

To Assess the Effects of Mobile Phone usage on SBP (Systolic Blood Pressure) Among Adult Population**Amera Anjum Saifee¹, Rashmi Iyengar², Madhuli Patni³**¹Senior Resident, Dept. of Physiology, ESIC, Medical College & Hospital, Sanathnagar, Hyderabad, Telangana, India²Assistant Professor, Dept. of Physiology, Mamata Academy of Medical Sciences, Hyderabad, Telangana, India³Assistant Professor, Dept. of Physiology, Mamata Academy of Medical Sciences, Hyderabad, Telangana, India

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Corresponding Author: Dr. Amera Anjum Saifee

Conflict of interest: Nil

Abstract:

Background: Worldwide, mobile phone usage has been increased dramatically which could affect the health of the people. In this pilot study a significant drop in heart rate, due to the placement of a dialling mobile phone on the chest, was found, thus confirming the hypothesis. Compared to the sham phone condition in the preceding 15 minutes, heart rate was lowered with approximately one beat per minute during the radiation condition. Heart rate returned to approximately the same level as before the radiation exposure in the subsequent sham phone condition.

Materials & Methods: The sample was derived from a population of 197 subjects who underwent monitoring for the study purposes. Blood pressure of the subject was measured in right hand, sitting posture by sphygmomanometer(mercury) and we have given 5 minutes rest before checking BP. Total WBC count was done by haemocytometer method using Turk's fluid as diluents. Cells were counted manually using compound microscope.

Results: Similarly, a significant positive correlation was found between the total duration of calls and in white blood cells. After adjustment for age, sex, and, the relationship between the duration of MP use its significance. In our study 2 no. of subjects is >11000 (Cumm/dl) are total leukocyte count whose percentage is 1.01 of the total subjects. 21 (n) no. of subjects are >141 (mmHg) of systolic blood pressure whose percentage is 10.65 of total subjects. 2 (n) no. of subjects are >91 (mmHg) of diastolic blood pressure whose percentage is 1.01 of total subjects.

Conclusions: In this study, it was shown that the duration of mobile phone use may affect the autonomic balance in healthy subjects. The electromagnetic field created by mobile phone use may induce HRV changes in the long term.

Keywords: Systolic Blood Pressure, Diastolic Blood Pressure, White Blood Cells, Heart Rate Variability. Electromagnetic Field, Mobile Phone.

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Introduction

The low amount of ionizing radiation is not much harmful, but the high amount of ionization of radiation can cause radiation sickness and cancer. The DNA is genetic material of cell that is sensitive to ionizing radiation. The DNA of the cell can be changed with ionizing radiation.[2] Smart phones give harmful radiation which can contribute to various harmful diseases such as brain tumors, male infertility, and hearing Impairment, effects on fetus, Alzheimer's disorder, Parkinson's disease, asthma, cardiovascular diseases, insomnia, high blood pressure, leukemia, birth defects, immune disorder, and rheumatoid arthritis. Electro-magnetic radiation causes symptoms such as headache, sleep

disturbance, tiredness and DNA damage due to the wireless radiation given off by the mobile phone devices.[3] In present time mobile phones users has grown significantly across the world. Almost world is estimated to be using mobile phones. [4,5]. Electromagnetic radiation is the flow of photons in the space. Each photon contains a certain amount of energy and different types of radiation are makes the amount of energy which is found in the photons. Ionizing radiation waves contain high energy that overcome the binding energy of electrons in atoms/molecules and creates ions. The Non-ionizing radiation wave does not carry high energy to make ions from atoms or molecules. These are low amount

of frequency radiations, such as radio waves, microwaves, infrared waves, etc. [6]. According to the medical test the low amount of ionizing radiation is not much harmful, but high amount of ionization of radiation can cause radiation sickness and cancer etc. The DNA is genetic material of cell that is sensitive to ionizing radiation. [2] Mobile phones including smart phone give harmful radiation can cause the harmful diseases such as brain tumors, male infertility, and hearing Impairment, effects on fetus, Alzheimer's disorder, Parkinson's disease, asthma, cardiovascular diseases, insomnia, high blood pressure, leukemia, birth defects, immune disorder and rheumatoid arthritis. Also the regular and long term use of mobile phone can have negative impact upon biological system especially on autonomic nervous system. [7]. Nowadays, the use of mobile phones has increased. These devices do not use any cable, hence are functioning on the basis of wireless radio-frequency wave. Smart phone are widely used in our country and especially by young people. Smart phones generate the electromagnetic radiation during its use. Electromagnetic radiation may have influence on autonomic, cardiovascular, endocrine, blood, and reproductive system.⁸ Therefore, I want to do a study regarding effects of radiation emitted by mobile phones on cardiovascular and haematological parameters among young adult population in Integral university campus in Lucknow.

Materials & Methods

The sample was derived from a population of 197 subjects who underwent monitoring for the study purposes. Blood pressure of the subject was measured in sitting posture by sphygmomanometer(mercury) and we have given 5 minutes rest before checking BP. All the participants were healthy, and none of them were on pharmacological treatment. Also, the investigated persons underwent 12-lead electrocardiographic (ECG) examination and echocardiography at rest. Population with coronary heart disease, heart failure, congenital heart disease, fever, hypoxia, a history of arrhythmia, neurological disease, endocrine disorder, and hypertension is excluded. The physical activity level and sedentary behaviour of the population were evaluated by an experienced physical therapist using the short-form International Physical Activity Questionnaire (IPAQ). All the population had been using MPs for >10 years prior to the study. The durations of mobile phone use were determined retrospectively from the individuals' telephone billing records. Daily durations of mobile phone use were calculated automatically by dividing the total duration of calls. HRV measurement were not included in the study

Statistical Analysis: The data will be analysed using statistical package for social science software appropriate statistical chi-square test will be used to analyse the data, P-value <.05 was taken as significant.

Results

Table 1: Number (n) and percentage (%) of Age group distribution of the subjects

Age (year)	No. of Subjects (n)	Percentage (%)
<20	11	5.58
21-25	168	85.27
26-30	15	7.61
31-35	3	1.52

As per table-1

- 11 (n) no. of subjects are ≤ 20 years of age whose percentage (%) is 5.58 of the total no. of subjects.
- 168 (n) no. of subjects are 21-25 years of age whose percentage (%) is 85.27 of the total no. of subjects.
- 15 (n) no. of subjects are 26-30 years of age whose percentage (%) is 7.61 of the total no. of subjects.
- 3 (n) no. of subjects are 31-35 years of age whose percentage (%) is 1.52 of the total no. of subjects

Table 2: Number (n) and percentage (%) of Gender distribution of the subjects

Gender	No. of Subjects (n)	Percentage (%)
Male	172	87.30
Female	25	12.69

As per table-2

- 172 (n) no. of subjects are male whose percentage (%) is 87.30 of the total no. of subjects.
- 25 (n) no. of subjects are female whose percentage (%) is 12.69 of the total no. of subjects.

Table 3: Continuous duration of mobile phone usage (hours) in number (n) and percentage of subjects respectively

Duration of mobile phone usage(continuous in hours)	No. of Subjects (n)	Percentage (%)
≤ 1	72	36.54
2	99	50.25
3	24	12.18
>4	0	0

As per table-3

- 72 (n) no. of subject's duration of usage mobile phones are ≤1 hours whose percentage (%) is 36.54 of the total no. of subjects.
- 99 (n) no. of subject's duration of usage mobile phone are 2 hours whose percentage (%) is 50.25 of the total subjects.
- 24 (n) no. of subject's duration of usage mobile phone are 3 hours whose percentage (%) is 12.18 of the total subjects.
- 0 (n) no. of subject's duration of usage mobile phone are ≥4 hours whose percentage (%) is 0 of the total subjects.

Table 4: Number (n) and percentage (%) of subjects with their leukocyte (WBC) count respectively

TLC (Cumm)	No. of Subjects (n)	Percentage (%)
<4000	0	0
4000-11000	195	98.98
>11000	2	1.01

As per table-4

- 0 no. of subjects is <4000 (Cumm/dl) are total leukocyte count whose percentage is 0 of the total subjects.
- 195 no. of subjects is 4000-11000 (Cumm/dl) are total leukocyte count whose percentage is 98.98 of the total subjects.
- 2 no. of subjects is >11000 (Cumm/dl) are total leukocyte count whose percentage is 1.01 of the total subjects.

Table 5: Number (n) and percentage (%) of subjects with their systolic blood pressure respectively

Systolic blood pressure (mmHg)	No. of Subjects (n)	Percentage (%)
100-120	107	54.31
121-140	79	40.10
>141	21	10.65

As per table-5

- 107 (n) no. of subjects are 100-120 (mmHg) of systolic blood pressure whose percentage is 54.31 of total subjects.
- 79 (n) no. of subjects are 121-140 (mmHg) of systolic blood pressure whose percentage is 40.10 of total subjects.
- 21 (n) no. of subjects are >141 (mmHg) of systolic blood pressure whose percentage is 10.65 of total subjects.

Table 6: Number (n) and percentage (%) of subjects with their diastolic blood pressure respectively

Diastolic blood pressure (mmHg)	No. of Subjects (n)	Percentage (%)
70-80	98	49.74
81-90	97	49.23
>91	2	1.01

As per table-6

- 98 (n) no. of subjects are 70-80 (mmHg) of diastolic blood pressure whose percentage is 49.74 of total subjects.
- 97 (n) no. of subjects are 81-90 (mmHg) of diastolic blood pressure whose percentage is 49.23 of total subjects.
- 2 (n) no. of subjects are >91 (mmHg) of diastolic blood pressure whose percentage is 1.01 of total subjects.

Table 7: Duration of continuous usage (hours) of mobile phone by the subjects and their systolic blood pressure (SBP mmHg)

Duration (Hours)	No. of subjects	Systolic blood pressure (mmHg)		Total	Chi-square test value	p-value
		100-120	121-140			
≤1	Count	69	5	74	1.896	0.169
2-3	Count	107	16	123		
Total	Count	176	21	197		

As per table-7

- The 69 (n) no. of subjects who have used mobile phone ≤1 hour's duration their systolic blood pressure was 100-120 (mmHg) and 5 (n) no. of subjects there are whose systolic blood pressure are 121-140 (mmHg).
- the 107 (n) no. of subjects who have used mobile phone 2-3 hours duration their systolic blood pressure was 100-120 (mmHg) and 16 (n) no. of subjects are their whose systolic blood pressure are 121-140 (mmHg).
- P-value for these result are 0.169, that is >0.05 and hence the result found above is not significant

Table 8: Duration of continuous usage (hours) of mobile phone by the subjects and their diastolic blood pressure (DBP mmHg)

Duration (hours)	Diastolic BP (mmHg)			Total no. of subjects	Chi-square test	p-value
	70-80	81-90	>91			
≤1	40	34	0	74	1.906	.386
2-3	58	63	2	123		
Total	98	97	2	197		

As per table-8

- The 40 (n) no. of subjects who have used mobile phone ≤1 hours duration their diastolic blood pressure was 70-80 (mmHg) and 34 no. of subjects are their whose diastolic blood pressure was 81-90 (mmHg).
- the 58 (n) no. of subjects who have used mobile phone 2-3 hours duration their diastolic blood pressure was 70-80 (mmHg) and 63 no. of subjects are their whose diastolic blood pressure was 81-90 (mmHg).
- P-value for these result are 0.386, that is >0.05 and hence the result found above is not significant

Table 9: Duration of continuous usage (hours) of mobile phone by the subjects and their total leukocyte count (TLC) (Cumm/dl)

Duration (hours)	TLC (Cumm/dl)		Total no. of subjects	Chi-square test	p-value
	4000-11000	>11000			
≤1	73	1	74	0.133	0.715
2-3	122	1	123		
Total	195	2	197		

As per table-9

- the 73 (n) no. of subjects who have used mobile phones for ≤1 hours duration their diastolic total leukocyte count (TLC) was 4000-11000 (Cumm/dl) and 1 no. of subjects are their whose TLC was >11000 (Cumm/dl).
- the 122 (n) no. of subjects who have used mobile phones for 2-3 hours duration their diastolic total leukocyte count (TLC) was 4000-11000 (Cumm/dl) and 1 (n) no. of subjects are their whose TLC was >11000 (Cumm/dl).
- P-value for these result are 0.715, that is >0.05 and hence the result found above is not significant.

Discussion

In the present study, cardiovascular & haematological parameters like Blood Pressure (SBP & DBP) & total WBC count were estimated respectively. White blood cell count was found to be within normal range among young subjects using mobile phone for 2 hours a day. Whereas only 2 subjects were found to have increased (more than 11,000 cells per mm³ of blood) value of WBC count. These findings suggest non significant effect of mobile usage on WBC count among subjects studied. Majority of the subjects in this study used mobile phone for 2 hours duration. This short period of exposure of electromagnetic radiation to the body may not be adequate factor for decreasing or increasing total WBC count among subjects studied. However, 2 subjects reported to have increased WBC count more than normal range. The possible

reason for this variation in the finding of WBC count, may be individual's phenotype or genotype or environmental factors or may be the type of smart phones and their emitted type of radiation or their thermal or non thermal effects subsequently on different types of human cells. The scope of further study of similar kind is needed when subjects using mobile phones for 4 hours a day or more of same configuration (GSM or CDMA) are recruited. Dangerous gamma radiation may be one of the possible factors responsible for health hazards related to smart phones. According to a study conducted in Baghdad, Iraq, on smoker and non smoker subjects and then the 2 (two) study groups were exposed to gamma radiation. After increasing the doses of γ -rays, the declining in the values of WBCs, lymphocytes, and neutrophils were found in the smokers blood is greater than of non smokers and this confirms that these cells are more fragile, weak, and less tolerant to external stimuli. Gamma rays cause damage at cellular level and are penetrating, causing diffuse damage throughout the body. Low levels of γ -rays cause a stochastic health risk, which for radiation dose assessment is defined as the probability of cancer induction and genetic damage. High doses produce deterministic effects, which is the severity of acute tissue damage that is certain to happen.[9] According to above finding and our finding in context with haematological parameter (WBC total counts) is not similar to that of the previous study conducted by Sih et al (2017) [9] Our finding in context with haematological parameters (WBC total counts) is similar to that of the previous study conducted by Sani A. et al (2018) on effects of electromagnetic radiation of mobile phones on haematological parameters among male Albino Rats. [10] Our finding in context with haematological parameters (WBC total counts) is similar to that of the previous study conducted by Suleyman et al (2002) on effects of extremely low frequency electromagnetic fields on hematological and immunologic parameters in welders. [11] The precursor cells of WBC production in red marrow (myeloid cell) are not enough stimulated or depressed by radiation (ionizing/electromagnetic or thermal or non thermal effects) emitted by mobile phones used by majority of the subjects for 2 hours duration, therefore, total WBC count was found to be within normal range among majority of the subjects in this study. White blood cells are giving us immunity; any abnormality in WBC count will affect our immune status. The decreased WBC population in blood will make us prone to variety of infections bacterial or viral. Hypertension is a common vascular condition that is a strong and independent risk factor for CVD. The association between cell-phone usage and hypertension is significant because it is a risk factor for development of cardiovascular diseases. The rise of cell-phone usage has also led to concerns over their possible

adverse effects on human health. [12] The cell phone usage exerts both thermal and nonthermal influences on the users. Radiofrequency radiation is emitted from their antennas and from circuit elements inside. Because cell phones are held against the head, many studies have examined the risk that these phones pose on the brain, including cognitive function and sleep. Some occupational studies have shown that chronic exposure to low-intensity electromagnetic field (EMF) is associated with increased risk of cardiac arrhythmias, acute myocardial infarction, cardiovascular mortality and alteration of diurnal variation of blood pressure but others have not found such an association. [12] Our finding in context with cardiovascular parameters (Blood Pressure) is similar to that of the previous study conducted by Aghav et al (2018) on environmental pollution due to mobile phones radiation effects on blood pressure. [13] Our finding in context with cardiovascular parameters (Blood Pressure) is similar to that of the previous study conducted by Basandrai et al (2017) on nonthermal effects of mobile phones radiation on human heart rate and blood pressure. [14] Our finding in context with cardiovascular parameters (Blood Pressure) is not similar to that of the previous study conducted by Sivaranjani Suresh et al (2011) on cell phones usage and self reported hypertension and blood pressure. [15]

Conclusion

Majority of the subjects studied in our study shown their WBC total count within normal physiological range, except two (2) subjects whose WBC total count was found to be increased more than normal range. Majority of the subjects studied in our study shown their blood pressure (SBP, DBP) parameters within normal physiological range, except two (2) subjects whose blood pressure (DBP) was found to be increased more than normal range. The present study demonstrate that a long-term duration of Mobile phone use may influence and change the autonomic balance in favour of an increased sympathetic tone. An increase in the sympathetic tone concomitant with a decrease in the parasympathetic tone measured in long-term MP users.

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