ORIGINAL RESEARCH

A comparison of the influence of BMI on blood pressure levels in obese and non-obese people

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ABSTRACT
Aim: A comparative study of effect of body mass index on blood pressure level in obese and non-obese individuals. **Material & methods:** The subjects were given an explanation of the goal of the research as well as the procedure. After receiving informed permission, body mass index and blood pressure measurements were measured. These parameters were systolic blood pressure, diastolic blood pressure, pulse pressure, and mean arterial blood pressure (MAP). **Results:** The mean value of both systolic and diastolic blood pressure was shown to be statistically substantially higher in patients who were overweight or obese compared to those whose weight was considered normal. **Conclusion:** As compared with patients who were not fat, those who were obese had higher mean values for the various blood pressure metrics. In this particular investigation, a number of different blood pressure indicators and body mass index were shown to have a substantial positive link with one another. The findings of this investigation led the researchers to the conclusion that participants who were fat had a greater chance of developing hypertension.

Keywords: BMI, SBP, DBP, MAP

INTRODUCTION

One of the most significant issues affecting people's health all around the globe is obesity. [1] It is a significant independent risk factor for chronic illnesses including cardiovascular disease and diabetes mellitus, and it is linked with high morbidity and death rates. Obesity is a substantial risk factor for these diseases. [2] According to the World Health Organization (WHO), up to twenty percent of the population in developed countries may be affected by obesity-associated hypertension. This condition may account for seventy-eight percent of essential hypertension in males and sixty-five percent of essential hypertension in females, respectively. [3,4] The World Health Organization (WHO)[4] found that one in six persons are obese and that one in three adults had high blood pressure (BP), with the greatest incidence being documented in Africa. Weight problems and high blood pressure are two of the avoidable risk factors for cardiovascular disease that place a significant financial burden on society, especially in less developed nations. [5] The asymptomatic nature of hypertension, which has been referred to as a "silent killer," makes it one of the 10 largest contributors to the global burden of illness. It is also the most significant risk factor for death globally. According to the findings of many studies, hypertension is the cause of death for around nine million individuals every year. Many earlier research have shown the prevalence of hypertension in Africa. Formerly thought to be a condition associated with wealth, hypertension is increasingly seen among economically disadvantaged populations. The disease of hypertension places a significant burden on South Africa. There are around 6.2 million hypertensive people living in South Africa, with 3.2 million having blood pressure that is higher than 160 mmHg. [6]

Several studies have pointed to a direct connection between an increase in blood pressure and a rise in weight.[5,7] It has been shown that those who are obese have a probability of developing hypertension that is three and a half times higher than average, and that an

increase in adipose tissue storage is responsible for sixty percent of all cases of hypertension. [2] According to the findings of the National Health and Nutrition Examination Survey conducted in 2004, the prevalence of hypertension was found to be 42.5% among obese individuals who had a body mass index (BMI) of more than 30 kg/m2, whereas the prevalence was only 15.3% among individuals who were lean. 8 Another genetic element that leads to the rise in blood pressure levels in persons who are obese is the distribution of visceral fat. In addition, environmental and behavioural factors, such as the consumption of alcohol, the smoking of cigarettes, the timing of the onset of childhood obesity, changes in daily lifestyle habits, and alterations in lipid profiles may be implicated in the distribution of visceral fat and increased BP values. According to the findings of the vast majority of research, the amount of fat that is positioned more centrally in the body is a more important factor in the raising of blood pressure in both men and women. [9] Researchers in Ghana found a positive link between the body mass index (BMI) and blood pressure (BP) in persons aged 30 to 50 years old. Employees in financial institutions and administrative offices, for example, are required to sit for long periods of time as part of their jobs, which makes them more likely to lead a sedentary lifestyle. White-collar jobs, in particular, are among the occupations most likely to involve sitting for extended periods of time. These people have a greater propensity to spend the bulk of their adult working life participating in less physical exercise outside of the hours that they are paid to work, which makes them more prone to obesity and illnesses. According to the findings of a research conducted in India, the prevalence of hypertension among workers was much greater than that of the general population of the nation, and this correlation was shown to be more favourable. [10]

MATERIAL & METHODS

The study was a hospital based cross sectional study conducted at Department of Medicine, Government Medical College and Associated Hospital, Rajouri, J&K, India. Total 300 subjects were recruited according to simple random sampling method and selection criteria.

INCLUSION CRITERIA

Both male and female subjects who are willing to participate in study, having Body Mass Index (BMI) > 18.5 kg/m2 , Age more than 20 years.

EXCLUSION CRITERIA

Those who are known to have cases of obesity as a result of hypothyroidism, Cushing syndrome, hypothalamic illness, or pregnancy. Individuals who are suffering from conditions such as congestive heart failure, renal failure, or cirrhosis with ascitis. Those who were overweight and using medications that reduced their cholesterol levels or altered their lipid metabolism were also disqualified.

METHODOLOGY

The subjects were given an explanation of the goal of the research as well as the procedure. After receiving informed permission, body mass index and blood pressure measurements were measured. These parameters were systolic blood pressure, diastolic blood pressure, pulse pressure, and mean arterial blood pressure (MAP). The formula that was used to calculate BMI was body weight in kilogrammes divided by height in metres squared. Once the patient had rested for five to ten minutes, their blood pressure was taken while they were seated with their hands propped up on the exam table and their cubital fossa supported at the level of their heart. It was measured three times, each time separated by five minutes, for every participant, and the average of these three readings was utilised for the statistical analysis. It was ensured that each participant had not had any food or drink of any type in the preceding half an hour before their blood pressure was measured. This includes coffee, tea, water, and any other beverage.

According to the subjects' body mass index (BMI), the subjects were separated into three groups: Group I consisted of subjects with a weight that was normal (between 18.5 and 24.9 kg/m2), Group II contained subjects who were overweight (between 25 and 29.9 kg/m2), and Group III contained subjects who were obese (30 or more kg/m2). Group III: Obesity (defined as having a body mass index of above 30).

The programme known as GraphPad Prism was used in order to carry out the statistical analysis. The values were presented using a mean and standard deviation format. The unpaired student's t-test was used in order to analyse the significance of the mean differences. Pearson In order to examine the degree of connection between the parameters, the correlation coefficient, or r, was computed. A p value of less than 0.05 was considered to indicate statistical significance.

RESULTS

The study was carried out on 300 subjects, out of which 150 were males and 150 were females. The subjects were divided into three groups according to their body mass index and each group contains 100 subjects.

Table 1: Age and gender of the participants

Gender	Number	Percentage
Male	150	50
Female	150	50
Age		

below 25	80	26.67
25-35	140	46.67
35-45	45	15
Above 45	35	11.67

Table-2 shows mean value of age and BMI.

Table-2: Mean Value of Age and BMI

Group	Age (years)		BMI (kg/m^2)	
	Mean	± SD	Mean	± SD
I	39.01	4.36	23.96	1.36
II	42.63	4.96	26.66	1.89
III	45.69	3.66	33.11	1.99

Table-3 shows mean value of blood pressure parameters which suggested that all the blood pressure parameters were elevated in Gr-III as compared to Gr-I & II.

Table-3: Mean Value of Blood Pressure Parameters

Parameters	Group I		Group II		Group III	
	Mean	± SD	Mean	± SD	Mean	± SD
SBP	120.33	3.69	127.01	3.67	135.08	6.66
DBP	79.01	2.87	82.09	2.22	86.44	4.38
PP	41.69	2.91	45.11	3.18	49.27	4.22
MAP	91.98	3.64	97.06	4.44	103.07	5.39

Table-4 shows comparison of blood pressure parameters between nonobese (Gr-I+II) and obese subjects (Gr-III).

Table-4: Comparison between non-obese subjects and obese subjects

Parameters	Non obese (Group I+II)	Obese (Group III)	t-test	p value
SBP	123.07	135.14	4.69	< 0.0001
DBP	80.64	86.14	4.89	< 0.0001
PP	43.11	49.06	4.63	< 0.0001
MAP	95.22	103.01	4.74	< 0.0001

Table-5 shows correlation coefficient between blood pressure and BMI. As per table-6, blood pressure was positively correlated with BMI.

Table-5: Correlation coefficient between blood pressure and BMI

Blood pressure parameters	Correlation Coefficient (r)	p	95% Confidence Interval for r
SBP	0.61	< 0.0001	0.47 – 0.72
DBP	0.67	< 0.0001	0.43 – 0.69
PP	0.69	< 0.0001	0.41 – 0.68
MAP	0.69	< 0.0001	0.46 – 0.71

The mean value of systolic and diastolic blood pressure is significantly higher in overweight and obese subjects than in normal weight subjects.

DISCUSSION

A big issue affecting people's health all throughout the globe is obesity. The prevalence of obesity is steadily increasing across the board in each and every nation on the face of the planet; hence, the accompanying rates of sickness and death, as well as the financial and medical burdens, are anticipated to continue their upward trend. The bulk of these consequences are brought on by co-morbid illnesses, the most common of which are coronary artery disease, hypertension, type 2 diabetes mellitus, respiratory disorders, and dyslipidemia. According to the World Health Organization (WHO), overweight and obesity have reached such epidemic proportions in the world's population that they are beginning to take the place of more conventional threats to public health, such as malnutrition and infectious illnesses. [11] In 2008, the proportion of persons aged 25 and over who were diagnosed with high blood pressure (HBP) was close to forty percent worldwide. According to the World Health Organization (WHO), the proportion of people living with high blood pressure was greatest in Africa (46%) among both sexes. [12] According to research conducted in Ghana's metropolitan areas in the year 2003, the prevalence of hypertension was determined to be 28.3% in the Greater Accra Area and 28.7% in the Ashanti Region. The body mass index, often known as BMI, is a scale that is used to assess the weight of a human body in relation to the height of the individual. This scale is determined by dividing the

weight in kilogrammes by the square of the height in metres. [13]

In the current investigation, the mean value of both systolic and diastolic blood pressure was shown to be statistically substantially higher in patients who were overweight or obese compared to those whose weight was considered normal. Similar research carried out by Renu Lohitashwa et al.,[14] on first-year medical and dental students of the age group 17–20 years old who were enrolled at J. N. Medical College, Belgaum in the academic years 2008– 09 and 2009–10 found significantly higher mean values of systolic and diastolic blood pressure in overweight and obese students in comparison to normal weight students. This research was comparable to the present study. Enhanced sympathetic tone, activation of the renin-angiotensin system (RAS), hyperinsulinemia, structural changes in the kidney, and elaboration of adipokines (hormones produced in fat itself) such as leptin are generally thought to be responsible for the alterations in the pressure-natriuresis curve that are associated with obesity. [15]

CONCLUSION

As compared with patients who were not fat, those who were obese had higher mean values for the various blood pressure metrics. In this particular investigation, a number of different blood pressure indicators and body mass index were shown to have a substantial positive link with one another. The findings of this investigation led the researchers to the conclusion that participants who were fat had a greater chance of developing hypertension.

REFERENCES

1. Ng M, Fleming T, Robinson M, Thomson B, Graetz N. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis for the Global Burden of Disease Study. Lancet. 2014;384:766–781.
2. Salvetti G, Santini F, Versari D, Virdis A, Fierabracci P. Fat distribution and cardiovascular risk in obese women. J Obes Metab. 2008;4:202–207.
3. Ali AT, Crowther NJ. Health risks associated with obesity. J Endocrinol Metab Diabetes SA. 2005;10;(2):56–61.
4. World Health Organization. Global status report on noncommunicable diseases 2014. Geneva. Switzerland, 2015 (accessed 27 July 2018
5. Bloom DE, Cafiero ET, Jane-Llopis E, Abrahams-Gessel S, Bloom LR, Fathima S. et al. The global economic burden of non-communicable diseases. Geneva: World Economic Forum, 2011.
6. Rayner B. What is the prevalence of hypertension? Health 24: hypertension, 1. http://www.health24.com/Medical/Hypertension/Faqs/What-isthe- prevalence-of-hypertension-20130205 (accessed 3 Jul 2016).
7. Nguyen T, Lau DCW. Obesity epidemic and its impact on hypertension (Review). Can J Cardiol. 2012;28(3):326–333.
8. Landsberg L, Aronne LJ, Beilin LJ, Burke V, Igel LI, Lloyd-Jones D, Sowers J. Obesity-related hypertension: pathogenesis, cardiovascular risk, and treatment −a position paper of the Obesity Society and the American Society of Hypertension. J Clin Hypertens. 2013;21:8–24.
9. Sironi AM, Gastaldelli A, Mari A, Ciociaro D, Positano V, Postano V. et al. Visceral fat in hypertension: influence on insulin resistance and B-cell function. J Hypertens. 2004;44:127–133.
10. Vuvor F. Correlation of body mass index and blood pressure of adults of 30–50 years of age in Ghana. J Health Res Rev. 2017;4:115–121.
11. Initial use of ambrisentan plus tadalafil in pulmonary arterial hypertension. Galiè N, Barberà JA, Frost AE, et al. N Engl J Med. 2015;373:834–844.
12. Hypertension in Ghana: a cross-sectional community prevalence study in Greater Accra. AmoahAG. https://pubmed.ncbi.nlm.nih.gov/12894954/ Ethn Dis. 2003;13:310–315.
13. Prevalence, detection, management, and control of hypertension in Ashanti, West Africa. Cappuccio FP, Micah FB, Emmett L, et al. Hypertension. 2004;43:1017–1022.
14. Lohitashwa, R., & Patil, P. A cross sectional study of relationship of obesity indices with blood pressure and blood glucose level in young adult medical students. International Journal.2012; 3(4), 102-107.
15. Ronald, G. V. Systemic hypertension: mechanisms & diagnosis, Eugene Braunwald‟s Heart Disease, A text book of cardiovascular medicine 9th edition.2011; 935-943.