International Journal of Biotechnology and Biomedical Sciences
p-ISSN 2454-4582, e-ISSN 2454-7808, Volume 3, Issue 1; January-June, 2017 pp. 16-17

http://www.krishisanskriti.org

Effect of Mobile Phone on Heart Rate and Blood Pressure in Normal Healthy Mobile Phone Users

K.Singh.MD[1] and Kulwant Dabla.MD.[2]

[1,2]PGIMS, Rohtak, Haryana
E-mail: [1]dr_rb_singh@rediffmail.com

Abstract

Background*: Ubiquitous use of Mobile Phone (MP) is reported to affect biological system in humans. Objective: The study was planned to investigate the effects of mobile phone on Heart Rate (HR) and Blood Pressure (BP) in normal healthy mobile phone users. Material and methods: Study was carried out in 30 normal healthy males in the age group of 18-40 years, before and after exposure to MP (1800 MHz, GSM band, model Panasonic GD75) who were using MP for more than 5 years. Statistical analysis was done by paired 't' test.*

Results*: After exposure to MP, HR was found to be increased significantly (P<0.001). There was no effect on systolic BP, but significant reduction in diastolic BP and elevation in pulse pressure (p<0.01) occurred.*

Conclusion*: EMR emitted from MP may affect cardiovascular system.*

Keywords*: Electromagnetic Waves. Mobile Phone. Heart Rate. Blood Pressure.*

Effect of Mobile Phone on Heart Rate and Blood Pressure in normal healthy mobile phone users

1. INTRODUCTION

Mobile phones (MP) are part of telecommunication connectivity, infiltrated every part of life. Electromagnetic radiation (EMR) emitted not only from mobile phones but also from other household devices as Wi-Fi, television, microwaves, and radio transmitters etc., may affect biological system by producing oxidative stress through lipid peroxidation [1]. Electromagnetic waves (EMW) emitted from MP, unlike ionizing radiation such as X-rays or gamma rays, are not able to break chemical bonds and not so powerful to damage deoxyribonucleic acid (DNA), but these waves are likely to be absorbed by tissues closest to EMR exposure site and produce mild local thermal effect. In addition effect of EMR depends on use of mobile phone set technology, extent, type of use, phone antenna and distance from cell phone base station [2]. Due to excessive use of MP, electromagnetic radiation was reported to be 11.48 mW/mm, which is 1,148% of biological limit [3]. So, it is very necessary to investigate and monitor any potential public health impact of increasing MP use. Since MPs are used in close proximity to the heart, so 900MHz EMR emitted from MP may be absorbed by heart [1]. Therefore, aim of the study was to find out the effect of EMW emitted from MP heart rate (HR) and blood pressure (BP).

2. MATERIAL AND METHODS:

The study was carried out in 30 healthy male subjects in the age group of 18 -40 years (mean 29.21 ± 1.20) in Physiology department at PGIMS, Rohtak, Haryana. Subjects were using MP for more than 5 years, with more than 30min/day exposure. Subjects having hypertension, cardiac disease, diabetes mellitus, acoustic disorders, and computer professionals were excluded from the study. The written consent was taken from each subject. Exposure to EMW was done by listening to MP - 1800 MHZ frequency, Band GSM Type, Model Panasonic GD75, placed near to ear for 10 min. in on position. Specific Absorption Rate (SAR) was 0.669 Watt / Kg averaged over 10 gm of tissue. Non-exiting topics were made to listen in monotonous tone. Local ethical committee approved the study. Recording was taken around 10 A.M to avoid diurnal variation. All subjects were abstained from consuming caffeinated beverages, smoking and physical activity 12 hours preceding the procedure. Subjects were asked to take at least 15 min rest before the procedure to avoid any effect of anxiety at the time of experiment. Precaution was taken to avoid any disturbance and avoid any incoming call and message at the time of experiment, and same mobile phone was used for all recordings [4].

Blood pressure was recorded by sphygmomanometer (arm cuff method). HR and BP were recorded before and after exposure to MP. Statistical analysis was done by applying paired 't' test. A p value < 0.05 was considered significant.

3. RESULT:

The study was conducted in 30 male healthy subjects with mean BMI (24.7 ± 1.98). Subjects were exposed to MP for duration of 10min. during the experiment. Subjects were using MP for the last 5 to 8 (6.2 ± 2.2) years, per day exposure to

MP varied from > 30 min , duration of per call varies from 2 to 30 (10.2 ±3.75) min. HR was found to be increased significantly ($p<0.001$) after exposure to MP (77.12 ± 4.85) compare to basal level (75.83 ± 5.34). There was no change in systolic BP (120.56 ± 5.65 vs 120.16 ± 5.20) but diastolic BP was reduced (73.27 ± 14.04 vs 74.52 ± 10.75) and pulse pressure ($p<0.01$) was increased (45.08 ± 4.96 vs 41.76 ± 12.13) significantly ($p<0.01$) by EMR emitted from MP versus before MP exposure .

4. DISCUSSION:

MP has now become an essential requirement, integral part of daily life. MPs are reported to produce thermal, autonomic, neurological, acoustic effects i.e., headache, giddiness, clicking sound in the ear, and blurring of vision. Whole of the study was carried out in male subjects, in young age group to avoid effect of gender and age [5, 6]. It was documented by Kamiya et al [7] that flexed position of forearm and hand grip exercise may increase sympathetic outflow. In our study, we eliminated this factor by keeping the phone near to subject's head and keeping the hand straight. Every precaution was taken to keep the subject absolute immobile to remove the movement factor [8].

In our study, HR was found to be increased. It is in accordance with Shelke et al [9], who reported that HR increased during MP ring. Similarly even antenatal and postnatal maternal use of MP results in statistically significant increase in fetal and neonatal HR [10]. In our previous study also, R-R interval was found to be reduced in both MP nonusers and MP users groups after exposure to MP [11]. Increase in HR is also documented by MP use. [12]. In contrast, significantly lower arterial BP and HR are demonstrated in EMW exposed than non exposed persons [13]. While others did not find any change in arterial BP and HR during or after radiofrequency (RF) of 900 MHz cellular phones [14]. It is postulated that EMW affects the HR through central mechanism via brain structures that controls autonomic functions especially HR and heart rhythmicity [15]. It is also reported that change in HR and BP were independent of EMW exposure from MP [14].

In this study, diastolic BP was reduced, pulse pressure was increased without any alteration in systolic BP. In contrast, it is reported that arterial BP and HR did not change during or after 35 min exposure to 900 MHz,1800 MHz and sham exposure condition [14]. In another study, researchers could not find any difference in HR, BP and ECG parameters before and after MP exposure [14,15].

MP receives and transmits high frequency microwave radiation, which excites molecular structures, particularly water molecules, causing non thermal effects. EMR emitted from the MP can penetrate organic tissues, causing temperature rise in deeper layers, preferably in tissues with high water content. Recently it is demonstrated that biological effects are possible without any warming of tissues [16]. Therefore, it is concluded that mobile phone may affect cardiovascular system.

REFERENCES

[1] Ozguner F, Altinbas A, Ozaydin M, Dogan A, Vural H, Kisioglu A N et al. Mobile phone –induced myocardial oxidative stress: protection by a novel antioxidant agent caffeic acid phenethyl ester. Toxicology and Industrial Health 2005; 21: 223-30.

[2] Meena J K, Verma A, Kohli C, Ingle K. Mobile phone use and possible cancer risk: Current perspectives in India. Indian J Environ Med 2016; 20(1): 5-9.

[3] Dhami A K. Study of electromagnetic radiation pollution in an Indian city. Environ Monit Assess 2011; 184: 6507-12.

[4] Singh K, Das S. Effect of EMW emitted from mobile phone on HRV in mobile phone nonusers and users. Indian J Physiol Pharmacol 2009; 53 (5): 405.

[5] Andrezejak R, P orema ZM, Derkacz A, Skalik R, Gaci P, Beck B. Influence of the call with a mobile phone on heart rate variability parameter in healthy volunteers. Industrial Health 2008; 46: 409 -17.

[6] Huikurich, Pikkujamsa S, Airasinan K, Ikaheimo M, Rantala A, Kauma H, Lilja M, Kasaniemi Y. Sex related differences in autonomic modulation of heart rate in middle aged subjects. Circulation 1996; 94: 122 - 5.

[7] Kamiya A, Michikami D, Fu Q, Niimi Y, Iwase S, Mano T, Suzumura A. Static hand grip exercise modifies arterial baroreflex control of vascular sympathetic outflow in humans. Am J Physiol Regul integr Comp Physiol 2001; 281: 1134-9.

[8] Brennere KM, Thomas S, Shepherd RJ. Autonomic regulation of circulation during exercise and heat exposure: Inferences from Heart Rate Variability. Sports Med 1998; 26: 85- 99.

[9] Shelke VS, Badwe AN, Kulkarni NB, Krishna AP. Effect of mobile ring on Heart Rate Variability in mobile phone users and non mobile users. JAPI 2008; Supple (124 abstract): p1179.

[10] Rezk A Y, Abdulqawi K, Mustafa R M, Abo El, Azm T M, Al Inany Hesham. Fetal and neonatal responses following maternal exposure to mobiles phones. Saudi Med J 2008; 29(2): 477- 83.

[11] Singh K, S Das. Effect of electromagnetic radiation emitted from mobile phone on electrocardiographic variables and rate pressure product. International J Physio 2017; 5(1): 28-32.

[12] Razavinia A. Studying the effects of mobile phone on electrocardiogram parameters of students in Zahedan University of medical sciences. International J Mobile Network Design Innovation 2014.conference paper.

[13] Borkiewicz A, Gadzieka E, Zmyslony M. Heart Rate Variability in workers exposed to medium frequency electromagnetic fields. J Auton Nerv Syst 1996; 59: 91-7.

[14] Tahvanainen K, Nino J, Halonen P, Kuusela T, Laitinen T, Lansimies E. Cellular phone use does not acutely affect blood pressure or heart rate of humans. Bioelectromagnetics 2004; 25: 73-83.

[15] Braune S, Riedel A, Schulte-Monting J, Raezek J. Influence of radio frequency electromagnetic field on cardiovascular and hormonal parameters of the autonomic nervous system in healthy individuals. Radiat Res 2002; 58: 352-6.

[16] AlOrainy A. Recent research on mobile phone effects. Proceedings of the International conference on non-ionizing radiation at UNITEN (ICNIR 2003). Electromagnetic fields and our health. 20th -22nd October 2003.