Effect of Obesity on Blood Pressure, Pulse Rate and Skin Fold Thickness

Bijal Mehul Shah*, Bhavna A. Selot, Patel Sangita Vashrambhai***, Paresha Lalsinh Solanki******

*Assistant professor, Dept. of physiology, *** Associate Professor, Dept. of PSM, ****2nd Year Resident, Dept. of PSM, Medical College Baroda,

Abstract: Background & Objectives: To find out the effect of obesity on blood pressure and pulse rate. Methods: There were total 30 obese individuals (BMI>30) and 30 control subjects selected for the study in the physiology department of Medical College, Baroda. The cardiovascular parameters taken for the study were pulse rate per minute in standing and supine postures, systolic and diastolic blood pressure in both standing and supine postures. Skin fold thickness, waist-hip ratio and waist circumference were also measured in both the group. The data was entered and analyzed by using Epi info software. Results: The values for pulse rate were significantly higher (P<0.05) in obese individuals (85.84±10.83 per minute) when taken in standing posture, compared to those of control subjects (80.16±5.77 per minute). The values of systolic blood pressure were found to be significantly higher (P<0.001) in obese individuals irrespective of postures (138.00±1.90 mm Hg in supine and 145.36±14.61 mm Hg in standing posture) when compared with control subjects(120.32±9.16 mm Hg in supine posture and 124.64±8.86 mm Hg in standing posture.) Similar finding observed in diastolic blood pressure. Conclusion: The results show the significant increase in Pulse Rate and Blood pressures. (SBP and DBP) in obese individuals when compared with the values of control subjects. [Bijal S NJIRM 2017; 8(3):93-97]

Key Words: Blood Pressure, Obesity, Body Mass Index and Pulse rate

Author for correspondence: Bijal Mehul shah, KANCHANAM 9, Green Park Soc, Opp M.G School , Manjalpur -390011 Vadodara, Gujarat M: 8320885120 E-Mail: bijalshah726@yahoo.com

Introduction: Obesity can be defined as generalized accumulation of excess fat in the body. Carbohydrate and protein store in human body are limited, increase fat intake on other hand does not stimulate fat oxidation thus long standing positive fat balance resulting obesity.

Increasing overweight and obesity emerging as one of the greatest threat to world public health. Obesity is an increase in body weight beyond the limitation of skeletal and physical requirement.

Prevalence of obesity (overweight or obese, BMI ≥25) in men are 26.3% in urban, 14.3% in rural and 18.6% total in India. In Gujarat 25.9% in urban, 14.3% in rural and 19.7% total in India.[1]

The prevalence of overweight and obesity are at high risk of development of adverse health problems that can reduce a person quality of life and may be shorten a person life , because of complications like hypertension cardiovascular disease, respiratory disease, sleep apnea , metabolic disorder.[2]

Excess weight gain and visceral obesity are major causes of hypertension, 65%-75% risk for human essential hypertension. Both central and peripheral nervous system are involved in development of obesity and resulting in cardiovascular complication. Sympathetic activation is involved in many cardiovascular complication of obesity , like hypertension cardiovascular disease, respiratory disease, sleep apnea , metabolic disorder.[3]

In addition according to guyton hypothesis altered renal function and excess sodium reabsorption by kidney play a major role in obesity induced hypertension. Heamodynamic abnormalities are associated with increased blood flow , vasodilatation , increased cardiac output and hypertension .increased renal sodium reabsorption , physical compression of kidney by fat , activation of rennin angiotensin aldosteron mechanism , increase sympathetic nervous system leads to hypertension.[456]

Methods: This study was conducted in the Department of Physiology,Medical College, Baroda. All the subjects of study were males between the age group of 25-50 years.

Sample selection criteria:

1. Participants in our study were of two different categories:
2. Control subjects who were having body mass index less than 25
3. Obese and overweight individuals (N=30) who were having the body mass index more than 25. Subjects were selected after applying the inclusion and exclusion criteria and taking written informed consent for all participants. Subjects were categorized into the two groups based on the BMI

classification for the world health organization (WHO) population .

Inclusion criteria:

1. Subjects aged 25-50 years males.
2. At the time of participation all the subjects were asymptomatic and were not under any sort of medical treatment related to major cardiovascular diseases in the past and specially so on the day of test.
3. All the subjects had daily physical exercise like walking & cycling for 20-30 minutes.

Exclusion criteria: Subjects with known cardiovascular, respiratory, thyroid dysfunction, diabetes mellitus, history of tobacco smoking/chewing and alcohol consumption, thoracic skeletal deformities.

Parameters recorded: Following the selection of subjects, a general physical examination was performed and the following anthropometric measurements and pulse and blood pressure were taken on them.

Weight Measurement: Weight is a key anthropometric measurement of body mass. Weight is the single most widely used measurement for the assessment of nutritional status.

All study subjects were weighed in the clothes they had worn. The weighing machine was regularly standardized with a known weight. The adults were instructed about the procedure. The scale was readjusted to zero after weighing each adult. They were made to stand erect with the both feet together without any support , looking straight with vision fixed on a point on the opposite wall such that the plan of vision was perpendicular to their body and parallel to the ground .The measurements were recorded to the nearest of 0.5 kg.

Height Measurement: Measurements were plotted on the wall using a non-elastic measuring tape for recording the height of the elderly. Erect heights were obtained with the subjects standing barefoot on the flat surface against the vertical wall with occiput, buttocks and heel touching the wall and arms hanging freely on the sides. A non-elastic plastic ruler was used to localize the upper limit of height measurements. Heights measurements were recorded to the nearest of 0.5cm.

Anthropometric measurements: Height (in meters) - using a stadiometer,
weight (in kilograms) - using DETECTO MEDIC NY USA capacity 140 Kg.
(precision of 100 grams), were measured.
Body mass index (BMI) which is calculated by dividing the body weight in kilogram(Kg) by the square of the height in meters (m).

According to National Programme for Prevention and Control of Diabetes, Cardiovascular Disease and Stroke If BMI is more than 25 is considered as obesity[7]

Skin fold thickness: Skin fold thickness was carried out by venire caliper for triceps , chest ,subscapular area and ant superior iliac spine.

Blood pressure: Blood pressure was measured on the right arm in sitting posture with subject in relaxed state. Standardized mercury Sphygmomanometer with adult size cuff was used. The first appearance of (Phase 1 of Korotkoff sounds) sound was used to define systolic Blood Pressure. The disappearance of sound (phase 5) was used to define Diastolic blood pressure. Two reading were taken five minute apart and the average of two readings was taken as the final blood pressure reading. A person was considered to be hypertensive if he/she were already diagnosed case of hypertension and/or on treatment or with a current SBP of ≥140 mmHg or DBP 90 mm Hg (JNC VIII criteria).The systolic and diastolic pressures should be measured at least three times over a period of at least 3 minutes and the lowest reading recorded.

Waist circumference: In cm, midway between the lower rib margin and the iliac crest in standing position to the nearest 0.5 cm with the help of standard non-elastic measuring tape. Cut-off points used, For males: ≥90 cm. For females ≥80cm.

Hip circumference: In cm, at the widest girth of buttocks in standing position, wearing light cloths to the nearest 0.5 cm with the help of standard non-elastic measuring tape.

Waist: Hip Ratio (WHR): Waist circumference divided by hip circumference. Cut-off points used, For males:≥0.90, For females:≥0.80

Pulse measurement - Pulse was measured in right radial artery in both standing and supine position. The data so collected were entered into computer using Epi Info (version 6.04d) software[6]. Data cleaning was carried out, checked for discrepancies, and rectified.

Table 1 Showing standard Anthropometrical Measurements of Control(n=25) and Obese subjects(n=25):

	Control		Obese	
Parameters	**Mean**	**SD**	**Mean**	**SD**
Age(yrs)	31.44	7.22	31.00	8.40
Height(cm)	168.00	5.28	166.28	5.01
Weight(kg)	61.16	7.64	94.56	11.53
Waist(ms)	79.76	7.35	110.80	1.16
Hip(cm)	87.12	6.88	117.00	17.55
Hip/Waist	1.10	0.09	1.05	0.11
BSA(m^2)	1.70	0.12	2.05	0.13
BMI(kg/m^2)	21.10	2.09	33.50	3.48
Skin fold thickness Tr SF(mm) Sup. Illiac SF(mm) Chest SF(mm) Sub Scap.SF(mm)	14.2 25.8 19.3 19.5	3.9 5.9 3.6 4.3	34.2 68.4 38.1 39.6	9.6 24.4 09.8 11.5

Table-2 Showing Pulse Rate (per min) and Systolic and Diastolic blood pressure in standing and supine postures in controls and obese individuals

	Control		Obese	
Parameters	**Mean**	**SD**	**Mean**	**SD**
PR/min(Standing)	80.16	5.77	85.84	10.83
PR/min(supine)	74.56	5.64	78.00	11.25
SBP in mmHG(Supine)	120.32	9.16	138.00	11.90
DBP in mmHg(Supine)	76.64	5.99	85.36	7.74
SBP in mmHg(Standing)	124.64	8.86	145.36	14.61
DBP in mmHg(Standing)	78.16	5.65	89.68	18.55

Result: The table 1 shows the anthropometrical measurements of control subjects and obese individuals. The mean age of control subjects was 31.44±7.22 years while that of obese individuals was 31.00±8.40 years. The mean heights were 168.00±5.28 and 166.28±5.01 cm of control and obese individuals respectively.

There was significant difference in weight of obese individuals (94.56± 11.53 kg) compared to the weight of control individuals (61.16±7.64 kg). The circumference at Waist and Hip were 110.84±11.16 cm and 117.00±17.55 cm respectively in obese individuals and 79.76± 7.35 cm and 87.12± 6.88 cm respectively in control subjects. The differences in both the parameters were found to be significantly higher in obese individuals compared to control subjects, though the Hip/waist was found non-significant.

The Body Surface Area of control and obese individuals were 1.70±0.12 Sq.m. and 2.05±0.13 Sq.m. respectively. Similarly Body Mass Index of control and obese individuals were 21.10±2.09 kg/m2 and 33.50±3.48kg/m2 respectively. Both the values were significantly higher in obese individuals compared to control subjects, suggesting clear-cut obesity.

The skin fold thickness of various body areas viz. triceps, superior iliac, chest and sub-scapular region were also showed significantly higher values in obese individuals compared to control subjects. The values for triceps skin fold thickness were 14.2±03.9 mm and 3.42±0.96 mm, for superior iliac region were 25.8±0.59 cm and 68.5±24.4 mm, for chest skin fold thickness 19.3±0.36 mm and 38.1±9.8 mm, and for sub-scapular region were 19.5±4.3 mm and 39.6±1.15 mm in control and obese individuals respectively.

The cardiovascular parameters of both the groups were shown in table-2.The pulse rate per minute was taken in standing as well as postures. Similarly systolic and diastolic blood pressure was also measured in both the postures. The values for pulse rate were significantly higher ($P<0.05$) in obese individuals(85.84±10.83 per minute) when taken in standing posture, compared to those of control subjects(80.16±5.77 per minute).Though there was higher pulse rate of obese individuals in supine posture the difference was found to be non significant.

The values of systolic blood pressure were found to be significantly higher($P<0.001$) in obese individuals irrespective of postures(138.00±1.90 mm Hg in supine and 145.36±14.61 mm Hg in standing posture)when

compared with control subjects(120.32±9.16 mm Hg in supine posture and 124.64±8.86 mm Hg in standing posture.)

Similarly, the diastolic blood pressure values were also found to be significantly higher (P<0.001 for standing posture and P<0.01 for supine posture) in obese individuals when compared with the values of control subjects irrespective of postures. The diastolic blood pressure of obese was 85.36±7.74 mm Hg in supine posture and 89.68±18.55 mm Hg in standing posture, while that of control subjects was 76.64±5.99 mm Hg in supine posture and 78.16±5.65 mm Hg in standing posture.

Discussion: In our study age was similar among obese and control individual so we can see the effect of obesity on blood pressure and pulse rate because here age is matched.

In our study the values for pulse rate were significantly higher in obese individuals when taken in standing posture, compared to those of control subjects. The values of systolic blood pressure were found to be significantly higher in obese individuals irrespective of postures in supine and g in standing posture when compared with control subjects in supine posture. Similar finding observed in diastolic blood pressure.

Obesity-associated arterial hypertension is characterized by activation of the sympathetic nervous system, activation of the renin-angiotensin system, and sodium retention, among other abnormalities. So blood pressure measurement is more important in obese individual.[4]

P. Wilson found that he overweight category is associated with increased relative and population attributable risk for hypertension and cardiovascular sequelae. Interventions to reduce adiposity and avoid excess weight may have large effects on the development of risk factors and cardiovascular disease at an individual and population level.[3]

S. Chatterjee concluded that skin folds, BMI and body mass are expectedly higher among obese boys because of their excessive body fat percentage. Standard for BMI and skinfolds are not only tools to measure obesity in boys of the studied population, but prediction equations for %fat from BMI will also be of vital clinical importance during the identification of the signs of obesity.[8]

S. Park observed that waist circumference or waist hip ratio may be a better predictor of CVD risk factors than BMI in Korean adults.[9]

Limitation of this study was whether Obesity causes hypertension or hypertension causes obesity not mentioned. For this prospective cohort study is required study.

Weight loss has been recommended for the obese hypertensive patient and has been shown to be the most effective non-pharmacological treatment approach. In recent years, a modest weight loss, defined as a weight loss of 5% to 10% of baseline weight, has received increasing attention as a new treatment strategy for overweight and obese patients.[10]

Conclusion: Herewith one can conclude that obesity or overweight burdens the cardiovascular system. The cardiac functions are exaggerated with increase in weight. The reduction in body weight may help in reversal of these parameters towards normalcy.

Acknowledgement: We express our sincere thanks to Dr. M.B.Jani and Dr.N.R. Pathak in particular for providing technical guidance.

References:

1. Indian Institute for Population Sciences. National Family Health Survey 4: State Fact Sheet, Gujarat. 2015;1–6.
2. Segula D. Complications of obesity in adults: a short review of the literature. Malawi Med J [Internet]. 2014 Mar [cited 2017 Apr 21];26(1):20–4. Available from: http://www.ncbi.nlm.nih.gov/pubmed/24959321
3. Wilson PWF, D'Agostino RB, Sullivan L, Parise H, Kannel WB, G T. Overweight and Obesity as Determinants of Cardiovascular Risk. Arch Intern Med [Internet]. 2002 Sep 9 [cited 2017 Apr 21];162(16):1867. Available from: http://archinte.jamanetwork.com/article.aspx?doi=10.1001/archinte.162.16.1867
4. Re RN. Obesity-related hypertension. Ochsner J [Internet]. 2009 [cited 2017 May 9];9(3):133–6. Available from: http://www.ncbi.nlm.nih.gov/pubmed/21603428

5. Cabandugama PK, Gardner MJ, Sowers JR. The Renin Angiotensin Aldosterone System in Obesity and Hypertension. Med Clin North Am [Internet]. 2017 Jan [cited 2017 Apr 28];101(1):129–37. Available from: http://www.ncbi.nlm.nih.gov/pubmed/27884224
6. Schütten MTJ, Houben AJHM, de Leeuw PW, Stehouwer CDA. The Link Between Adipose Tissue Renin-Angiotensin-Aldosterone System Signaling and Obesity-Associated Hypertension. Physiology [Internet]. 2017 May 12 [cited 2017 Apr 28];32(3):197–209. Available from: http://www.ncbi.nlm.nih.gov/pubmed/28404736
7. Officer M. National Programme for Prevention and Control of Diabetes , Cardiovascular Disease and Stroke A Manual for Medical Officer. Prev Control. 2009;1–52.
8. Chatterjee S, Chatterjee P, Bandyopadhyay A. Skinfold thickness , body fat percentage and body mass index in obese and non-obese Indian boys. 2006;15(October 2005):231–5.
9. Park S-H, Choi S-J, Lee K-S, Park H-Y. Waist circumference and waist-to-height ratio as predictors of cardiovascular disease risk in Korean adults. Circ J [Internet]. 2009 Sep [cited 2017 May 10];73(9):1643–50. Available from: http://www.ncbi.nlm.nih.gov/pubmed/19638708
10. Mertens IL, van Gaal LF. Overweight, Obesity, and Blood Pressure: The Effects of Modest Weight Reduction. Obes Res [Internet]. 2000 May [cited 2017 Apr 21];8(3):270–8. Available from: http://doi.wiley.com/10.1038/oby.2000.32

Conflict of interest: None
Funding: None
Cite this Article as: Bijal S, Bhavna S, Sangita P, Paresha S. Effect of Obesity on Blood Pressure, Pulse Rate and Skin Fold Thickness. Natl J Integr Res Med 2017; 8(3):93-97