. 124.07 ± 9.71, $p < 0.05$). Similarly, there was significant difference between mean diastolic B.P of controls and over weight (76.67 ± 5.71 vs. 84.81 ± 8.93, $p < 0.05$).

There was significant difference between the mean systolic B.P of controls and obese (117.59 ± 9.74 vs. 132.59 ± 11.63, $p < 0.05$). Similarly, there was significant difference between mean diastolic B.P of controls and obese (76.67 ± 5.71 vs. 90.00 ±7.46, $p < 0.05$) (Fig. 1).

In order to account for the variations originating from gender, we also made within group comparisons. In group I, there was no significant difference between the mean systolic B.P of controls and over weight (121.11 ± 9.00 vs. 125.00 ± 9.85, $p > 0.05$). However, there was significant difference between mean diastolic B.P of controls and over weight (78.06 ±4.58 vs. 85.00 ± 9.85, $p < 0.05$). There was significant difference between the mean systolic B.P of controls and obese (121.11± 9.00 vs. 134.44 ± 10.41, $p < 0.05$). Similarly, there was significant difference between mean diastolic B.P of controls and obese (78.06 ± 4.58 vs. 91.11 ±6.76, $p < 0.05$) (Fig. 2).

Table 1: Distribution of Control, Over Weight and Obese subjects among Group I (Males) and Group II (Females)

	Control	Over weight	Obese	Total
Group I (Male)	18	18	18	54
Group II (Female)	09	09	09	27
	27	27	27	81

Table 2:

Total study population (Group I + Group II)	Mean	SD	SEM
Control Systolic	117.59	9.74	1.87
Control Diastolic	76.67	5.71	1.10
Over weight Systolic	124.07	9.71	1.86
Over weight Diastolic	84.81	8.93	1.71
Obese Systolic	132.59	11.63	2.23
Obese Diastolic	90.00	7.46	1.43

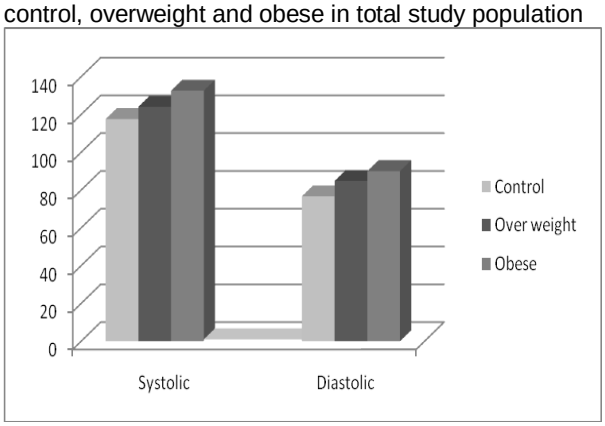
Table 3:

Group I	Mean	SD	SEM
Control Systolic	121.11	9.00	2.12
Control Diastolic	78.06	4.58	1.08
Over weight Systolic	125.00	9.85	2.32
Over weight Diastolic	85.00	9.85	2.32
Obese Systolic	134.44	10.41	2.45
Obese Diastolic	91.11	6.76	1.59

Table 4:

Group II	Mean	SD	SEM
Control Systolic	110.56	7.26	2.42
Control Diastolic	73.89	6.97	2.32
Over weight Systolic	122.22	9.71	3.23
Over weight Diastolic	84.44	7.26	2.42
Obese Systolic	128.89	13.64	4.54
Obese Diastolic	87.78	8.70	2.90

Fig. 1: Comparison of Mean Systolic and Diastolic B.P of control, overweight and obese in total study population



In group II, there was significant difference between the mean systolic B.P of controls and over weight (110.56 ± 7.26 vs. 122.22 ± 9.71, $p < 0.05$). Similarly, there was significant difference between mean diastolic B.P of controls and over weight (73.89

± 6.97 vs. 84.44 ± 7.26, $p < 0.05$). There was significant difference between the mean systolic B.P of controls and obese (110.56 ± 7.26 vs. 128.89 ±13.64, $p < 0.05$). Similarly, there was significant difference between mean diastolic B.P of controls and obese (73.89 ± 6.97 vs. 87.78 ± 8.70 $p < 0.05$) (Fig. 3).

Fig 2: Comparison of Mean systolic and Diastolic B.P of control, overweight and obese in Group I

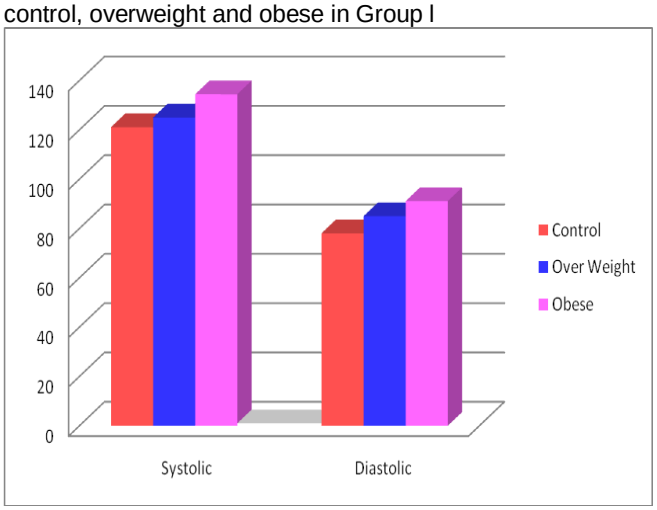
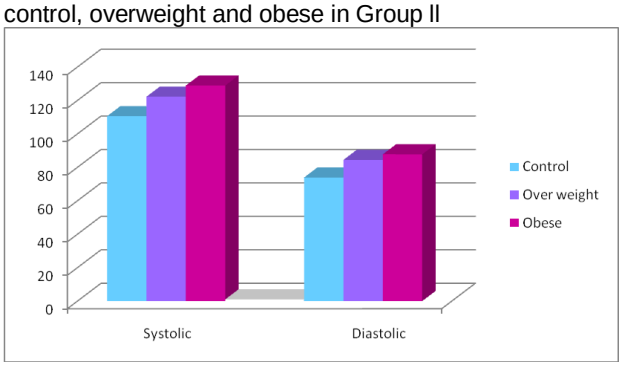


Fig 3: Comparison of Mean Systolic and Diastolic B.P of control, overweight and obese in Group II



DISCUSSION

Obesity has been associated with an increase in systemic B.P, however the precise mechanisms linking obesity to hypertension are not clearly understood. Obesity-associated hypertension might be attributed to production of several vasoactive factors from adipose tissue, increased sympathetic nervous system activity owing to the central nervous system action of leptin, and low atrial natriuretic factor (ANF) levels leading to sodium retention and volume expansion.[6] Results of the present study reveal a significantly higher systolic as well as diastolic B.P in overweight and obese subjects as compared to controls except in male controls and male over weight subjects where the difference in systolic B.P was found to be statistically insignificant. Consequently, we can conclude that an increase in weight seems to be associated with an increase in systolic and diastolic B.P. Similar findings have been reported by Leenen et al., Mohsen A. et al. and Bramlage et al[7-9].

In addition to the increasing prevalence of hypertension in obese subjects, the pharmacologic treatment of obesity-related hypertension is also challenging[9].

On one hand, the pathophysiologic contribution of weight gain to B.P elevation has been suggested by a number of workers, while on the other hand, it has been reported that the reverse is also true.[6, 10,11] It has been observed that the persons of equal weight who had higher initial B.P gain more weight in the future. The concurrence of hypertension and obesity might be attributed to a primary increase in the sympathetic tone.[10] Moreover, the combination of obesity and hypertension increases the risk of cardiovascular diseases.[12] The loss of weight is frequently accompanied by a decrease in B.P supporting the hypothesis that an increased in BMI contributes to the increased prevalence of hypertension.[13] Consequently, lifestyle modifications, including weight reduction and increased physical activity must be considered as early steps in the management of obesity-related hypertension. Moreover, it is expected that public health strategies to reduce the obesity epidemic would also markedly reduce the burden of hypertension.[7] Furthermore, it is hereby suggested that the impact of weight gain on B.P must be confirmed on the basis of future longitudinal studies.

CONCLUSION

We conclude that an increase in weight seems to be associated with an increase in systolic and diastolic B.P.

Acknowledgements:

- All subjects of study
- Shahbaz A. Khan, Deputy IT Manager, IT Department Lahore Medical and Dental College, Lahore.
- Department of Biochemistry, Lahore Medical and Dental College, Lahore.

REFERENCES

1. Haslam DW, James WP. Obesity. Lancet 2005; 366: 1197-209.
2. Cox MM, Nelson DL. Lehninger Principles of Biochemistry. 5th ed. New York : W. H. Freeman and Company;2008.

3. Narkiewicz K. Obesity and Hypertension_ the issue is more complex than we thought. Nephrol Dial Transplant 2006; 21: 264-67.
4. Krauss RM, Winston M, Fletcher BJ, Grundy SM. Obesity Impact on cardiovascular disease. Circulation 1998; 98: 1472-76.
5. Tierney LM, McPhee SJ, Papadakis MA editors. Current Medical Diagnosis and Treatment. 49th ed. New York: McGraw Hill ; 2010.
6. Engeli S, Sharma AM. Role of Adipose tissue for cardiovascular-renal regulation in health and disease. Horm Metab Res 2000; 32: 485-499.
7. Leenen FH, McInnis NH, Fodor G. Obesity and the Prevalence and Management of Hypertension in Ontario, Canada. Am J Hypertens 2010; 23:1000-06.
8. Mohsen AE, Arjumand SW. Prevalence of hypertension in obese and non-obese Saudis. Saudi Medical Journal 2001; 22: 44-48.
9. Bramlage P, Pittrow D, Wittchen HU, Kirch W, Boehler S, Lehnert H et al. Hypertension in overweight and obese primary care patients is highly prevalent and poorly controlled. Am J Hypertens 2004; 17: 904-10.
10. Julius S, Valentini M, Palatini P. Overweight and Hypertension: a 2-way street?. Hypertension 2000; 35: 807-13.
11. Kotchen TA. Obesity-related Hypertension? Weighing the evidence. Hypertension 2008; 52: 801-02.
12. Thomas F, Bean K, Pannier B, Oppert JM, Guize L, Benetos A. Cardiovascular Mortality in overweight subjects: the key role of associated risk factors. Hypertension 2005; 46:654-59.
13. Mark AL. Dietary therapy for obesity: an emperor with no clothes. Hypertension 2008;51:1426-34.