Research Article

Effect of direct exposure to ringing mobile phone waves on ECG heart rate and rhythm among healthy adults

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Abstract

The effect of electromagnetic wave from mobile phones on human health is of great interest, the current study was designed to investigate the effect of mobile phone electromagnetic waves on ECG heart rate and rhythm among different healthy adult volunteers' ages and sex while mobile phone was placed on the chest pocket level during ringing mode. It was an experimental, comparative study conducted in the period from march 2014 to August 2016 in north of Sudan at Elsheikh Abdallah Elbadri University among 850 volunteers, Sudanese and other nationalities.500 male and 350 females, aged 16 - 49 years were included in the study. ECG was done before and after exposure to ringing mobile phone. Significant changes in ECG heart rate and rhythm was detected and the results was found to be consistent in males and females' group. The study conclude that mobile phone is not a safety device and should not be used by medical staff inside the ECG rooms.

Keywords*: Ringing Mobile phone, ECG heart rate, rhythm, chest pocket level, healthy adult.*

Abbreviations: ECG Electrocardiogram, HR Heart Rate

I. INTRODUCTION

Smart phones became an integral part of the people live. The effect of cell phones on human health is a field of researcher interest. Mobile phones' radiofrequency transmitters, operating at frequencies between 450 and 2700 MHz with peak powers in the range of 0.1 to 2 watts [1, 2]. In 2015, there were 7.4 billion phone subscriptions worldwide, although the actual number of users whom own more than one mobile phone is uncertain [3]. The current study is conducted to investigate the potential risks of mobile phones wave on ECG heart rate and rhythm among different volunteers' age group in both sex. Using of mobile phone may possibly represent a long-term health risk [4,5]. Some countries have warned against the use of mobile phones by minors in particular, due to health risk uncertainties [6].The effect of mobile phone waves on the heart has not been studied in Sudan before.

Objective

The aim of current study is to assess the effect of direct exposure to ringing mobile phone waves on ECG heart rate and rhythm among healthy adult.

II. MATERIAL AND METHODS

It was an experimental comparative prospective cross-sectional study conducted at Faculty of Health Sciences in Elsheikh Abdallah Elbadri University, during March 2014 to August 2016 among 850 Sudanese and non-Sudanese volunteers' males and females' students and workers in the University aged 16 – 49 years. The hypothesis introduced whether radiofrequency induced by a mobile phone can affect ECG readings. ECG paper test was printed first as base line, then mobile phone was placed near ECG machine in ringing mode, silent mode and during charging, then ECG machine test paper was printed during all mobile phone modes and the results was analyzed The volunteers were abstained from tea, coffee or cola containing beverages or alcohol before 30 minutes of ECG recording to minimize the effect of these confounding factors on ECG parameters. The participants were requested not to use mobile phone before 30 minutes of the recording of the ECG. Researcher used volunteers' mobiles cell (2G, 3G, Nokia during study time). The 12-lead ECG (baseline) was recorded using ECG machine (6 canals ECG machine 2010. Zoncare model CE:0434, version number: V1.0.s) when mobile was absent, during ringing mobile phone cells. Mean, standard deviation, paired t. test and cross

tabulation, 99% level of confidence were used for data analysis.. P value ≤ 0.01 considered to be statistically significant. ECG Rate was interpreted in 1st 10seconds, 2nd10seconds and 3rd10 seconds after direct exposure.

III. RESULT

The total number of study population was 850 of both gender.61% were students and39% of them were workers. There is significant increase of HR after phone exposure in 1st 10 seconds and 3rd10 seconds compared to that obtained before exposure, while no significant increase of HR in 2nd 20 seconds (Table 1,Figure 1).Significant change was detected in ECG rhythm after exposure to ringing mobile phone where92.4% of males and 88.6% of females showed irregularity of rhythm during 30 seconds of exposure (Table 2, Figure 2).

Table (1): Effect of mobile phone on ringing mode at chest pocket level on ECG rate

Parameter	Before exposure (Mean±SD)	1st 10 seconds (Mean±SD)	2nd 10 seconds (Mean±SD)	3rd 10 seconds (Mean±SD)
ECG HR	78.16±9.787	85.987±10.118	77.831±10.965	81.481±10.803
P value		0.000	0.533	0.000

Figure (1) Effect of mobile phone on ringing mode at chest pocket level on ECG rate

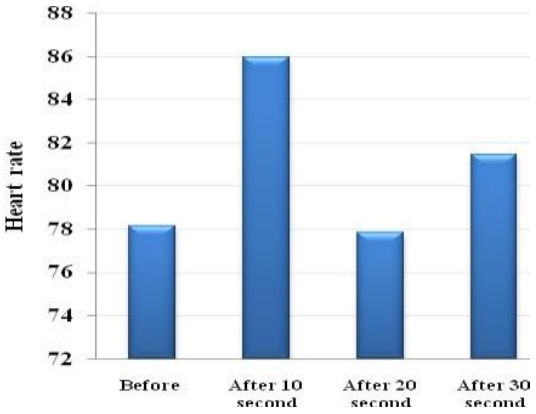
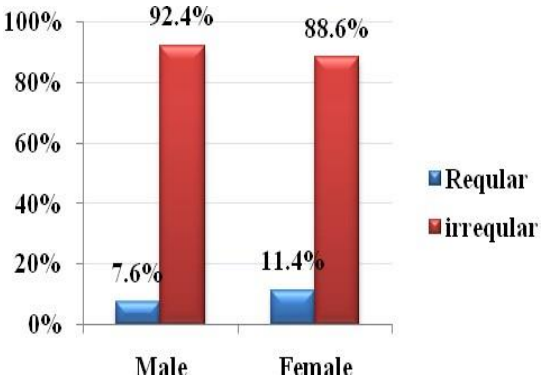


Table (2): Effect of mobile phone on ECG rhythm and the correlation with gender.

Gender	During 30 seconds	
	Regular ECG HR	Irregular ECG HR
Male	38 (7.6%)	462 (92.4%)
Female	40(11.4%)	310 (88.6%)

Figure (2) Effect of mobile phone on ECG rhythm in male and female subjects



IV. DISCUSSION

The present study is the first one to be conducted in Sudan and few studies have been conducted on the effects of mobile phone on the ECG worldwide. The results revealed that there was clear influence of direct exposure to mobile phone wave on ECG HR.

Statistically significant increase over the first 10 second and 30 seconds post exposure was noticed in the present study, while result showed no significant change over 20 second post exposure. Current result is in agreement to another study done by Dawser Hussain et.al (2014) where there is a random increase in the average heart rate of the volunteers from 75 to 103 b/m[(7)]. ECG rhythm became irregular sinus rhythm post exposure to mobile phone wave after direct exposure .This was found to be consistent with previous study done by Kavyannejad et al 2009 which reported the onset of sinus arrhythmia as the result of mobile phone [(8)]. Other previous study conducted in Zahedan University of Medical Sciences showed significant difference between heart rate during talking in comparison with heart rate during ringing and resting in both genders [(9)]. Ahmed thajudine et al 2012, studied the effect of mobile phone radiation on heart rate variability among 14 volunteers. The result indicated an increase hear rate when mobile phone is kept close to the chest and a decrease when kept close to the head. Mobile phone has caused changes in HR pattern and the change varied with its position, but the changes was found to being significant [(10)]. Devasia, T.et al , studied the effect of different mobile phone on healthy volunteers and reported that the mobile phone positioned to the proximity of the heart has no effect on the heart rate or cardiac electrical activity [(11)]. Niger. J.et al reported that acute exposure to electromagnetic waves from cell phones placed near the heart may not interfere with the electrical activity of the heart or blood pressure in healthy individuals in18 subjects which was too small sample size to be taken in consideration [(12)].

V. CONCLUSION

The study concluded that mobile phone wave during ringing mode at chest pocket level has significant effect on ECG heart rate and rhythm and further studies is recommended for more elaborations of the results obtained.

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