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Original Research Article.

Assessment of Effect of Obesity on Parasympathetic Nervous System: An Institutional Based Study

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ABSTRACT

Background: Obesity is a challenge for global public health. The ANS autonomic nervous system (ANS) plays a central role in the communication between the CNS and the gastrointestinal system either in short-term or in long-term regulation of body weight. Hence; we planned the present study to assess the effect of obesity on parasympathetic nervous system.

Materials & Methods: The present study included evaluation of Effect of Obesity on Parasympathetic Nervous System. A total of 200 subjects were included in the present study. Among these 200 subjects, 100 were obese while the remaining 100 were non-obese. Complete demographic and clinical details of all the obese and non- obese subjects were obtained. Cold Pressor test (CPT) was done. Based on the criteria mentioned in the previous literature, autonomic neuropathy was considered to occur when systolic BP failed to rise by 16 to 20 mm of Hg or diastolic BP failed to rise by 12 - 15 mm of Hg. All the results were compiled on Microsoft excel sheet and were analyzed by SPSS software.

Results: Non- significant difference was obtained while comparing the heart rate response to immediate standing between subjects of both the study groups. CPT systolic blood pressure value for subjects of the obese and non-obese group was 8.4 and 11.0 respectively. We obtained significant difference while comparing the CPT- systolic blood pressure value in between subjects of both the study groups. However; non- significant difference was obtained while comparing the CPT- diastolic values in between subjects of both the study groups.

Conclusion: Some degree of autonomic nervous system dysfunction is associated with obesity.

Key words: Nervous System, Obesity, Parasympathetic.

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INTRODUCTION

Obesity is a challenge for global public health. Obesity may induce the onset of other conditions leading to overt cardiovascular disease, such as glucose intolerance, dyslipidemia, impaired glucose tolerance and type 2 diabetes, hypertension, and kidney failure. Being overweight or obese increases the risk for cardiovascular disease through multiple mechanisms, including diabetes, dyslipidemia, atherosclerosis, renal disease, and hypertension. Although these disorders often occur together and have been termed the "metabolic syndrome", they are almost always initiated by obesity.[1-3]

The afferent vagal pathways are probably the most important link between the gut and the brain and interact in a complex way with gut hormones. Sympathetic nervous system has the physiological function of increasing lipolysis and energy expenditure, through sympathetic innervation in white and brown adipose tissue; thus it is abnormally activated in obesity in a compensatory but ineffective fashion.[4-6] I t is clear that any dysfunction in the pathways involved in maintaining body weight homeostasis may lead to weight gain and obesity. The ANS plays a central role in the communication between the CNS and the gastrointestinal system either in short-term or in long-term regulation of body weight.[7] Hence; we planned the present study to assess the effect of obesity on parasympathetic nervous system.

MATERIALS & METHODS

The present study was planned in the department of Department of Physiology, Dr. S.N. Medical College, Jodhpur, Rajasthan, India, and it included evaluation of Effect of Obesity on

Parasympathetic Nervous System. From all the subjects, written consent was obtained after explaining in detail the entire research protocol. A total of 200 subjects were included in the present study. Among these 200 subjects, 100 were obese while the remaining 100 were non-obese. Criteria for defining obese and non-obese were as follows:

- Subjects with BMI (body mass index) less than 30 Kg/m^2 were categorized as non- obese,
- Subjects with BMI of more than 30 Kg/m^2 were categorized as obese.

Diabetic and hypertensive patients were excluded from the present study. We also excluded patients who had positive history of any form of psychiatric disorder, or had positive history of intake of any ANS (autonomic nervous system) affecting drug. Complete demographic and clinical details of all the obese and non- obese subjects were obtained. Following parameters of all the subjects was recorded based on criteria's described previously in the literature.

- Heart rate response to immediate standing - Ratio of 1.00 was taken as normal and value of less than 1.00 was considered as abnormal.[8]
- Cold Pressor test (CPT)- Immersion of the hand of the subjects in the cold water was done followed by maintenance of the temperature at 4-6 °C throughout procedure. Recording of the maximum rise in systolic and diastolic pressures was done. Based on the criteria mentioned in the previous literature, autonomic neuropathy was considered to occur when systolic BP failed to rise by 16 to 20 mm of Hg or diastolic BP failed to rise by 12 -15 mm of Hg.[9, 10]

All the results were compiled on Microsoft excel sheet and were analyzed by SPSS software. Chi- square test was used for evaluating the results.

Graph 1: Comparison of demographic details of the subjects

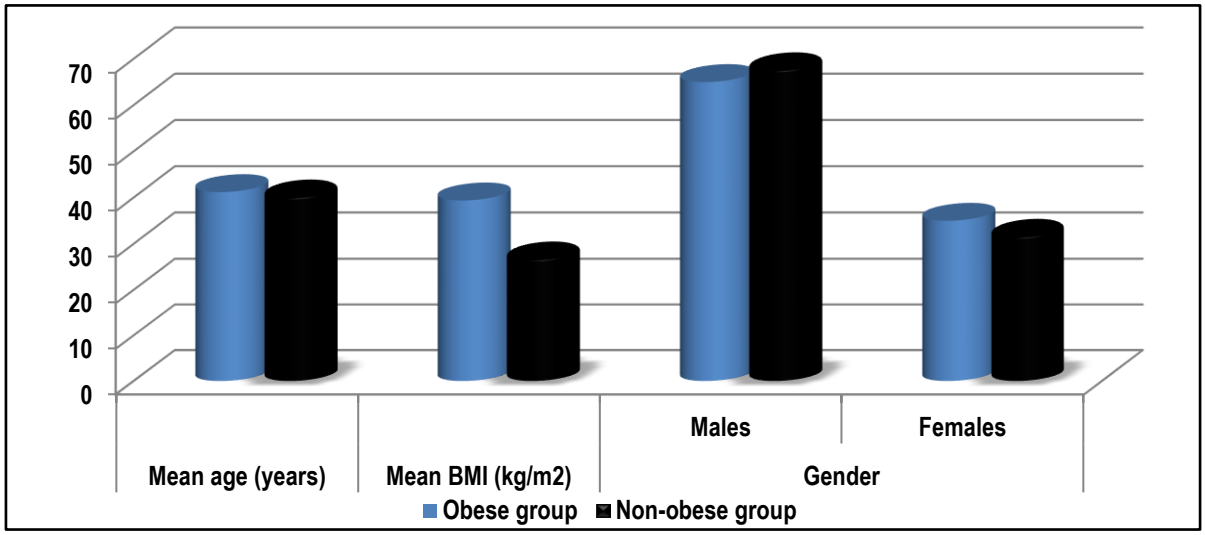
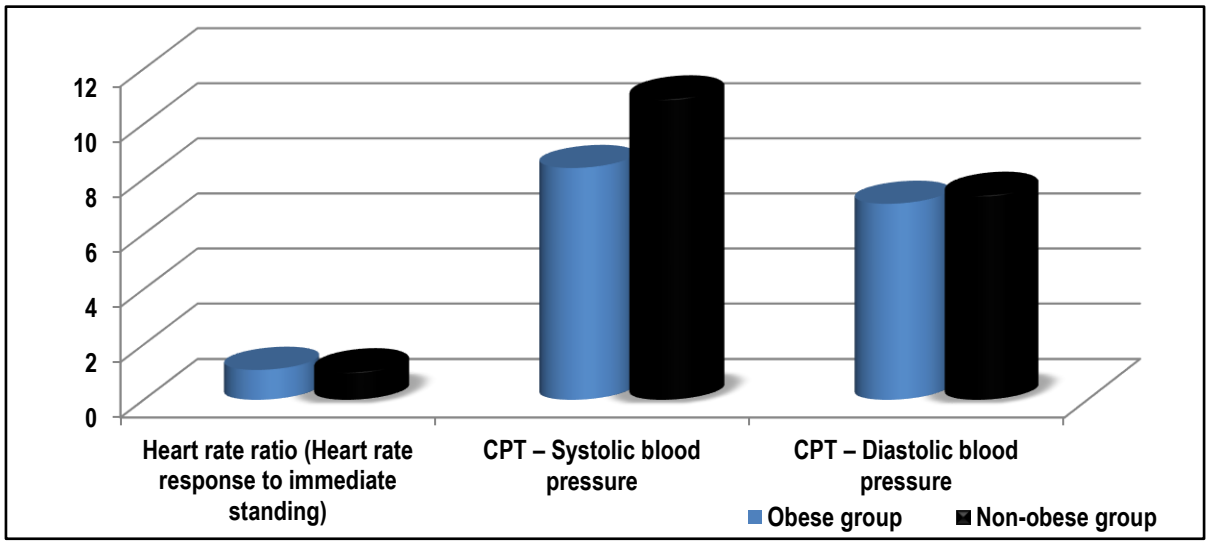


Table 1: Comparison of clinical parameters in between both the study groups

Parameter	Obese group	Non-obese group	P- value
Heart rate ratio (Heart rate response to immediate standing)	1.08	1.10	0.25
CPT – Systolic blood pressure	8.4	11.0	0.02*
CPT – Diastolic blood pressure	7.1	7.5	0.65

*: Significant

Graph 2: Values of clinical parameters in between both the study groups



RESULTS

In the present study, a total of 200 subjects were included, among which, 100 were obese while the remaining 100 were non-obese. Mean age of the obese subjects was 41.2 years while the mean age of the non-obese subjects was 39.4 years. Mean BMI of the obese and non-obese subjects was 27.1 and 39.4 Kg/m^2 respectively. There were 65 males in the obese group while there were 68 males in the non-obese group. Non- significant difference was obtained while comparing the heart rate response to immediate standing between subjects of both the study groups (P-value > 0.05). CPT systolic blood pressure value for subjects of the obese and non-obese group was 8.4 and 11.0 respectively. We obtained significant difference while comparing the CPT-systolic blood pressure value in between subjects of both the study groups. However; non- significant difference was obtained while comparing the CPT- diastolic values in between subjects of both the study groups.

DISCUSSION

In the present study, non- significant difference was obtained while comparing the heart rate response to immediate standing between subjects of both the study groups. CPT systolic blood pressure value for subjects of the obese and non-obese group was 8.4 and 11.0 respectively. Rossi RC et al analyzed cardiac autonomic behavior and hemodynamic parameters in obese young people. 92 individuals (20.58±1.48 years) were evaluated, divided into two groups: obese and eutrophic. Heart rate (HR) was captured for 30 min in the supine position whilst breathing spontaneously. Blood pressure (BP) values were obtained prior to performance of the protocol. For the autonomic analysis, 1000 beats were used for the calculation of heart rate variability indices in the time (Mean RR, SDNN and RMSSD) and frequency (LF, HF and LF/HF) domains, in addition to the Poincaré plot (SD1, SD2, SD1/SD2 and qualitative visual analysis). The obese group presented higher baseline BP and HR values compared to the eutrophic. Regarding autonomic modulation a significant decrease was observed in the RMSSD; SD1, HFms and HFnu indices in the obese group, indicating a decrease in vagal activity and reduced SDNN and SD2 rates, with statistical significance for the former, suggesting a reduction in overall variability. The high value of the LFnu index and decrease in Mean RR in the obese group pointed to relative sympathetic predominance in these individuals. The visual analysis of the Poincaré plot showed less dispersion of the points in the obese group. The obese group presented higher BP and HR values at rest and autonomic impairment, characterized by a reduction in parasympathetic activity and relative predominance of sympathetic activity.[11] Vanderlei LC et al compared the autonomic function of obese and eutrophic children by analyzing heart rate variability. One hundred twenty-one children (57 male and 64 female) aged 8 to 12 years were distributed into two groups based on nutritional status [obese (n = 56) and eutrophic (ideal weight range; n = 65) according to the body mass index reference for gender and age]. For the analysis of heart rate variability, heart rates were recorded beat by beat as the children rested in the dorsal (prone) position for 20 minutes. The SDNN, RMSSD, pNN50, SD1, SD2, LF and HF indices in milliseconds squared were lower among the obese children when compared to the eutrophic group. There were no alterations in the SD1/SD2 ratio, LF/HF ratio, LF index or HF index in normalized units. There was a significant difference between groups in the RR interval (R-to-R EKG interval). The obese children exhibited modifications in heart rate variability, characterized by a reduction in both sympathetic and parasympathetic activity[12]

We obtained significant difference while comparing the CPT-systolic blood pressure value in between subjects of both the study groups. However; non- significant difference was obtained while comparing the CPT- diastolic values in between subjects of both the study groups. Ali A et al examined any added effects of obesity on cardiac autonomic dysfunction in hypertensive patients. Hypertensive subjects (n=45) between 35-60 years of age were divided into two groups; Group A (n=30) consisted of non-obese hypertensive subjects and Group B (n=15) consisted of obese (BMI≥30kg/m2) hypertensive subjects. Cardiac autonomic function was assessed using four tests – Heart rate response to immediate standing (30:15 ratio), standing to lying ratio (S/L ratio), Blood pressure response to immediate standing and Cold Pressor Test (CPT). There were no significant differences for autonomic function tests between obese and non-obese hypertensive subjects (p >0.05). The results showed that there are no significant differences in the cardiac autonomic function responses between obese and non-obese hypertensive subjects.[13]

CONCLUSION

Under the light of above mentioned data, the authors conclude that some degree of autonomic nervous system dysfunction is associated with obesity. However; we recommend further studies for exploration of this aspect of obesity.

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