Original Article

Comparison of Pulse Rate and Blood Pressure between Obese and Non-Obese Young Adults

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Abstract

Obesity has been reported to be associated with a number of cardiovascular diseases. Some researchers forecast that obesity may contribute to increase prevalence of high blood pressure in young adults. To compare pulse rate and blood pressure between young obese and non-obese subjects, this cross-sectional analytical study was done in the Department of Physiology, Sylhet MAG Osmani Medical College from January to December 2017. Fifty obese (BMI ≥27.5 kg/m2) and age-sex matched non-obese (BMI 18.5-22.9 kg/m2) young adult were selected. The age (35.56 ± 3.02 years versus 32.40 ± 4.20 years; p=0.116) and sex 26 (52.0%) male versus 31 (62.0%) male; p=0.313) were not differ between obese and non-obese subjects. The mean resting pulse rate (82.98 ± 3.50 beats /minute versus 72.64 ± 3.58 beats/minute; p<0.001), systolic blood pressure (130.20 ± 10.00 mm Hg versus 107.30 ± 10.60 mm Hg; p<0.001) and diastolic blood pressure (80.90 ± 7.19 mm Hg versus 67.90 ± 7.22 mm Hg; p<0.001) were higher in obese compared to non-obese participants. Obesity increases pulse rate and blood pressure in young adults.

Keywords: *Obesity, pulse rate, systolic blood pressure, diastolic blood pressure*

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INTRODUCTION

Obesity may be defined as excessive accumulation of body fat resulting from the positive energy balance.[1] Globally it has become a serious public health challenge. Obesity becomes nearly doubled in past decade worldwide and its incidence continues to be rising rapidly in many countries, leading the World Health Organization to coin the word 'globesity' to explain the worldwide situation.[2] Obesity is become endemic and is approximately tripled worldwide between 1975 and 2016. In 2016 World Health Organization (WHO) reported that over 1.9 billion adult people were overweight and more than 650 million were obese globally. Overall, about 13% of the adult global population (11% and 15% of male and female respectively) was obese in 2016.[3]

Physiologically, obesity is an excess of body fat leading to weight gain.[4] Body Mass Index (BMI) gives the most efficient measure of obesity in population level because it is identical for all ages of adults and also for both sexes. BMI is calculated as weight (kg) divided by height in meters square (BMI=kg/m^2 - Quetelet's Equation).[5] WHO has set standards for normal weight, overweight and obesity by BMI (BMI 18.5-24.9), (BMI 25-29.9) and ≥30kg/m^2 respectively. But, the BMI cut off point for normal weight, overweight and obesity for Asian population are lower than the WHO criteria which are (BMI 18.5-22.9), (BMI 23-27.5) and ≥27.5 kg/m^2 respectively.[6]

Obesity is linked to with a number of cardiovascular (CV) diseases, pro-inflammatory state, coagulation abnormalities and metabolic disturbances like lipid abnormalities, altered glucose metabolism, insulin resistance and development of type 2 diabetes mellitus.[7]

Weight of a person depends on the balance between one's energy intake and energy expenditure. Autonomic nervous system (ANS) encompasses a major part in the adjustment of intake of food with involvement in controlling signals for satiety and expenditure of energy; thus, dysregulation of ANS is a factor for weight gain. Dysregulation of ANS incorporates a bi-directional connection to obesity; ANS alterations may initiate obesity whereas excess weight gain induces dysfunction of ANS.[8] The altered ANS function in obesity consequently results in cardiovascular disorders.

Hence in obesity the study on ANS function is of considerable clinical interest.[9] Disturbed sympathetic nervous system (SNS) function is also of significance in obesity.[10] SNS is the primary regulator of cardiovascular system activity; obesity might trigger alteration within the sympathetic regulation of cardiovascular function, thus favouring the rise in cardiovascular complications and morbidity.[5]

Blood pressure (BP) is regulated by activity within the autonomic nervous system.[11] Obesity is related to sympathetic activation and is the leading explanation of development of hypertension.[12] However, a recent report indicated that the extent of BP did not increase despite a rise in obesity.[13] In an exceedingly large cross sectional study, BMI has been shown to be a stronger index of body fatness compared to waist-hip ratio.[14] Therefore, it is important to assess the effect of obesity on BP and pulse rate, and to clarify to what extent this prevalence of high BP are often accounted for by the presence obesity measured by BMI among young adults.

MATERIALS AND METHODS

This was a cross sectional analytical study was conducted in the Department of Physiology, Sylhet MAG Osmani Medical College from January to December 2017. Fifty obese (BMI ≥27.5 kg/m^2) and 50 non-obese (BMI 18.5-22.9 kg/m^2) persons aged between 18-40 years were selected from staffs, attendants of admitted and outdoor patients in Sylhet MAG Osmani medical College and Hospital were selected. Individuals with diabetes mellitus, chronic kidney diseases, stroke and other neurological disorders, any obvious cardiovascular diseases, chronic obstructive lung diseases, thyroid disorders and hypertension were excluded. Non probability convenient sampling was applied to sampling.

Informed written consent was taken from all the participants after full explanation of the aim of the study. They were informed of their right to withdraw from the study at any stage without any consequences.

All the participants were assessed from history, physical examination. Those who fulfilled the inclusion criteria were enrolled and those fulfilled the exclusion criteria were excluded in this study.

Assessment of Weight and Height: Weight was recorded in kilograms with the participant standing on the weighing balance without shoes and minimum clothing. Weight of the patients and controls were recorded in the same weighing balance. Height was recorded in meter with the subject barefooted, feet together, back and heels against the upright bar of the height scale; head upright in Frankfort horizontal plane – look straight ahead. The height measuring scale has a vertical bar and a horizontal bar of wood which was brought down comfortably on participants' head.

Calculation of Body Mass Index: Body Mass Index (BMI) was estimated using the formula, BMI=Weight in Kilogram's/Height in meters^2.

Grouping of the sample: The participants were divided into two groups by their body mass index. Group A consisted of obese subjects with BMI ≥27.5 kg/m^2 and Group B consisted of non-obese subjects with BMI between 18.5-22.9 kg/m^2 each consisting 50 sample.

Measurement of blood pressure and pulse rate: Blood pressure was measured on right arm by auscultation method with a standardized clinical sphygmomanometer using an appropriate cuff. A stethoscope was placed over the brachial artery pulse, proximal and medial to the cubital fossa, and below the underside fringe of the cuff. BP measurements were taken 5 min after resting with the subject in sitting position. The cuff was rapidly inflated to pressure above the extent at which the radial pulse could now not be felt. According to appearance of Korotkoff sound was recorded as systolic BP, then the mercury was allowed to fall further till the sound ceased to be tapping in quality, became muffled and then disappeared was noted as diastolic BP. A mean of two recordings (each one minute apart) was taken. Pulse rate was calculated by palpation of radial pulse for one minute.

Statistical Analysis: Collected data were processed and analyzed with the assistance of Statistical Package for Social Science (SPSS) Version 22.0. Quantitative data were expressed as mean and standard deviation; and comparison was done using Chi-quare (χ^2) test. Qualitative data were expressed as frequency and percentages; comparison was done using unpaired t test. P value of <0.05 was taken as significant.

Ethical Consideration: After explaining the aim of study, informed written consent was taken from each subject. The consent form clearly described the aim, objectives and method of study, confidentiality of the interview, risk and good things of participating in the study, their right to participate voluntarily and refuse at any point of time from the study were explained to the respondents .

Prior to the starting of the study, the research protocol was submitted to the ethical review committee of Sylhet M.A.G Osmani Medical College, Sylhet and an approval was obtained.

RESULTS

Table I shows the age (mean ± SD) was 35.56 ± 3.02 (range, 22-38) years in obese participants and was 32.40 ± 4.20 (range, 22-38) years in non-obese participants. The age difference of obese participants and non-obese participants did not reach the level of significance (t=1.585; p=0.116).

There were 26 (52.0%) male and 24 (48.0%) female in obese group; whereas 31 (62.0%) male and 19 (38.0%) female in non-obese group. The sex difference between the participants of obese and non-obese group failed to show any statistically significant difference (χ^2=1.020; p=0.313).

Table I. Comparison of Participants According to Demographic Characteristics

Demographic characteristics		Study group		p value
		Group-A (n=50)	Group-B (n=50)	
Age (mean ± SD) years		35.56 ± 3.02	32.40 ± 4.20	†p=0.116
Sex	Male	26 (52.0%)	31 (62.0%)	*p=0.313
	Female	24 (48.0%)	19 (38.0%)	

*Chi-Square (χ^2) Test and †unpaired't' test were applied to analyze the data. SD: Standard deviation.

Table II shows the height (mean ± SD) of the obese participants was 1.61 ± 0.07 (range 1.47-1.78) meters; whereas the height of the non-obese participants was 1.63 ± 0.08 (range 1.42-1.73) meters. The height of obese and non-obese participants failed to differ significantly (t=-1.599; p=0.113).

The weight (mean ± SD) of the obese participants was 76.39 ± 10.08 (range 42-181) Kg; whereas the weight of the non-obese participants was 57.14 ± 6.56 (range 42-85) Kg. The weight of the obese participants was higher significantly compared to non-obese participants (t=11.316; p<0.001). The BMI (mean ± SD) of the obese participants was 29.39 ± 2.27 (range 18.3-31.9) Kg/M^2; whereas the BMI of the non- obese participants was 21.34 ± 1.02 (range 18.7-38.0) Kg/M^2. The BMI of obese was higher significantly compared to non-obese participants (t=22.885; p<0.001).

Table II. Comparison of participants by anthropometric status

Anthropometric status	Study subjects		p value
	Group-A (n=50)	Group-B (n=50)	
Height (Cm)	1.61 ± 0.07	1.63 ± 0.08	*p=0.133
Weight (Kg)	76.39 ± 10.08	57.14 ± 6.56	*p<0.001
BMI (Kg/M2)	29.39 ± 2.27	21.34 ± 1.02	*p<0.001

*Unpaired t test was employed to analyse the data.
Data were presented as mean ± SD (standard deviation).

Table III shows the resting pulse rate (mean ± SD) was 82.98 ± 3.50 (range 76-90) beats /minute in obese participants and 72.64 ± 3.58 (range 68-80) beats/minute in non-obese participants; the resting pulse rate was higher significantly in obese compared to non-obese participants (t=14.602; p<0.001).

The resting systolic blood pressure (mean ± SD) was 130.20 ± 10.00 (range 100-150) mm Hg in obese participants and was 107.30 ± 10.60 (range 90-140) mm Hg in non-obese participants; the SBP was higher significantly in obese compared to non-obese participants (t=11.110; p<0.001).

The resting diastolic blood pressure (mean ± SD) was 80.90 ± 7.19 (range 60-90) mm Hg in obese participants and was 67.90 ± 7.22 (range 60-85) mm Hg in non-obese participants; the DBP was higher significantly in obese compared to non-obese participants (t=9.020; p<0.001).

Table III. Comparison of participants according to resting pulse and blood pressure

Parameters	Study subjects		p value
	Group-A (n=50)	Group-B (n=50)	
Pulse (beats/min)	82.98 ± 3.50	72.64 ± 3.58	*p<0.001
SBP (mm Hg)	130.20 ± 10.00	107.30 ± 10.60	*p<0.001
DBP (mm Hg)	80.90 ± 7.19	67.90 ± 7.22	*p<0.001

*Unpaired t test was employed to analyse the data.

Data were presented as mean ± SD (standard deviation).

DISCUSSION

In this study, subjects with BMI greater than 27.5 were categorized into obese and those with BMI 18.5 to 22.9 kg/m^2 as non-obese.[15]

This study revealed that the mean age was 35.56 ± 3.02 and 32.40 ± 4.20 years (p=0.116); sex 52.0% male versus 62.0% male (p=0.313) did not differ significantly between two groups of participants. Akhter et al.[10] supported this result that obese and non-obese participant were matched for age and sex. Shibao et al.[16] also reported that the mean age was 35 ± 3.0 and 32 ± 3.0 years (p=0.256); and equal number of male and female obese and non-obese respectively.

This study showed that the height of the obese participants was 1.61 ± 0.07 meters and non-obese participants was 1.63 ± 0.08 meters. The height of obese and non-obese participants failed to differ significantly (p=0.113). This result correlated with Shenoy et al.[17] that the height of both obese and non-obese participants failed to differ significantly (p=0.50). This result was also concordance with the study of Akhter et al.[10] that the height of both obese and non-obese participants failed to differ significantly (p>0.05).

This study showed that the weight of the obese participants was 76.39 ± 10.08 Kg; and the non- obese participants was 57.14 ± 6.56 Kg. The weight of the obese participants was higher than that of non-obese participants (p<0.001). This finding was consistent with the study of Akhter et al.[10] that the weight of obese was greater than that of non-obese. Shetty et al.[18] also reported that the weight of the obese was greater than that of non-obese (p<0.001).

In the current study BMI of the obese participants was 29.39 ± 2.27 and the non- obese participants was 21.34 ± 1.02 Kg/M^2. BMI of obese was greater than that of non-obese participants (p<0.001). This result was consistent with Chaudhuri et al.[19] that BMI of the obese participants was greater compared to non-obese participants. This result was also supported by Akhter et al.[10] that BMI of the obese participants was greater compared to non-obese participants.

The resting pulse rate was 82.98 ± 3.50 beats /minute in obese participants and 72.64 ± 3.58 beats/minute in non-obese participants. The resting pulse rate of the obese participants was greater the non-obese participants (p<0.001). This result correlated with the study of Chaudhuri et al.[19] that the resting pulse rate of the obese participants was greater than that of non-obese participants. This result was also supported by Das and Mondal,[8] that resting pulse rate of obese group was greater compared to that of non-obese group (p = 0.01). But Shenoy et al.[17] failed to find significant disparity in the resting pulse rate between obese group participants and non-obese participants (p= 0.67).

In the current study the resting SBP (mm Hg) was 130.20 ± 10.00 in obese participants and was 107.30 ± 10.60 in non-obese participants. The SBP of the obese participants was greater significantly compared to that of non-obese participants (p<0.001). Das and Mondal,[8] supported this result that resting SBP of obese group was greater significantly compared to the SBP of non-obese group. But Chaudhuri et al.[19] failed to find significant discrimination between the SBP of obese group and non-obese group (p=0.22).

This study demonstrated that the resting DBP (mm Hg) was 80.90 ± 7.19 in obese participants and 67.90 ± 7.22 in non-obese participants. The DBP of the obese participants was greater significantly than that of non-obese participants (p<0.001). Das and Mondal,[8] supported this result that resting DBP of obese group was greater

significantly than the DBP of non-obese group. But Kalpana et al.[20] found no significant disparity in the DBP between obese group and non-obese group (p>0.05).

Limitations of the study were (1) This study was done in a single tertiary care hospital, (2) sample size was small due to time constrain and (3) sampling was non-random.

CONCLUSIONS

Obesity is related to increased pulse rate and blood pressure in young obese subjects. Therefore, young obese subjects are more prone for risk of development of hypertension or other cardiovascular disorders in later stages of their life. Hence further studies involving multicenter and large sample are of utmost needed to succeed in a legitimate conclusion.

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