Short Communication

Effects of exercise on PR intervals, QRS durations and QTC intervals in male and female students of University of Abuja

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Abstract

A study was conducted to determine the effect of exercise on Electrocardiogram (ECG) variables in students of University of Abuja, and gender variation of these variables was compared.

Forty medical students were considered (22 males and 18 females), ages 18-30 years. The volunteers were subjected to exercise stress test by using bicycle ergometer. They exercised till exhaustion or attainment of 85% Heart Rate Maximum (HRmax) (Modified McArdle Protocol). ECGwas recorded pre and post-exercise.

QTcintervals pre and post-exercise were 386.55 ± 4.4ms and 415.82 ± 4.89ms (range: 346 - 468ms) in males and 399.39 ± 4.81ms and 409.11 ± 4.44ms (range: 367 - 446ms) in females respectively. QTC was significantly raised post-exercise in male subjects. PR interval pre and post-exercise were 153 ± 5.09ms and 154.75 ± 3.35ms (range: 116 - 206ms) in males and 160.44 ± 6.5ms and 153.33 ± 4.53ms (range: 116 - 243ms) in females respectively. QRS duration pre and post-exercise were found to be 90.86 ± 0.97ms and 94.09 ± 2.09ms (range: 83 - 122ms) in males and 87.44 ± 1.36ms and 88.89 ± 2.06ms (range: 80 - 113ms) in females respectively.

Keywords: ECG, Exercise, Healthy, Young.

Introduction

Sound health and physical fitness are positively associated with good mental health and well-being. People who have regular physical exercise tend to have less anxiety and depression and lower level of stress than do people with a sedentary lifestyle.[1] It is not only athletes that require physical exercise for better performance but also non-athletes for maintenance of physical and mental health. Buffalo health study concluded that cardiopulmonary function is the long term predictor for overall survival rates in both genders and could be used as a tool in general health assessment.[2,3]

In our environment, preschool physical examinations do not include ECG for new students and baseline values are scarce. This study was conducted to assess the effect of exercise on ECG parameters in young adults at Abuja. It was a pilot study that will be expanded to include thousands of students admitted into the university yearly. This will boost the database in this environment and pick out some early signs of cardiovascular disorders among students.

Electrocardiograph (ECG) is an important non-invasive and acceptable tool for assessment of myocardial contractility and electrical conduction.[4] Patterns of ECG vary from person to person and even within a person, it varies when exposed to different physiological conditions. To the best of our knowledge, no such study has been done among the youths at Abuja. Previous studies of prevalence of ECG findings usually uses subjects 25-75 years or above.[5] The baseline data can also help in predicting those that may likely develop myocardial dysfunction later in life.[6]

To adequately guide this work, one major hypothesis was formulated, i.e.

The null hypothesis is that exercise has no significant effect on cardiac parameters in young healthy subjects.

Methods and Results

The inclusion criterion for participating in this study was being a medical student of University of Abuja. There were 45 preclinical students in the new medical school. All the students volunteered to participate. Forty (40) students aged 18-30 years qualified to participate after the exclusion criteria were applied. The exclusion criteria were as follows: Previous history of heart disease; Ingestion of digitalis in preceding six months; Fixed-rate pace maker in subjects; Uncontrolled metabolic disease (especially diabetes mellitus); Neuromuscular, musculoskeletal or rheumatoid disorders; Hypertension and associated pulmonary disease (e.g. asthma, pneumonia etc.); Previous history of chest surgery; Pregnancy; On any medication.

Subjects were adviced for relaxation, wear light clothing and take their normal meals 2-3hrs before the study.

Anthropometric measurements were taken. Pre-exercise blood pressure, pulse rate and respiratory rates were recorded.

Table-1: PR Interval, QRS Duration andQTcIntervalof subjects pre and post-exercise (ms).

Sex	PR Interval		QRS Duration		QTCInterval	
	Pre-Exercise	Post-Exercise	Pre-Exercise	Post-Exercise	Pre-Exercise	Post-Exercise
Male	153.00 23.9.	154.75 14.7.	90.86 4.57.	94.09 9.81.	386.55 20.63.	415.82 22.94*.
Female	160.44 27.54.	153.33 19.21.	87.44 5.77.	88.89 8.76.	399.39 20.41.	409.11 18.84.
Paired Diff. of Means	-12.94 37.45	-0.13 25.01	3.94 8.32	6.33 13.46	-12.56 33.46	5.39 29.26

Values are mean SD
*Significant (p<0.05).

Table-2: Correlations between PR Interval, QRS Duration and QTCInterval and measured variables Pre and Post-exercise.

Variables	PR Interval		QRS Duration		QTCInterval	
	Pre	Post	Pre	Post	Pre	Post
Height	- 0.18	0.11	0.39*	0.29	- 0.11	0.08
Weight	- 0.19	0.08	0.19	0.10	- 0.05	0.18
BMI	- 0.04	0.02	- 0.19	-0.20	0.06	0.17

*Significant (p<0.05).

A qualified medical personnel supervised the period of exercise test to handle any emergency that may arise. Three technical staffs we also involved in the study. The procedure was demonstrated to the subjects before the exercise.

Recordings were carried out according to the specifications of the American Heart Association, i.e. subjects lying supine, arms by their side, chest electrodes in their correct positions, limb electrodes on the wrists and ankles, recording at 25 mm/sec, calibrated at 10 mm/mV.

Exercise stress test was done using bicycle ergometer (Magnetic Bike). The age-predicted maximal heart rate (HRMax) was first calculated using the formula, HRMax = 220 - age.[7] 85% (sub maximal level) of this value is the heart rate the subject aims to achieve during the stress test.[8] Subjects sat comfortably on a bicycle with the seat adjusted in such a way that there was knee flexion when the contralateral knee was fully extended. The digital monitor was reset and resistance was fixed at stage 2. The subject started walking slowly and gradually increased the speed, until the attainment of 85% age-predicted HRMax or when exhausted and could not continue due to fatigue (modified McArdle protocol).[9] Before final dismounting, the subject is asked to walk/run slowly for about 30 seconds. The subject was then asked to sit and relax and the ECG recorded again. The duration of exercise, distance covered, calories burnt and the maximal heart rate were recorded by the digital monitor. The room temperature at the time of study was 34°C. The study was approved by the ethical committee of College of Health Sciences, University of Abuja. The subjects gave written informed consent for participating in the study. It was according to Helsinki Declaration of June 1964 and amended in Seoul in October 2008.

Data obtained was interpreted using SPSS 13.0. The differences between pre and post-exercise values were evaluated using the pairwise t-test. All descriptive data was expressed as means ± standard deviations. Results were considered significant when p was ≤ 0.05.

The descriptive statistics: The ages of the subject ranged from 18-30 years, with average of 21 years among males and 23 years among the females. Their heights were between 1.5-2.0m with average in males being 1.77m and 1.58m in females. The subjects weighed between 44 - 92kg with the average weight in males being 67kg and in females 52kg. BMI of the subjects ranged between 17.72 and 28.57, with males having an average of 21.46 and females 22.52. Duration of QTCinterval in males was significantly raised post-exercise but marginal in females (Table-1).

Pre-exercise PR interval was found to be higher in females as compared to male subjects. Post-exercise, the values were higher in males (Table-1). QRS duration was found to be higher in males both pre and post-exercise (Table-1). The ECG variables were correlated with descriptive variables pre and post exercise. This was to ascertain the strength of relationship between the variables studied. The results are shown in ECG variablesof pre- and post-exercise and correlated with descriptive variables in (Table-2).

Discussion

In this study, QTCdurations fell within the normal range, higher in the females both pre and post-exercise. An increase was recorded post-exercise in both sexes the increase in males was statistically significant (p-value <0.05).

Jonathan and Adams (2002)[8] found the normal responses during exercise to be shortening of PR, QRS and QT internals. This was corroborated by Monero-Reviriego and Meniro.[10] The obvious response to the

increase in HR is shortening of the PR interval, QRS durationand QT interval. These changes occur in normal subjects and are related to a normal HR response.[8] But in our study, reverse was the case. It was only the PR intervals in females that showed a post-exercise decrease. Though the changes were not statistically significant except in QTC interval in males where there was significant increase post-exercise. There is thus need for further studies in this region to verify if there is post-exercise increase and look for possible confounding factors that may give these effects.

Conclusion

The paired difference between males and females were not significant in any of the measured variable. Conclusions drawn from the study revealed an unexpected finding where PR, QRS and QT durations were prolonged post-exercise in apparently healthy young medical students. Though they all fell within normal range, ideally these parameters decrease with exercise due to increase in heart rate. The researchers found very little work done in this area, especially among the blacks. There is need to explore this area of study among the blacks especially with the rising incidence of cardiovascular diseases.

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