RESEARCH ARTICLE

EVALUATION OF AUTONOMIC FUNCTIONS IN OBESE AND NON-OBESE MEDICAL STUDENTS

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ABSTRACT
Background: Obesity a major risk factor for many acute and chronic disorders, including cardiovascular and cerebrovascular disease and diabetes.
Aims & Objective: To evaluate autonomic functions in obese and non-obese medical students.
Materials and Methods: A total of 30 non obese and 30 obese medical students in age group of 18-25 years who have satisfied inclusion and exclusion criteria and have consented to participate in study were enrolled. Each enrolled subjects baseline blood pressure (BP) was recorded and evaluation of autonomic function was done using Hand grip dynamometry and Cold pressure test values.
Results: There was significant difference in autonomic parameters values between obese and non-obese students, indicative of deranged autonomic and cardiac functions in obese.
Conclusion: Implementation of early interventional programs (weight reduction, life style changes and physical exercise) to prevent obesity related cardiovascular sequelae in future.
Key Words: Body Mass Index (BMI); Blood Pressure; Autonomic Functions

Introduction

Obesity is a disorder of energy balance affecting wide range of people belonging to diverse ethnic groups, age and socioeconomic status. Prevalence of overweight and obesity is increasing in adolescents in India which is a concern in terms of the complications being seen in the later stage of life if not taken care of in time.

The causes of obesity are manifold that include lack of regular exercise, sedentary habits, over consumption of high calorie foods, and genetic, perinatal and early life factors.[1] Obesity has been found to have a positive correlation with endocrinal dysfunction, lipid profile, hypertension, insulin resistance and morbidity from coronary heart disease in adulthood.[2]

The direct effects of the obese state on heart function, and the means by which excessive body fat might be negatively affecting cardiac health during the growing years, however this has received less attention. It is well-recognized that cardiac mass and chamber dimensions are increased in the obese adult, which is reflected in a greater resting stroke volume and cardiac output. Given sufficient duration and/or severity of obesity, this hyperkinetic state is supplemented by increasing evidence of systolic and diastolic myocardial dysfunction, which may progress to overt clinical heart failure. The cause of this myocardial dysfunction is unclear, but chronic volume overload, insulin resistance, autonomic changes, and local metabolic derangements have all been implicated as possible etiologic factors. This information is beginning to emerge as the effects of adiposity on cardiac health of adolescents. These data indicate trends of diminishing ventricular function in youth related to level of obesity; however, overt myocardial dysfunction is rare, and reserve capacity with exercise is generally preserved. Given the marked rise of obesity in youth, an understanding of the pathophysiological implications of these effects early in the lifespan is clearly important. Such information underscores the urgency of preventive efforts and serves to help define specific management strategies.[3]

Current study is undertaken to find out the correlation between obesity and associated alterations in cardiovascular functions.

Materials and Methods

Study Design: 60 Students in the age group 18-25 years were randomly selected to obtain mixed group of students from M.G.M. Medical College and were screened to identify, (i) Non obese group: healthy with BMI < 23 kg/m^2; and (ii) Study group (obese): healthy with BMI > 23 kg/m^2.

Table-1: WHO Classification of adults according to BMI[10]	
Classification	**BMI (kg/m²)**
Normal	18.5-22.9
Average Overweight	> 23
At risk – Increased	23 - 24.9
Obese –I: Moderate	25 - 29.9
Obese – II: Severe	> 30

Method: Inclusion criteria included, (i) Students in the age group of 18-25 years; (ii) Students who are obese to their respective age and sex were selected. 30 obese students and 30 non-obese students were selected according to the parameters mentioned. Exclusion criteria were comprised of, (i) students suffering from any medical ailments; (ii) anxious, apprehensive and uncooperative students; and (iii) any history of smoking, addiction of tobacco, use of any medications to be excluded from the study. Institutional ethical clearance was obtained. Body mass index was calculated as per the formula:

$$Body\ Mass\ Index\ (BMI) = \frac{Weight\ (kg)}{Height\ (m^2)}$$

The students having BMI of more than the cut-off value for their respective age and sex were designated as the test/obese group (both overweight and obese students to be clubbed together). Identical number of age and sex matched non-obese medical students served as controls. Students were explained about the procedures to be undertaken. A brief personal history was taken and written consent was obtained as per Helinski declaration modified according to the test protocol, (i) The subjects were made to rest for 10 min before recording their baseline systolic and diastolic blood pressure along with mean blood pressure as per standard procedure. (ii) Two recordings of blood pressure were taken from which the average baseline blood pressure (systolic or diastolic) was obtained before each of the following test.

Cold Pressor Test (CPT): The right hand of the subject was immersed up to the wrist in cold water at a temperature of 4°C for 1 minute. Blood pressure was recorded at 30 seconds and 1 minute after the submersion of the hand. After taking out the hand, blood pressure was recorded after every minute, till it returned to the baseline. The subjects were given rest for about 30 minutes before performing next test.

Handgrip Dynamometer Test (HGT): The baseline systolic and diastolic blood pressure values were recorded. The subjects were asked to perform Maximal Voluntary Contraction (MVC) by gripping the handgrip dynamometer, as hard as possible for few seconds and the maximum force exerted was noted down. After giving rest for a few minutes, the subjects were made to perform isometric exercise at 30% of the maximal voluntary contraction to the point of fatigue. Systolic and diastolic blood pressure recordings were taken at intervals of each minute during the period of exercise. The mean systolic and diastolic blood pressure, the increase in systolic and diastolic blood pressure during the isometric exercise were calculated and the maximal values of systolic and diastolic BP achieved during exercise were noted down.

Statistical Analysis: Results were analyzed by using Unpaired Student T-test with "P" value < 0.05 for significance.

Results

60 subjects [Group A (non-obese): n = 30 and Group B (obese): n = 30) that have satisfied the inclusion and exclusion criteria were selected. Two groups for the study were similar in age in terms of basic characteristics. Group A and Group B showed significant difference in Height, Weight and BMI (p<0.001) Table-2.

Table 3 shows comparison of handgrip dynamometry and table 4 shows comparison of cold pressor test values as follows:

- Group B subjects showed significant increase in Baseline diastolic BP (p<0.001) when compared to Group A in changes from the observed values.
- Group B subjects showed significant increase in Maximum diastolic BP (p<0.001) when compared to Group A in changes from the observed values.
- Group B subjects showed significant decrease in Change in diastolic BP (p<0.001) when compared to Group A in changes from the observed values.

Table-2: Comparison of height, weight, BMI in groups

Groups	Height (mean ± SD)	Weight (mean ± SD)	BMI (mean ± SD)
Group A	169.9 ± 12.89	55.00 ± 9.396	19.09 ± 2.652
Group B	163 ± 13.19	78.50 ± 9.641	30.12 ± 6.356

Table-3: Handgrip dynamometry analytical values

Blood Pressure	Group A	Group B	P value
Baseline diastolic	74.07 ± 3.463	83.33 ± 4.405	< 0.0001 significant
Maximum diastolic	82.33 ± 4.397	90.87 ± 4.629	< 0.0001 significant
Change in diastolic	8.133 ± 2.161	7.533 ± 1.795	Not significant

Table-4: Comparison of cold pressor test values

Blood pressure	Group A	Group B	P-value
Baseline diastolic	71.40 ± 4.304	82.13 ± 5.680	< 0.0001 significant
Maximum diastolic	80.40 ± 5.103	87.67 ± 4.104	< 0.0001 significant
Change in diastolic	8.533 ± 2.285	5867 ± 2.345	Not significant

Discussion

Autonomic instability enhanced basal vasoconstrictor tone and pressor response to applied cold stimulus could make these obese Subjects prone to hypertension and other cardiovascular disorders later in life. The results of the present study indicate high baseline diastolic blood pressure (DBP) values prior to cold pressor test and isometric exercise in the obese group. The high values of baseline DBP had a significant positive correlation with BMI. These results of our study are in line with the results of Ribeiro et al.[4] and Guizar et al.[5] who have observed increased blood pressure levels in obese group as compared to their control counterparts.

The Cold pressor test (CPT) elicits the pressor response to a cold stimulus and is an indicator of vasoconstrictor tone. The response of blood pressure to Cold pressor test is characteristic for the individual. In the present study, the maximal/ceiling value as well as range/response (Δ) of diastolic blood pressure during cold pressor test was found to be higher in obese group subjects as compared to lean group. Hines and coworkers[6] indicated that the vasopressor response to locally applied cold was due to an increase in the total peripheral resistance as a result of vasoconstriction and that the cardiac output did not change. On the contrary, Hejl[7] has mentioned that the pressor response in most normotensive subjects was due to a rise in cardiac output and the pressor response in hypertensive subjects was due to an increase in peripheral resistance.

For the Isometric exercise, the obese group revealed truncated response as compared to the lean group. Ewing et al.[8] have defined a rise of diastolic blood pressure of 15 mmHg or more as normal, 11–15 mmHg as borderline and 10 mmHg or less as abnormal, response to Handgrip dynamometer test. The obese in the present study showed borderline response while the group children exhibited normal response. During Handgrip dynamometer test, the literature mentions heart rate dependent increase in cardiac output and blood pressure with little change in total peripheral resistance.[9] Thus the responses observed during the Cold pressor test and Handgrip dynamometer test have been explained on varied Physiological principles.

Conclusion

There was significant difference in the autonomic parameters (Cold pressor test and hand grip dynamometry) values between obese and lean subjects. This paves the way for implementation of early interventional programs (weight reduction, life style changes, and physical exercises) to prevent the onset of obesity related cardiovascular sequelae in the future by early intervention.

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