

ORIGINAL ARTICLE**The Mean and Standard Deviation of ECG Parameters in Healthy Zagazig University Students.**Mahmoud Elbanna¹, Mahmoud Hassan Shah², Manar Mostafa Al Zaki³, Mohammed Hassan Khedr⁴¹ Resident of cardiology, Cardiology department, Zagazig General Hospital, Zagazig, Egypt² Professor of cardiology, Faculty of Medicine, Zagazig University, Zagazig, Egypt.³ Professor of cardiology, Faculty of Medicine, Zagazig University, Zagazig, Egypt.⁴ Lecturer of cardiology, Faculty of Medicine, Zagazig University, Zagazig, Egypt.**Corresponding author**Mahmoud Ibrahim Elbanna
Resident of
cardiology, Cardiology
department, Zagazig General
Hospital, Zagazig, Egypt**E-mail:**drclever872@gmail.com

Submit Date 2021-01-22

Revise Date 2021-02-20

Accept Date 2021-03-24

ABSTRACT

Background: Sudden cardiac death (SCD) in young adults has a rare incidence but it is tragic. It affects five per 100,000 yearly according to some studies. One of the main causes of SCD especially in young adults is non-structural heart diseases that include long QT syndrome, short QT syndrome, Brugada syndrome, catecholaminergic polymorphic ventricular tachycardia, idiopathic ventricular fibrillation (IVF), atrio-ventricular node block, and recently early repolarization. In Egypt there is no sufficient data about prevalence of these diseases or normal ECG parameters. The aim of this work is to assess the mean and standard deviation of electrocardiography (ECG) parameters in healthy Zagazig University students which will help in addition to old studies and coming studies to better management of sudden cardiac death especially in young adults.

Methods: In this study we collected a random sample of healthy students from Zagazig University Student Hospital (during general examination during the application for the university) and student accommodation in August and September 2017. Our sample size was 800 students, 474 were females and 326 were males, the mean age was 18.42 ± 1.1 .

Results: Athletes has a slower heart rate, wider QRS, and longer QT interval than non-athletes. Females have longer QT and narrower QRS than males.

Conclusion: there is a significant difference between athlete and non-athlete and also there is a significant difference between male and female in the mean and standard deviation of QT interval, QRS duration, and heart rate.

Keywords: QT interval, QRS, heart rate

**INTRODUCTION**

Sudden cardiac death in the young adults is rare but it is tragic. It affects five per 100,000 yearly according to some studies. Non-structural heart diseases that cause sudden cardiac death include long QT syndrome, short QT syndrome, Brugada syndrome, catecholaminergic polymorphic ventricular tachycardia, idiopathic ventricular fibrillation (IVF), AV node block, pre-excitation syndrome, and recently early repolarization. Some of these non-structural heart diseases can be detected by resting ECG [1][2].

There is a little data in Egypt about prevalence of SCD, the mean of ECG parameters and prevalence of ECG abnormalities in population. So in this paper we studied the mean and standard deviation of ECG

parameters in healthy Teenagers. This study provides data that can help in addition to old and coming studies to better management of sudden cardiac death especially in young age.

AIM OF WORK

To assess the mean and standard deviation of ECG parameters in healthy Zagazig University students. PATIENTS AND METHODS:

Technical design: A cross sectional study carried out at Zagazig University Student Hospital and student accommodation. Sample was collected in August and September 2017 at Zagazig University Student Hospital and student accommodation. 2000 healthy students of Zagazig University students, whom met the inclusion criteria were 800. Our inclusion criteria was to be healthy student by

general examination , local cardiac examination ,and medical history and to be 17-25 years old. Exclusion criteria is student who have hypertension, diabetes mellitus, valvular heart disease, ischemic heart disease, renal impairment or o medications that cause ST-T changes e.g. (Na channels blockers, beta blockersetc.).

Methods: All patients were subjected to full history taking, full general examination , local cardiac examination and resting ECG. Student was considered active (athletic) if he participates in an amateur team, college team, local team or national team that requires regular competition against others, places a high premium on excellence and achievement, and requires regular physical training. Then Resting Electrocardiograph of the standard 12 leads in supine position after rest in a quiet room with a quiet respiration. ECG was done by electrocardiograph machine of Fukuda Denshi (Cardimax FX-7102) and was interpreted by three cardiologists from Zagazig University cardiology department.

Administrative considerations: This study has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans. Written consent was obtained from individuals participated in this screen. The study was approved by the research ethical committee of Faculty of Medicine, Zagazig University (Institutional Research Board IRB)..

Statistical analysis:Data collected throughout history, basic clinical examination, and standard ECG analysis was coded, entered and analyzed using Microsoft Excel software. Data were then imported into Statistical Package for the Social Sciences (SPSS version 20.0) (Statistical Package for the Social Sciences) software for analysis. Data

were collected and submitted to statistical analysis. The following statistical tests and parameters were used. Mean was calculated by this equation ($Mean = \sum x /n$) where $\sum x$ is the sum of the values and (n) is the number of subjects. Standard deviation (SD) was derived by this equation

$SD = \sqrt{\Sigma(x - \bar{x})^2 / (n - 1)}$, where $\Sigma(x - \bar{x})^2$ is the sum of the square of the differences of each observation. Chi square test was used to compare between two groups regarding the distribution of different variables by this equation $\chi = \Sigma[(O - E)^2 / E]$.

RESULT

Our sample collected was 2000 students, 800 met the inclusion criteria 474 were females and 326 were males, the mean age was 18.42 ± 1.1 . Level of activity in all sample and between males and females are shown in table (1) and (2). The mean and standard deviation of PR interval, heart rate, cQT and QRS of our sample are shown in (table 3). Comparison between male and female in the mean and SD are shown in table (table 4),with statistically significant longer QTc in females ,heart rate was significantly lower in males than females , QRS duration was significantly wider in males ,and there was no statistically significant difference in PR interval between males and female .Comparison between athletes and non-athletes in the mean and SD are shown in table (table 5) and shows that athletes had a statistically significant lower heart rate ,longer QRS ,shorter QTc than non-athletes ,and there was statistically non-significant longer PR in athletes .Comparison between athletic males and non-athletic males, also between athletic females and non-athletic females in the mean and SD of ECG parameters are shown in (table 6).

Table 1: Studied group level of activity

		N	%
Physical activity	Sedentary	508	63.5
	Athlete and Active	292	36.5
Total		800	100.0

Table2 : level of activity between male and female

	Gender	Gender		Total	X ²	P
		Female	Male			
Physical activity	N	61	231	292	706.6	0.00**
	%	12.8%	71.0%	36.5%		
Total	N	474	326	800		
	%	100.0%	100.0%	100.0%		

Table3:Mean and median rate, PR interval, QRS and cQT in all

	Rate	PR interval mesc	QRS ms	cQT ms
Mean ±SD	78.94±12.6	141.45±32.6	99.15±15.5	413.47±27.1
Median (Range)	77.0 (43-127)	139.0 (97-764)	98.0 (70-391)	414.0 (37-492)

Table 4 :Mean and SD of rate, PR interval, QRS and cQT in male and female

	Gender	N	Mean	Std. Deviation	t	P
Rate	m	326	74.1560	12.42825	-14.741	0.00**
	f	474	82.2369	11.77276		
PR interval ms	m	326	142.8612	17.47904	1.599	0.110
	f	474	140.4823	39.89074		
QRS ms	m	326	106.6216	19.77181	19.368	0.00**
	f	474	94.0371	8.68251		
cQT ms	m	326	403.9287	32.91511	-13.668	0.00**
	f	474	420.0211	19.61775		

Table 5 :Mean and SD of rate, PR interval, QRS and CQT in athlete and non-athlete

	Physical activity	N	Mean	Std. Deviation	t	P
Rate	Not	508	82.5976	11.60634	18.350	0.00**
	Athlete	292	72.5986	11.94681		
PR interval ms	Not	508	140.9984	38.66051	-0.816	0.415
	Athlete	292	142.2370	18.12054		
QRS ms	Not	508	95.9693	9.79546	-12.562	0.00**
	Athlete	292	104.7082	21.16098		
cQT ms	Not	508	418.8268	19.68106	12.099	0.00**
	Athlete	292	404.1548	34.55652		

Table 6: comparison of Mean and SD of rate, PR interval, QRS and CQT in athlete and non-athlete among male and female

Gender		Physical activity	N	Mean	Std. Deviation	t	P
f	Rate	Non Athlete	413	83.0832	11.31289	6.570	0.00**
		Athlete	61	76.4803	13.18637		
	PR interval ms	Non Athlete	413	140.3975	42.17597	-0.191	0.849
		Athlete	61	141.0592	17.84489		
	QRS ms	Non Athlete	413	94.0542	8.91929	0.176	0.860
		Athlete	61	93.9211	6.88171		
	cQT ms	Non Athlete	413	421.1315	19.54081	5.138	0.00**
		Athlete	61	412.4671	18.49679		
m	Rate	Non Athlete	95	80.4703	12.61994	9.787	0.00**
		Athlete	231	71.5779	11.39331		
	PR interval ms	Non Athlete	95	143.6314	15.59718	0.803	0.422
		Athlete	231	142.5467	18.19494		
	QRS ms	Non Athlete	95	104.3602	9.03289	-2.090	0.037*
		Athlete	231	107.5450	22.68568		
	cQT ms	Non Athlete	95	408.7288	16.95283	2.669	0.008*
		Athlete	231	401.9601	26.65754		

DISCUSSION

In our study the results of ECG parameters of the sample was PR interval 141.45±32.6 ms ,QRS duration 99.15±15.5 ms ,and QTc duration

413.47±27.1 ms .In a study done in 2018 in Spain ,the sample was 1911 students with mean age 14 years, the PR interval was 135.81± 17.87 ms, QRS was 90.10±10.68 ms ,and QTc was 417.19±24.97

ms, with a wider QRS and shorter PR than our study[3].

Regarding ECG parameters difference between males and females, in our study QTc, was statistically significant longer QTc in females .In a study done in 2018 on north American adolescents with age between 16 and 18 years , the mean and SD of QTc was 387 ± 27 ms in males and 394 ± 22 ms in female .QTc was longer in females than males like our study and QTc of both males and females was significantly shorter than in our study [4].

In Singapore 2012 a study on was done on the ECG of 18476 young male adults in clinical examination before participation in military. The mean and standard deviation of PR was 147 ± 21 ms ,QRS was 100 ± 13 ms ,QTc 393 ± 26 ms .In our study males had PR 142.8 ± 17 ms ,QRS 106.6 ± 19 ms, and QTc 403.9 ± 32 ms .In comparison to this study , males in our study had a shorter PR ,wider QRS and longer QTc.We should note that 70% of males of our sample were athletic ,but percentage of athletes in this study is not known[5].

Regarding difference between athletes and non-athletes, in our sample there were 292 athletes (231 males and 61 females) and 508 non-athletes (413 females and 95 males). In our study athletes had a statistically significant lower heart rate (72.5 ± 11.9 vs. 82.5 ± 11.6), longer QRS (104 ± 21 ms vs 95.9 ± 9.7 ms),shorter QTc (404 ± 34 ms vs. 418 ± 19 ms) than non-athletes and there was statistically non-significant longer PR (142 ± 18 ms vs 140 ± 38 ms).But in a study done in Qatar in 2012 (mean age 22.6 years ,800 were athletes and 135 non-athletes) there was statistically non-significant difference between athletes and non-athletes in PR(160 ± 29 ms in athletes 158 ± 26 ms in non-athletes) nor in QRS (86.9 ± 9 ms in athletes 85.8 ± 8.9 ms in non-athletes) and in contrary to our study QTc was longer in athletes(396 ± 26 ms vs. 389.5 ± 24 ms)[6]

In a study in U.K in 1999 done on 1000 athletes and 300 non-athletes, showed that athletes had statistically non-significant longer QRS (92 ± 12 ms vs. 89 ± 7 ms) and had a statistically significant longer PR (153 ± 20 ms vs. 140 ± 18 ms) than non-athletes like our study ,but showed that athletes had statistically significant longer QTc (391 ± 27 ms vs. 379 ± 29 ms) than non-athletes in contrary to our study [7].

CONCLUSION

Athletes have a slower heart rate, wider QRS , and longer QT interval than non-athletes. Females have longer QT and narrower QRS than males. No significant difference in PR interval between athletes and non-athletes. There is a significant difference between athletes and non-athletes and between males and females in the mean and standard deviation of ECG parameters. There a difference in mean and SD of ECG parameters between ethnicities.

REFERENCES

- 1-Priori SG, Wilde AA, Horie M, Cho Y, Behr ER, Berul C, et al. HRS/EHRA/APHS expert consensus statement on the diagnosis and management of patients with inherited primary arrhythmia syndromes: document endorsed by HRS, EHRA, and APHS in May 2013 and by ACCF, AHA, PACES, and AEPC in June 2013. *Heart Rhythm*. 2013;10(12):1932-1963.
- 2-Ackerman M, Atkins Dianne L, Triedman John K. Sudden Cardiac Death in the Young. *Circulation*. 2016;133(10):1006-1026.
- 3- Vilardell P, Brugada J, Aboal J, Loma-Osorio P, Falces C, Andrea R, et al. Characterization of Electrocardiographic Findings in Young Students. *Rev Esp Cardiol (Engl Ed)*. 2018.
- 4- Saarel EV, Granger S, Kaltman JR, Minich LL, Tristani-Firouzi M, Kim JJ, et al. Electrocardiograms in Healthy North American Children in the Digital Age. *Circ Arrhythm Electrophysiol*. 2018;11(7):e005808
- 5-Ng CT, Ong HY, Cheok C, Chua TS, Ching CK. Prevalence of electrocardiographic abnormalities in an unselected young male multi-ethnic South-East Asian population undergoing pre-participation cardiovascular screening: results of the Singapore Armed Forces Electrocardiogram and Echocardiogram screening protocol. *Europace*. 2012;14(7):1018-1024.
- 6- Wilson MG, Chatard JC, Carre F, Hamilton B, Whyte GP, Sharma S, Chalabi H. Prevalence of electrocardiographic abnormalities in West-Asian and African male athletes. *Br J Sports Med*. 2012;46(5):341-347.
- 7- Sharma S, Whyte G, Elliott P, M. Padula, R. Kaushal, N. Mahon, W. J. McKenna. Electrocardiographic changes in 1000 highly trained junior elite athletes. *Br J Sports Med*. 1999;33(5):319-324.

How to cite

Elbanna, M., Shah, M., Al Zaki, M., Khedr, M. The Mean And Standard Deviation Of ECG Parameters In Healthy Zagazig University Students. *Zagazig University Medical Journal*, 2024; (121-124): -. doi: 10.21608/zumj.2021.58236.2089