

Effect of obesity on parasympathetic nervous system

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Abstract

Introduction: Obesity is associated with adverse and deranged cardiovascular events which could be due to the altered Sympathetic and parasympathetic balance seen in these individuals. In recent times Obesity is recognized and considered as a Major, worldwide, health issue.

Material and Method: The Present study was conducted in the Department of Physiology, Index Medical College, Indore (MP). 50 Obese (25 male and 25 female) and 50 non obese (25 male and 25 female) young adults were included. A parasympathetic test was performed on both the groups. All data are expressed as mean± standard deviation. Comparison between groups of obese male, non-obese male, obese female and non-obese female was performed using student's t-test (t-test for two independent samples / Two-tailed test). Differences was considered significant at $p < 0.05$.

Result: It was observed that obese young adults had reduced parasympathetic activity.

Conclusion: This altered balance of Autonomic Nervous system increases the risk of cardiovascular disorders.

Keywords: Obesity, cardio-vascular disease, parasympathetic system and obesity

Introduction

The Physiology of Human body, orchestrated through endocrine and neural pathways, allows humans to sustain and survive starvation for as long as several months. However, in the presence of nutritional abundance and sedentary life, that is also influence importantly by genetic endowment, this system increases adipose energy stores and produces adverse health issues ^[1]. Epidemiological data shows that prevalence rates are increasing in industrialized countries as well as developing countries, especially in adolescent population ^[2]. Almost 60% of individuals having obesity are suffering from metabolic syndrome (which include increased abdominal circumference, high blood pressure, increased blood triglycerides, elevated fasting blood glucose level and increase in low density lipo-protein). Certain type of cancers (Colon, ovarian, and breast), thromboembolic disorders, Gastro-intestinal tract disorders (Gall bladder pathology, gastro-esophageal reflux disease), and skin disorders are also more prevalent in obese population. Surgical and Obstetrics risks are higher with obesity. Obese patients also have a greater risk of pulmonary functional impairment including

Obstructive sleep apnea, endocrine abnormalities and proteinuria [3].

The autonomic imbalance (sympathetic and parasympathetic) in obesity can lead to an increased incidence of sudden cardiac death [4, 5]. Autonomic disturbance is also associated with increased sympathetic activity and reduced vagal tone in the pathophysiology of arrhythmias and sudden cardiac death [6]. An elevated vagal activity often exerts a beneficial effect in obesity [7]. Rapid weight gain is associated with increased cardiac sympathetic tone in humans [8].

Present study is an attempt to find out the effect of obesity on parasympathetic autonomic functions in young obese individuals. Early establishment of this correlation will help in preventing future cardiac autonomic disturbances e.g. congestive heart failure, coronary artery disease, hypertension etc.

Materials and Methods

The present study was conducted in the Department of Physiology, Index Medical College & Research centre, Indore, MP. The sample size was collected among the students of Index Medical College, Index Dental College. A total of 100 students of age group 18-26 years were included. They were divided into 4 groups on the basis of obesity and gender.

Group 'A' consisted of 25 obese boys [OB+ boys].

Group 'B' consisted of 25 obese girls [OB+ girls].

Group 'C' consisted of 25 Non obese boys [OB- boys].

Group 'D' consisted of 25 Non obese girls [OB- girls].

Inclusion criteria: Age group of 18-26 years. Both gender included.

Exclusion criteria: Known case of diabetes mellitus, hypertension, cardiovascular diseases or Endocrine disorders; on any drug that may alter parasympathetic autonomic functions of their body; chronic smokers and chronic alcoholics.

Tests of parasympathetic functions: Heart rate response to slow deep breathing (E: I ratio).

When subjects became comfortable, the procedure was explained to them before recording was done. Subjects was asked to lie quietly on the couch and was connected to ECG monitor (BPL India Cardiac Model 308) and the heart was recorded in the standard limb lead II. The arterial blood pressure was measured from a mercury sphygmomanometer. First the resting heart rate and blood pressure was recorded in lying position.

Slow deep breathing test

Deep autonomic breathing at a ratio of six cycles per minute is probably the most common and reliable test to assess respiratory sinus arrhythmia, with acceleration of heart rate during inspiration and deceleration during expiration under optimized conditions [9].

Subject in supine posture was instructed to inspire with the examiners index finger going up and expire when the finger goes down to regulate his/her respiratory rate at 6 cycles per minute. The E: I ratio (Expiratory: Inspiratory Ratio) is the ratio of maximum and minimum R-R intervals during expiration and inspiration respectively during the maneuver. The E: I ratio above 1.20 was considered normal.

Statistical analysis

Statistical analysis was done using Microsoft Excel software, Microsoft Corporation U.S.A

2016. For each variable group mean and standard deviation of the mean, were calculated according to accepted statistical methods. Mean differences were tested for significance by student's Unpaired 't' test. The statistical significance was assigned at $p < 0.05$.

Observation and Results

The present study was carried out in the Department of Physiology, Index Medical College and Research centre, Indore, M.P. A total of 100 students in the age group of 18-26 years were studied.

Tests for parasympathetic function deep breathing test (E: I Ratio)

Table 1: Comparison of Expiratory Inspiratory ratio (E:I) by Student 't' test during deep breathing test in group A (Obese boys) and group B (non-obese boys)

	Group A (Obese boys)	Group B (Non obese boys)	p-value
E: I Ratio			
Mean± SD	1.34± 0.07	1.46± 0.10	<0.001

Table 2: Comparison of Mean values of Expiratory Inspiratory ratio (E:I) by student t test in Group C (obese girls) & D (non-obese girls)

	Group C (Obese girls)	Group D (Non obese girls)	p-value
E:I Ratio			
Mean± SD	1.37± 0.1	1.47± 0.08	<0.001

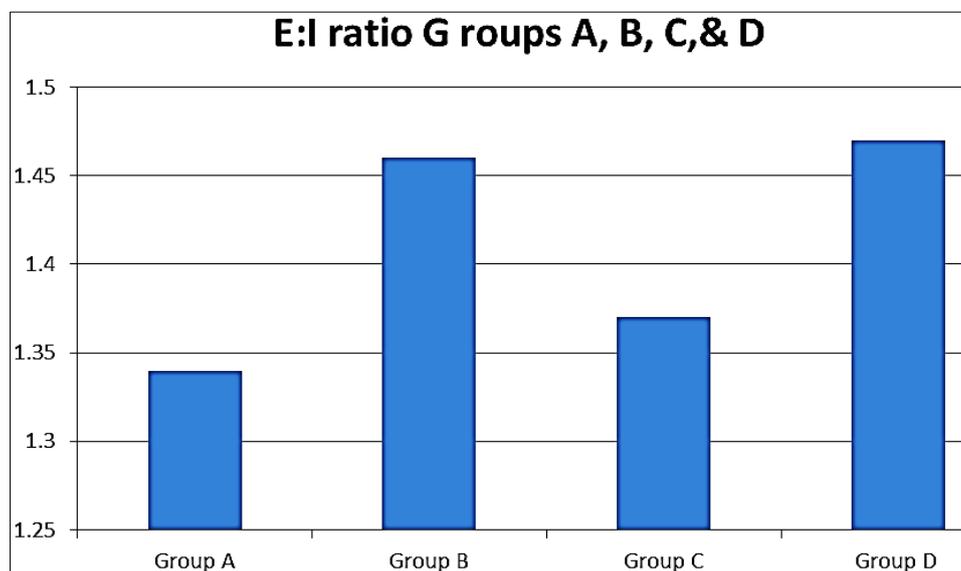


Fig 1: Comparison of mean values of Expiratory Inspiratory ratio (E: I) in Group A (Obese boys), Group B (non-obese boys), Group C (obese girls), Group D (non-obese girls).

Discussion

The present study was planned to explore the effect of obesity on autonomic functions in young adults in the age group of 18-26 years among 100 subjects. The subjects were divided into either obese or non-obese on the basis of their Body mass index (BMI) and Body Fat percentage (BF%).

The results of present study showed the decreased E: I ratio in obese subjects as compared to control subjects. It indicates the decreased activity of parasympathetic nervous system and

baroreflex sensitivity in obese subjects.

E: I ratio was negatively associated with obesity that's the E: I ratio was decreased in obese [10], as compared to controls which is similar to our study. The effect of obesity on cardiac autonomic activity and found the presence of E: I decrement along with increased level of sympathetic activity in obese group [11], which is contradictory to our studies.

Baroreceptor resetting may occur in obese individuals due to atherosclerosis that hardens the carotid sinus walls. This causes decrease in compliance. Our study shows the result in support with Emdin M *et al.*, 2001 which states that there is decrease in sympathetic and parasympathetic activity in obese people as compare to normal subjects [12]. Borne *et al.* also showed the same results in their study in 1999 [13]. Obesity is associated with both sympathetic and parasympathetic nervous system dysfunction [14].

People with metabolic syndrome (Obesity, Insulin resistance and dyslipidemia) are known to be at higher risk for cardiovascular disease (CVD). A 10% increase in body weight above an individual's usual weight is accompanied with a decrease in parasympathetic activity. The effect of increased weight is one mechanism for cardiac alterations such as arrhythmias that accompany obesity.

In this study obese subjects had significantly lower autonomic functions as compared to non-obese subjects. Similar results were found by Tetsuya Kemura [15].

Conclusion

Obesity has major negative effects on health. Epidemic of chronic non-communicable diseases have also been associated with increasing obesity. Decreased E:I ratio in obese subjects as compared to the control subjects indicates the decreased activity of parasympathetic nervous system and baroreflex sensitivity in obese subjects.

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