Short Communication

Vagal withdrawal is similar in preobese and obese Indian adults

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Abstract

Preobesity and obesity are among the leading causes of preventable deaths worldwide. Decreased vagal activities and high basal heart rate (BHR) observed in obesity have been reported to be associated with the future cardiovascular events. Therefore, in the present study, the difference in BHR and time domain indices (TDI) among preobese and obese subjects has been assessed. Body mass index, BHR, and TDI of heart rate variability were assessed in overweight (n = 50) and obese (n = 50) group subjects. BHR and TDI, which primarily reflect the parasympathetic cardiac modulation, were not found to be significantly different between the preobese and obese subjects. To conclude, high BHR and decreased TDI observed in the studied population suggest that there was no difference in vagal activities between the preobese and obese subjects.

Key words: Basal heart rate, vagal withdrawal, obesity, preobesity, time domain indices

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INTRODUCTION

Preobesity and obesity along with its associated co-morbidities have been reported to be some of the leading causes of preventable death worldwide.[1] Especially in Asians, about 300,000 deaths were reported annually, as a result of the individual being either preobese or obese.[2] Resting tachycardia observed in preobese and obese subjects has reported to be an established cardiovascular (CV) risk.[3] Earlier reports suggest that the obesity produces dysfunctions of autonomic nervous system.[4,5] Time domain indices (TDIs) of heart rate variability (HRV) is a useful tool to measure cardiac vagal activity.[6] Decreased vagal activity has been reported in preobesity and obesity.[7-9] However, the difference in vagal activities between the preobese and obese subjects has not been adequately studied. Therefore, in the present study, we have assessed the difference in basal heart rate (BHR) and TDI among the preobese and obese subjects.

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METHODS

This is a cross-sectional study conducted in the Department of Physiology, Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER), Puducherry, India. After obtaining approval of the project plan from the research and Ethics Committees of JIPMER, 100 healthy young adults were recruited from the Medicine OPD, JIPMER. Based on the body mass index (BMI) classification of the World Health Organization for Asian population,[10] these subjects were divided into the following groups:

- Overweight group: Healthy subjects having BMI 23–27.4 (n = 50)
- Obese group: Healthy subjects having BMI 27.5 or above (n = 50).

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Written informed consent was obtained from all the participants prior to initiation of the study. Subjects on antihypertensive therapy or receiving any medication, with a history of smoking and/or alcoholism, with acute or chronic ailments, and known cases of diabetes mellitus, hypertension, cardiac diseases, kidney disease, or any endocrinal disorder were excluded from the present study. As the level of physical fitness is a major determinant of vagal tone, subjects performing regular athletic activities, body-building exercises, and yoga[3] were also excluded from the study.

Brief procedure

Height was measured to the nearest millimeter by a wall-mounted stadiometer and weight was measured with digital weigh balance to the nearest 0.1 kg. BMI was calculated using the formula: weight in kilograms divided by square of height in meters. After 10 min of supine rest, BHR and 5 min HRV were recorded. For recording of short-term HRV, recommendation of the Task Force on HRV was followed.[11] For this purpose, electrocardiography (ECG) electrodes were connected and lead II ECG was acquired at a rate of 1000 samples/second during supine rest using BIOPAC MP 100 data acquisition system (BIOPAC Inc., USA). The data were transferred from BIOPAC to a windows-based PC with Acqknowledge software version 3.8.2. HRV analysis was done using the HRV analysis software version 1.1 (Bio-signal Analysis group, Finland). Different TDIs such as mean RR, square root of the mean squared differences of successive normal to normal intervals (RMSSD), standard deviation of normal to normal interval (SDNN), and the number of interval differences of successive NN intervals >50 ms (NN50) were recorded. SPSS version 19 (SPSS Software Inc., Chicago, IL, USA) was used for statistical analysis. All the data were presented as mean ± SD. Normality of data was tested by Kolmogorov–Smirnov test. The level of significance between the groups was tested using Student's *t*-test and $P < 0.05$ was considered significant.

RESULTS

There was no significant difference in age ($P = 0.838$) and BHR ($P = 0.050$) between the subjects preobese and obese group subjects [Table 1]. BMI was significantly ($P < 0.0001$) higher in obese group compared to preobese group [Table 1]. However, none of the TDI of HRV was significantly reduced in obese group subjects compared to preobese group subjects [Table 2].

DISCUSSION

In the present study, TDI which represents the vagal modulation of cardiac drive[11,12] was not significantly different [Table 2] between the preobese and obese group subjects. From the present findings, it is evident that there was no significant difference in cardiac parasympathetic drive between the preobese and obese subjects. This was further supported by the high BHR in these preobese and obese subjects, which could be a potential CV risk.[3] Moreover, there was no significant difference in BHR between the preobese and obese subjects [Table 1]. Since, BHR is an index of vagal tone[12] from the high BHR observed in the present study, it is evident that the cardiac parasympathetic drive was significantly reduced in both preobese and obese subjects.

Our findings are in agreement with previous reports suggesting that the decreased vagal activity in the form of decreased TDI and increased BHR was observed in preobese and obese subjects.[7-9] Thus, the present study suggests that there was no significant difference in vagal activity between these preobese and obese subjects. However, findings of the present study should be validated on a larger population due to the small sample size in the present study, which might not been adequate to assess the difference in vagal withdrawal between these two groups.

CONCLUSION

TDI of HRV was reduced, but was not significantly different between the preobese and obese group

Table 1: Age and basal cardiovascular parameters in preobese and obese subjects

Parameters	Preobese group (*n*=50)	Obese group (*n*=50)	*P*
Age (years)	27.75±6.28	27.97±8.61	0.884
Height (m)	1.61±0.07	1.63±0.11	0.281
Weight (kg)	64.98±7.31	76.53±11.06	<0.0001
BMI (kg/m^2)	24.87±1.15	31.16±2.13	<0.0001
BHR (per min)	76.47±11.49	80.89±10.78	0.050

The values are expressed as mean±SD; statistical analysis was done by Student's *t*-test. The *P*<0.05 was statistically considered significant. BMI: Body mass index, BHR: Basal heart rate, SD: Standard deviation

Table 2: Time domain indices of heart rate variability in preobese and obese groups

Parameters	Preobese group (*n*=50)	Obese group (*n*=50)	*P*
Mean RR (ms)	616.08±385.18	493.48±389.31	0.116
RMSSD (ms)	48.08±27.66	42.32±20.15	0.237
SDNN (ms)	42.56±21.46	38.26±20.04	0.303
NN50	72.06±33.84	62.26±35.89	0.163

The values are expressed as mean±SD; statistical analysis was done by Student's *t*-test. The *P*<0.05 was statistically considered significant. Mean RR: Mean-RR intervals, SDNN: Standard deviation of the averages of NN intervals in all 5 min segments of the entire recording, RMSSD: The square root of the mean of the sum of the squares of differences between adjacent NN intervals, NN50: Number of interval differences of successive NN intervals greater than 50 ms, SD: Standard deviation

subjects. Further, the high BHR observed in preobese and obese subjects was also not significantly different between these groups. Thus, findings of the present study suggest that the vagal withdrawal is similar in preobese and obese group subjects.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Center for Disease Control and Prevention. Adult Obesity Facts. Available from: http://www.cdc.gov/obesity/data/adult.html. [Last accessed on 2015 Nov 23].
2. World Health Organization. Obesity and Overweight Factsheet; Number 311. 2011. Available from: http://www.who.int/mediacentre/factsheets/fs311/en/index.html. [Last accessed on 2015 Oct 12].
3. Jensen MT, Suadicani P, Hein HO, Gyntelberg F. Elevated resting heart rate, physical fitness and all-cause mortality: A 16-year follow-up in the Copenhagen Male Study. Heart 2013;99:882-7.
4. Laederach-Hofmann K, Mussgay L, Rúddel H. Autonomic cardiovascular regulation in obesity. J Endocrinol 2000;164:59-66.
5. Amador N, Pérez-Luque E, Malacara JM, Guízar JM, Paniagua R, Lara S. Leptin and heart sympathetic activity in normotensive obese and non-obese subjects. Ital Heart J 2004;5:29-35.
6. Malliani A. Heart rate variability: From bench to bedside. Eur J Intern Med 2005;16:12-20.
7. Pontiroli AE, Merlotti C, Veronelli A, Lombardi F. Effect of weight loss on sympatho-vagal balance in subjects with grade-3 obesity: restrictive surgery versus hypocaloric diet. Acta Diabetol 2013;50:843-50.
8. Baum P, Petroff D, Classen J, Kiess W, Blüher S. Dysfunction of autonomic nervous system in childhood obesity: A cross-sectional study. PLoS One 2013;8:e54546.
9. Indumathy J, Pal P, Pal GK, Ananthanarayanan PH, Parija SC, Balachander J, *et al.* Association of obesity indices and metabolic markers with sympathovagal imbalance and cardiovascular risks in obesity in Indian population. Obes Res Clin Pract 2014;9:55-66.
10. WHO Expert Consultation. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. Lancet 2004;363:157-63.
11. Heart rate variability: Standards of measurement, physiological interpretation and clinical use. Task force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology. Circulation 1996;93:1043-65.
12. Pal GK, Pal P. Autonomic function tests. In: Textbook of Practical Physiology. 3rd ed. Hyderabad: Universities Press; 2010. p. 282-90.