Original Research Article

Effect of moderate dynamic exercise on QT, QTC and QTD intervals in young obese adults

Ganashree C P[1], Aparna M[2*], Amrutha A M[3], Vijayalaxmi Mangasuli[4], Vijeth S B[5], Prashanth G[6]

{[1]Associate Professor, [2]Assistant Professor, Department of Physiology} {[3,4]Assistant Professor, Department of Community Medicine} Basaveshwara Medical College and Hospital, Chitradurga -577502, Karnataka, INDIA.

Email:ganashree@hotmail.com

Abstract

Background and Objectives: Obesity is becoming a global epidemic in both children and adults. QT interval, QT-interval corrected and the QT-interval dispersion derived from standard electrocardiograms represent ventricular repolarization heterogenecity. This study was undertaken to assess the QT, QTc and QTD intervals in response to dynamic exercise test in obese and normal weight medical students and to know the gender differences. **Methods:** 30 medical students of Basaveshwara Medical College and Hospital, Chitradurga formed the study group. QT, QTc and QTD were measured thrice with a gap of 5 minutes each, before and during the moderate exercise with Treadmill, and average was taken. **Results:** The study group showed significant change in electrocardiogram, that is QT, QTc and QTD intervals when correlated with BMI. There was significance among men and women. **Interpretation and Conclusion:** here was significant change in QT, QTc and QTD intervals among study group. There was significant change in QTc at baseline and during exercise test in men as compared to women.

Key Word: Obesity, QT, QTc and QTD intervals.

***Address for Correspondence:**
Dr.Aparna M, Assistant Professor Department of Physiology, Basaveshwara medical College, Chitradurga,577502, INDIA.
Email:ganashree@hotmail.com

Received Date: 23/11/2018 Revised Date: 16/12/2018 Accepted Date: 07/01/2019
DOI: https://doi.org/10.26611/103921

Access this article online	
Quick Response Code:	Website: www.medpulse.in
	Accessed Date: 05 February 2019

INTRODUCTION

Physical exercise can be regarded as a period of increased sympathetic activity with simultaneous parasympathetic withdrawal while the post-exercise period is about regaining the normal sympathovagal balance.[1,2] The beneficial effects of exercise on cardiovascular system have been proved beyond doubt. [3,4]Alarmed by reports that India will become the global diabetes capital by 2050, the Health Ministry of India has reduced the diagnostic cut-offs for body mass index (BMI) to 23 kg/m^2 and the standard waist circumference for Indian population to fight the battle against obesity. The standards have been set for the first time in the Ministry's consensus guidelines for Prevention and Management of Obesity and Metabolic Syndrome. BMI expresses the weight for height relationship as a ratio, i.e. weight (in kg) / height ^{2} (in meters) considered an indicator of the individual's fitness and obesity. Overweight status is defined using Centres for Disease Control and Prevention (CDC) age and sex specific nomograms for BMI.[5] Institute of Medicine recommends that individuals between 2 and 18 years of age with BMI of >30 kg/m2 or >95th percentile for age and gender (whichever is smaller) should be considered obese.[6] Individuals with BMI of >85th percentile but <95th percentile or 30kg/m^2 (whichever is smaller) will now be considered as overweight and this term will replace the term “at risk of overweight”.[7] Research over the past several years has shown that Indian physique and genetics are different from their western counterparts. Indians suffer more from abdominal obesity compared to people in the West where uniform distribution of excess fat all over the body is more prevalent. The guidelines estimate that the absolute mortality due to chronic heart diseases in India will

How to cite this article: Ganashree C P *et al.* Effect of moderate dynamic exercise on QT, QTC and QTD intervals in young obese adults. *MedPulse International Journal of Physiology.* February 2019; 9(2): 08-11. https://www.medpulse.in/Physiology/

increase to 20.3 million annually by 2010 and by 2020 it will touch 2.58 billion [The mortality rate stood at 1.59 million in 2000]. The current load of diabetes in the country (41 million) is expected to rise by 170 per cent in the next 20 years. Even today, India has the largest population of diabetics in the world as per the guidelines.[8] Measurement of the QT interval may at times present some difficulty. This is because it may be difficult to determine the exact beginning and end of the interval.[9] Recommended techniques include measuring the QT interval in the leads showing an initial **Q** wave, in leads where the **T** wave is most distinct, in lead II or avL where **U** wave is usually isoelectric or in leads where the QT is longest (most frequently V2 and V3.[22] According to Lipeschkin, if the interval between the two peaks in a notched **T** wave is 0.15 seconds or more, then the 2nd peak is **U**.[10]Normal QT_c intervalin males is 390 ms and in females is 440 ms. QT_c of 440ms in males and 460ms in females is considered abnormal.

AIM

This study was designed with an aim to record the QT, QT_c and QTD interval changes in response to dynamic exercise test in obese and normal weight medical students and to know the gender differences.

MATERIALS AND METHODS

A case control study was conducted in the Department of Physiology, Basaveshwara Medical College and Hospital, Chitradurga, India after approval from the institutional ethical committee. The study included 60 subjects. They were healthy, medical students of both genders between the ages of 18-22 yrs. They were categorized into two groups: Study group (30 young obese medical students) and control group (young healthy medical students).

Sample size: The sample size was estimated utilizing the earlier available literature. In the present study, assuming that the obese will have higher mean value of 2 units, this required a sample size of 30 each in obese and control groups. As we wished to explore the association with gender, 15 men and 15 women were included both from obese and normal weight group.

Study group: The study was explained total young obese students aged between 18-22 years studying in Basaveshwara Medical College and Hospital, Chitradurga. A more detailed explanation was given to those obese students who volunteered to participate in the study and written consent was taken regarding their willingness to participate in the study. Baseline ECG was taken for all and shown to a general physician for reading the ECG. Those students with normal ECG were subjected to moderate dynamic treadmill test with speed of 0.5mph / 0% grade for 1minute and increments of 0.1mph (miles per hour) each minute. Those who tolerated the initial warm up exercise were asked to do the exercise for 6-12 minutes duration until they felt fatigue or showed signs of cardiopulmonary distress.

Control group: Equal number of age matched normal weight students with BMI of 18.5-22.9 kg/m^2 were labelled as controls and were subjected to treadmill test after obtaining their due consent as was done with their obese counterparts.

The parameters studied in both the groups include**:**

- Weight, Height, Body mass index (BMI)
- Blood pressure (BP)
- ECG- QT, QT_c and QTD

INCLUSION CRITERIA:

Inclusion criteria for study group

- BMI (Body Mass Index)> $25kg/m^2$
- Age group: 18-22 years of either sex

Inclusion criteria for control group

- BMI18.5-22.9 kg/m^2
- Age group 18-22 years of either sex

Exclusion criteria for study group

- History of acute/chronic CVS ailments
- Abnormal ECG changes in the initial screening
- Hypertensive subject
- Smokers
- Alcoholics
- Tobacco chewers

Method of data collection: The exercise was performed in a well-ventilated room. Participants were instructed not to consume beverages and not to eat a heavy meal or participate in any vigorous activity 24 hours before the test. They were properly acquainted with the experimental protocol. A trained physician was present during the study and all the necessary resuscitation equipment was kept ready to deal with the complications if any occurred.

Conduct of Exercise Test: Informed consent was obtained after explaining the possible risks involved in exercise testing. The testing procedure was carefully explained to the subjects and treadmill walking was demonstrated. The areas for electrode applications are first rubbed with an alcohol or acetone saturated cotton swab (after shaving in males with hairy chest) to remove the superficial layer only. Then these areas are rubbed with fine sand paper or rough material to obtain good electrode contact. Since a standard 12 leads ECG with electrodes placed on the limbs could not be obtained during exercise, other electrode placements have been used. The arm electrodes and lower limb electrodes are brought on to the trunk and placed at sites nearest to the respective limbs. This modified placement (Mason-Likar

modification) lessened the motion artefact without producing much difference from the standard 12 lead ECG.[11]

RESULTS

The present study included 60 subjects (30 obese subjects and 30 normal weight subjects) in the age group of 18-22 years. The characteristics of the two groups are shown in Table 1.The Mean ± S.D. value of Body Mass Index and Waist-Hip ratio were higher in study group(SG) when compared to control group (CG) as shown in Table 1.

Table 1: Characteristics of the study and control groups

	Obese (Study group)	Normal weight (Control group)
Number of subjects	30	30
Age(in years)	18.83±1.05	18.67±0.99
BMI(in kg/m²)	28.56±3.56	21.91±1.42
WHR(in cms)	0.91±0.11	0.82±06

The Mean ± S.D values of QT, QT_c intervals were higher in study group as compared to control group which is statistically significant as shown in Table 2.QT Dispersion of study group was same when compared to control group at baseline as shown in Table 2.

Table 2: QT, QT_c and QTD intervals at baseline and at moderate exercise test in obese and normal group.

	Groups	Mean±SD	p value
Baseline			
QT interval	Obese	410±0.7	**<0.001**
	Normal	400±0.6	
QT_c	Obese	439.8±0.76	**0.021***
	Normal	439.0±0.76	
QTD	Obese	56.0±0.11	1.000
	Normal	56.0±0.11	
During Exercise			
QT interval	Obese	**410±0.9**	**<0.001***
	Normal	400±0.6	
QT_c	Obese	**440.8±2.50**	**<0.001***
	Normal	439.8±0.76	
QTD	Obese	**56.4±0.15**	**<0.001***
	Normal	56.0±0.11	

* p value <0.05 is statistically significant

The response to exercise test was an increase in QT, QT_c intervals but decreased QTD interval in the study group when compared to the control group but statistically not significant as shown in Table 3.

Table 3: QT, QT_c and QTD intervals at baseline and immediately after exercise test in obese and normal group.

	Groups	Mean ± S.D.	P value
Baseline			
QT interval	Obese	410±0.70	0.138
	Normal	400±0.60	
QT_c	Obese	439.8±0.76	0.021
	Normal	439±0.76	
QTD	Obese	56.0±0.11	1.000
	Normal	56.0±0.11	
Immediately after exercise			
QT interval	Obese	409.7±0.006	0.947
	Normal	409.3±0.006	
QT_c	Obese	439.82±0.75	0.846
	Normal	439.80±0.76	
QTD	Obese	56.034±0.11490	0.965
	Normal	56.067±0.11427	

*p value <0.05 statistically significant

DISCUSSION

Our data showed that uncomplicated obesity is associated with adaptive and appropriate changes in cardiac structure and function, which is depicted by electrocardiographic changes. QT prolongation may be a contributing factor to the excess of cardiovascular mortality that has been described in obese subjects who have an increased risk of arrhythmias and sudden death, even in the absence of cardiac dysfunction.[12]Earlier studies show that obesity is a condition that may be associated with early electrocardiographic and/or echocardiographic abnormalities even in the absence of clinical symptoms[13,14]. However, the sudden deaths and/or arrhythmias in obese people [15,17]are similar to those occurring in subjects suffering from a variety of other heart diseases[18,20]. It has been suggested that these events may be linked to abnormalities in repolarization.[21,22]RoutineQT, QT_c and QTD measurement has methodological limitations and the relevance of this parameter is still questioned[23-25].Our study considered QT, QT_c and QTD (the most simple index of ventricular depolarization and repolarization variability) because a prolonged QT ,QT_c and QTD is thought to be a possible risk factor for arrhythmias and sudden death[24,26]. In our study QT and QT_c was higher in study group at baseline itself and increased during moderate exercise but QTD was normal at baseline and increased during moderate exercise. The derangements in sympathetic cardiovascular function in the form of elevated baseline QT interval and prolongation of QT and QT_c intervals in response to treadmill exercise test in obese group points towards autonomic instability or dysfunction. QTD seems to be within the normal range in the obese group. This is comparable with that of age- and sex-matched healthy normal weight controls in a

population including both groups who had a wide range of BMIs.

CONCLUSION

In conclusion, QT and QT_c intervals are in higher range in comparison with age- and sex-matched healthy normal weight controls, in a population of obese subjects that have a wide range of BMIs but are without any cardiovascular complications. Further studies are needed to investigate QT, QT, and QTD in complicated obesity, especially in relation to echocardiographic parameters.

REFERENCES

1. Ekblom R, Goldbarg A, Kilbom A and Astrand P. Effects of atropine and propranolol on oxygen transport system during exercise in man. *Scand J Clin Lab Invest*. 1972; 30: 35-42.
2. Fagraeus L and Linnarsson D. Autonomic origin of heart rate fluctuations at the onset of muscular exercise. *J App Physiol*. 1976; 40: 679-82.
3. Joyner MJ and Green DJ. Exercise protects the cardiovascular system: effects beyond traditional risk factors. *J Physiol*. 2009; 587: 5551-58.
4. Gielen S, Schuler G and Adams V. Cardiovascular effects of exercise training. *Circulation*. 2010; 122: 1221-38.
5. Boban Mathew, Lisa Francis, Attila Kayalar, Jesse Cone. Obesity: Effects oncardiovascular Disease and its Diagnosis. JABFM Nov-Dec 2008; 21(6).
6. Kim E. Barrett, Susan M. Barman, Scott Boitano, Heddwen L. Brooks. Cardiovascular regulatory mechanisms. In: Ganong's Review of medicalphysiology, 23rd edition, McGraw Hill, New Delhi 2009: 555-568.
7. Nancy F Krebs, John H.Himes*et al*. Assessment of Child and Adolescentoverweight and obesity. Paediatrics 2007; 120: pp193-228.
8. www.drsharma.ca/2008/11?cat+6;accessed at 9:00p.m.on 17/11/2009
9. Macfarlane W Peter, Vietchlawrie TD, The normal electrocardiogram and ventrocardiogramIn: Macfarlane W Peter and Vietchlawrie TD editors. Comprehensive electrocardiology 1st edition Vol 1.Oxford : Pergamon Press;1989:451
10. LipeschkinE,Surawicz B : The measurement of the Q-T interval of the Electrocardiogram Circulation 1952;6:378-387.
11. Ellested ,Myrvin H-Stress testing protocols. In stress testing principles and practice, 4th edition, New Delhi, Jaypee brothers ; 1996:169-94
12. Drenick EJ, Fisler JS. Sudden cardiac arrest in morbidly obese surgical patients unexplained after autopsy. *Am J Surg* 1988;155:720–726.
13. Zarich, S. W., Kowalchuk, G. J., McGuire, M. P., Benotti, P. N., Mascioli, E. A., Nesto, R. W. (1991) Left ventricular filling abnormalities in asymptomatic morbid obesity. Am J Cardiol 68: 377–381. | Article | PubMed | ISI | ChemPort |
14. Mureddu, G. F., de Simone, G., Greco, R., Rosato, G. F., Contaldo, F. (1996) Left ventricular filling pattern in uncomplicated obesity. Am J Cardiol 77: 509–514.
15. Kannel, W. B., Plehn, J. F., Cupples, L. A. (1998) Cardiac failure and sudden death in the Framingham Study. Am Heart J 115: 869–875.
16. Messerli, F. H., Nunez, B. D., Vantura, H. O., Synder, D. W. (1987) Overweight and sudden death: increased ventricular ectopy in cardiopathy of obesity. Arch Intern Med 147: 1725–1728. \
17. Frank, S., Colliver, J. A., Frank, A. (1986) Electrocardiogram in obesity: statistical analysis of 1,029 patients. J Am Coll Cardiol 7: 295–299.
18. Barr, C. S., Naas, A., Freeman, M., Lang, C. C., Struthers, A. D. (1994) QT dispersion and sudden unexpected death in chronic heart failure. Lancet 343: 327–329.
19. Ichkhan, K., Molnar, J., Somberg, J. (1997) Relation of left ventricular mass and QT dispersion in patients with systematic hypertension. Am J Cardiol 79: 508–511.
20. Day, C. P., McComb, J. M., Campbell, R. W. F. (1990) QT dispersion: an indication of arrhythmia in risk patients with long QT intervals. Br Heart J 63: 342–344.
21. Algra, A., Tijssen, J. G. P., Roelandt, JRTC, Pool, J., Lubsen, J. (1991) QTc prolongation measured by standard 12-lead electrocardiography is an independent risk factor for sudden death due to cardiac arrest. Circulation 83: 1888–1894.
22. Schouten, E. G., Dekker, J. M., Meppelink, P., Kok, F. J., Vandenbroucke, J. P., Pool, J. (1991) QT interval prolongation predicts cardiovascular mortality in a apparently healthy population. Circulation 84: 1516–1523.
23. Zabel, M., Klingenheben, T., Franz, M. R., Hohnloser, S. H. (1998) Assessment of QT dispersion for prediction of mortality or arrhythmic events after myocardial infarction: Results of prospective, long-term follow-up study. Circulation 97: 2543–2550.
24. Pye, M., Quinn, A. C., Cobbe, S. M. (1994) QT interval dispersion: a non-invasive marker to susceptibility to arrhythmia in patients with sustained ventricular arrhythmias? Br Heart J 71: 511–514.
25. Kors, J. A., van Herpen, G., van Bemmel, J. H. (1999) QT dispersion as an attribute of T-loop morphology. Circulation 99: 1458–1463.
26. Helming, H., Holm, E., Jun, L., *et al*. (1998) The prognostic value of the QT interval and QT dispersion in all-cause and cardiac mortality and morbidity in a population of Danish citizens. Eur Heart J 19: 1391–1340.

Source of Support: None Declared
Conflict of Interest: None Declared