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Physiology

OBESITY: EFFECT ON PARASYMPATHETIC NERVOUS SYSTEM

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ABSTRACT

Background: Obesity is associated with adverse cardiovascular events which could be due to the altered autonomic balance seen in these individuals. Nowadays obesity is recognized as a major, worldwide, health problem.

Material and Method: The present study was conducted in the Department of Physiology, at National Institute of Medical Sciences and Research, Jaipur. 50 obese (25 male and 25 female) and 50 non obese (25 male and 25 female) were included. Parasympathetic tests were performed on both groups. All data are expressed as mean± standard deviation. Comparison between groups obese male, non obese male, obese female and non obese female was performed using the student's t-test (t-test for two independent samples / Two-tailed test). Differences was considered significance at $p<0.05$.

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

Conclusion: This altered balance of the autonomic nervous system increases the risk of cardiovascular disorders.

KEYWORDS : Cardiovascular diseases and obesity, Obesity, Parasympathetic system and obesity

INTRODUCTION

The physiology of body, orchestrated through endocrine and neural pathways, permits humans to survive starvation for as long as several months. However, in the presence of nutritional abundance and a sedentary lifestyle, that is also influenced importantly by genetic endowment, this system increases adipose energy stores and produces adverse health consequences [1].

Epidemiological data shows that prevalence rates are increasing not only in industrialized countries but also in developing countries especially in the adolescent population [2].

Approximately 60% of individuals with obesity are suffering from the metabolic syndrome (including elevated abdominal circumference, high blood pressure, increased blood triglycerides, raised fasting blood sugar and increase in low density protein). Certain cancers (colon, ovary and breast), thromboembolic disorders, digestive tract diseases (gallbladder disease, gastroesophageal reflux disease), and skin disorders are also more prevalent in the obese population. Surgical and obstetric risks are greater with obesity. Obese patients also have a greater risk of pulmonary functional impairment including sleep apnea, endocrine abnormalities and proteinuria [3].

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

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

MATERIALS AND METHODS

The present study was conducted in the Department of Physiology, National Institute of Medical Sciences and Research, Jaipur Rajasthan. The sample size was collected among the students of NIMS Medical college, Dental College and College of Paramedical technology. The study was conducted from January 2018 to June 2018. 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.

1. Group 'A' consisted of 25 obese boys [OB+ Boys]
2. Group 'B' consisted of 25 obese girls[OB- Boys]
3. Group 'C' consisted of 25 Non-obese boys [OB+ Girls]
4. Group 'D' consisted of 25 Non-obese girls [OB- Girls]

Inclusion criteria: Age group of 18-26 years. Both gender included.
Exclusion criteria: Subjects who were not interested to take part in the study; Known cases of diabetes mellitus, hypertension, cardiovascular diseases or Endocrine disorders; on any drug that may alter parasympathetic autonomic function of their body; Chronic smokers and chronic alcoholics.

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

When subjects became comfortable, the procedure was explained to them before recording was done. Subject was asked to lie quietly on the couch and was connected to as ECG monitor (BPL India Cardiac Model 308) and the heart rate 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 averaged 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 Students 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,

National Institute of Medical Sciences and Research, Jaipur Rajasthan. 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)

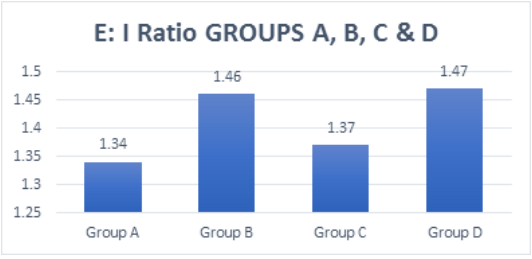
Table No. 1: Comparison of Expiratory Inspiratory Ratio (E:I) by Student t test during deep breathing test in group A (obese boys) and B (non-obese boys).

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

Table No. 2: Comparison of mean values of Expiratory Inspiratory ratio (E: I) by Student t test by Student t test in Group C (obese girls) & D (non-obese girls).

	Group A (obese boys)	Group B (non-obese boys)	p-value
E:I Ratio Mean ± SD	1.37 ± 0.1	1.47 ± 0.08	< 0.001

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



DISCUSSION

The present study was planned to explore the effect of obesity on autonomic functions in young adults within the age group of 18-26 years among 100 subjects. The subjects were segregated into either obese or non-obese by evaluating their Body Mass Index (BMI) and Body Fat Percentage (BF%).

The results of our present study showed the decreased E:I ratio in obese subjects as compared to the 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 elevated 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 decreases compliance. Our study shows the results 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 (central obesity, insulin resistance and dyslipidemia) are known to be at higher risk for cardiovascular diseases (CVD). A 10% increase in body weight above an individuals' usual weight is accompanied with a decrease in parasympathetic activity. The effect of increased weight is one mechanism for cardiac alterations such as arrythmias 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 adverse 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 baro reflex sensitivity in obese subjects.

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