

Study of the effect of obesity on QT-interval among adults

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ABSTRACT

Background: Obesity affects the different organ systems of human body and has been recognized as a risk factor for the development of many diseases. Most of the cardiovascular diseases develop due to obesity which reflects alterations in either cardiac morphology or conduction defects. These abnormalities are reflected in ECG as prolongation of various intervals. Prolongation of QT-interval has been found to be associated with ventricular arrhythmia and sudden cardiac death. **Aims and Objectives:** The aim of the study was to investigate the effect of obesity on QT-interval to assess the risk of development of cardiovascular diseases in early stage. **Materials and Methods:** A cross-sectional study was conducted on 80 cases and 80 controls, which included adults of 18–40 years age groups from both sexes. The cases were obese [body mass index (BMI) >30 kg/m²] and the controls were nonobese (BMI < 25 kg/m²). ECG of the cases and controls was recorded and their QT-intervals were calculated and analyzed with BMI by independent samples test. **Results:** We found significantly higher QT-intervals in obese group in comparison to that of nonobese group ($P = 0.000$). **Conclusion:** Obesity was found to be associated with prolongation of QT-interval among young obese adults. This prolongation of QT-interval duration increases the possibility of left ventricular enlargement and ventricular fibrillation. Hence the present study helps in creating awareness among obese people so that they can change their lifestyle in order to prevent the onset of the deleterious effects of obesity on their health.

Keywords: Obesity, body mass index, QT-interval, ventricular fibrillation

Introduction

Obesity is an independent risk factor, and a higher body mass index (BMI) increases cardiovascular morbidity and mortality when evaluated together with other coronary risk factors in the Framingham study.^[1] According to WHO classification of BMI, a person whose BMI is ≥ 30 kg/m² is obese and when BMI is between 18.5 and 24.99 then the person is considered normal.^[2] India ranks third in the world lying just behind USA and China in the global hazard list of prevalence of obesity.^[3] Cases of

obesity have doubled worldwide since 1980, as in 2014 more than 1.9 billion adults were overweight, out of which more than 600 million were obese.^[4] Obesity has reached to epidemic proportion in India. According to the National Family Health Survey-4 (NFHS-4) in 2015–16 conducted by Ministry of Health and Family Welfare (MOHFW) in India, the percentage of men and women aged 15–49 years, who were obese are 19 and 21%, respectively.^[5] It has been demonstrated that mortality due to coronary diseases have increased both in men and women with a higher BMI.^[6] Currently, it is a serious public health problem with established cardiovascular comorbidities and a major cause of sudden death in developed as well as developing countries.^[7] Obesity has been reported with prolongation of QT-interval.^[8,9] QT-interval prolongation is associated with ventricular arrhythmia

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Access this article online

Quick Response Code:



Website:
www.jfmpc.com

DOI:
10.4103/jfmpc.jfmpc_168_19

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How to cite this article: Kumar T, Jha K, Sharan A, Sakshi P, Kumar S, Kumari A. Study of the effect of obesity on QT-interval among adults. J Family Med Prim Care 2019;8:1626-9.

and sudden cardiac death.^[10] Therefore, this study was undertaken to investigate the changes in QT-interval among obese adults in order to prevent them from the development of cardiovascular diseases in future.

Materials and Methods

The study was conducted in a tertiary care hospital, from the month of January, 2017 to June, 2018. The design of the study was a cross-sectional observational study. The cases comprise 39 obese male and 41 obese female adults aged between 18 and 40 years and controls were same number of healthy male and female adults from the same age group, who participated voluntarily in the study. The cases and control were selected from the attendants of the tertiary care hospital. The study protocol was approved by the Institutional Ethical Committee and written informed consents were taken from all the participants.

The basis for selection of cases and controls was BMI and grouped as follows:

Group A: Normal/nonobese (BMI: 18.5–24.99 kg/m²) =80 (39 males and 41 females)

Group B: Obese (BMI ≥ 30 kg/m²) =80 (39 males and 41 females)

Exclusion criteria: Subjects with history of cardiovascular diseases, respiratory diseases, thyroid disorders, diabetes, smoking, neuropsychiatric disorder, menstrual abnormality, and those who were not interested were excluded from the study.

Collection of Data

Body weight was measured on portable weighing machine without shoes and lightly clothed, and height was measured in barefoot using Stadiometer. BMI was calculated as body weight in kilogram divided by the square of the body height in meters (kg/m²).

Blood pressure was recorded in supine position from the right upper arm using appropriate size of cuff after the subject had rested for at least 5 min with standard mercury sphygmomanometer. We recorded the blood pressure thrice at 5 min interval and took the average value.

The electrocardiographic recording was done by using three-channel ECG machine by Medicaid India. To avoid diurnal variations, we took ECG recordings of all subjects between 10 am and 12 noon.^[11] The speed of ECG paper was 25 mm/s and the voltage was 1 mV/cm. A resting ECG was recorded in lying posture after duly assuring them about the noninvasive nature of the procedure and after allowing them to rest for 10 min in a well-ventilated quiet room. The onset of the Q wave was regarded as the starting point of the QT-interval. The point where the T wave returned to the isoelectric TP-segment was accepted as the end of the QT-interval. QT-interval was manually measured by calculating the average of sequential three QT-intervals from the precordial lead of V5.

Statistical analysis

The data were compiled in Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) version 15.0. The variables were expressed as mean ± standard deviation. The confidence interval was 95% and *P* value < 0.05 was considered statistically significant. Independent sample *t*-test was used to compare the results of obese to nonobese control group subjects.

Results

The results were expressed as mean ± standard deviation. There was no significant difference in age and height between obese and nonobese group but a significant difference was found in weight and BMI between groups [Table 1].

Obese group had significantly higher systolic BP, diastolic BP, HR, and QT-interval compared to that of nonobese group as shown in Table 2.

Systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate (HR), and QT-interval were significantly higher among obese group.

Discussion

Obesity is a global health problem that alters cardiovascular parameters which are reflected in various ECG variables. Therefore, regular screening of the growing population of obese people is required to find out the cardiovascular abnormalities in early stage so that development of serious cardiovascular diseases can be prevented. It can be fulfilled only by the involvement of the large number of the trained primary care physicians, who can determine alterations in ECG variables.

In this study, HR, SBP, and DBP were significantly increased among obese when compared to nonobese individuals. We also found significantly higher QT-interval in obese. The QT-interval reflects the total duration of ventricular myocardial

Table 1: Comparison of baseline anthropometric data between nonobese and obese group

| Variables | Group A (nonobese) (n=80) | Group B (Obese) (n=80) | <i>P</i> |
|--------------------------|---------------------------|------------------------|----------|
| Age (years) | 25.75±4.87 | 25.95±4.97 | 0.95 |
| Weight (kg) | 57.58±7.84 | 81.28±7.62 | 0.000 |
| Height (m) | 1.61±0.08 | 1.58±0.064 | 0.002 |
| BMI (kg/m ²) | 22.11±1.87 | 32.71±2.06 | 0.000 |

Table 2: Comparison of cardiovascular variables between nonobese and obese group

| Variables | Group A (nonobese) | Group B (obese) | <i>P</i> |
|-------------|--------------------|-----------------|----------|
| SBP (mm Hg) | 113.30±7.81 | 128.15±5.99 | 0.000 |
| DBP (mm Hg) | 75.60±5.00 | 84.20±3.62 | 0.000 |
| HR (b/m) | 78.55±4.15 | 87.50±8.92 | 0.000 |
| QT (ms) | 0.34±0.027 | 0.37±0.025 | 0.000 |

depolarization and repolarization. A key mechanism underlying the present observation is most likely related to a developing cardiac repolarization disorder.^[12] Obesity causes significant abnormalities in cardiac morphology including left atrial enlargement, left ventricular geometric changes, and diastolic dysfunction.^[13-15] Obesity may lead to atrial and ventricular repolarization anomalies in addition to the morphological changes. In a previous study, Giraldo *et al.* reported no difference between patients with uncomplicated obesity and the controls in terms of QT-interval and QT-dispersion values.^[16] But Seyfeli *et al.* studied on the effect of obesity on QT-interval among 42 obese women in 2006 and they also found increased QT-interval.^[17] Few recent studies have also found strong positive correlation between QT-interval and BMI.^[18,19] Alpert *et al.* and Alexander *et al.* showed that significant weight loss in extremely obese patients leads to favorable cardiac structural, hemodynamic, and electrocardiographic changes.^[20-22] There is increasing evidence which suggests that obesity, particularly central obesity is associated with delayed ventricular repolarization as designated by prolongation of QT-interval.^[23] Several mechanisms have been suggested for QT-prolongation including autonomic system imbalance and autonomic neuropathy.^[24,25] Mutations of genes affecting cardiac ion channels have also found to be involved in cardiac repolarization, heart failure, cardiac hypertrophy, and myocardial infarction.^[26]

Limitations

1. We did not classify whether obesity in our participants was central or visceral.
2. We did not measure neurohumoral parameters.

Conclusions

Obesity was found to be associated with prolongation of QT-interval among young obese adults. This prolongation of QT-interval duration increases the possibility of left ventricular enlargement and ventricular fibrillation. Hence the present study helps in creating awareness among obese people so that they can change their lifestyle in order to prevent the onset of the deleterious effects of obesity on their health. Regular check of these parameters will help them in reducing the chance of its manifestations in future.

Acknowledgments

The authors would like to thank postgraduate students, lab technicians, and the participants for their cooperative and helping attitude. They are also grateful to the authority of department for providing us the equipment and other materials required for our study.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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