

6 original article

"Are Electromagnetic Field Radiation Targets Blood Cells?"

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ABSTRACT

In world of globalization is very difficult not to have technology. But with technology, come certain hazards. The only way to beat these is again, better technology. A cell phone technology is a best example of electromagnetic radiation, which introduce in India few years back, but now its need of society. It also works on electromagnetic radiation. The development of wireless communication systems has given rise to concerns about the potential human health hazards of increased and chronic exposure to electromagnetic field (EMF) and radio frequency (RF) radiation. The aim of this study is to evaluate whether the frequent exposures of electromagnetic field radiation targets the blood cells in human being.

The present study was conducted over a period of three years (2009-2012), which covers urban as well as rural areas of Surat districts. It was under taken in 114 subjects, including control group. The study includes anthropometric parameters (like Height, Weight, BMI), Clinical examination (like Pulse rate, base-line blood pressure etc.) and haematological tests (like blood count, blood indices and blood pictures) in various groups. Ethical approval and other aspects were taken into consideration. The blood tests were performed in all the 114 apparently healthy subjects. The data obtained was tabulated with respect to various parameters and was statistically analysed.

Although radiation exposures due to mobile phone and base station are very low, but once the energy is absorbed by the biological matter can cause severe and long lasting damage to human health. It might take years for the damage to produce noticeable symptoms. According to that we performed the study and we found the changes accordingly. In our study, haematological analysis shows that blood parameters were within the range, some of the parameter might increase or decrease as compared to control group but some of the alarming situations were sparking like 'rolls of coins' in RBC's which raises the risk of thrombosis or transport of oxygen, change in reticulocyte count may tells about bone marrow activity and so on. Based on this, we would like to conclude that the persistent & prolonged exposure under the cellular mobile phone & cellular phone base station is a risk factor.

INTRODUCTION

In today's world of globalization new technologies are growing up for benefit of human being. A wireless technology is one of them, which is developing rapidly and spreading dense network around us. A cell phone technology is one of them, which introduce in India few years back, but now its use is an essential part of business, commerce and society. Like mobile phone more and more wireless communication services are expected to come up which works on electromagnetic radiation and it seems that there is no way to reverse this trend.

A mobile/cellular phone and mobile/cellular base station is a low-power radio(s), mobile phone act as a single-channel, two-way radio and on the other hand mobile/cellular base station are multi-

channel two-way radio. They produce radio-frequency (RF) energy for the communication purpose (that's how they communicate), and along with communication they expose people near them. Around the world a variety of frequencies are used for mobile phones [Stuchly, 1998] and mobile phone base station. The interaction of that electromagnetic energy with biological material (like cells, laboratory animals or humans) depends on the frequency of the source [Foster, 1997], and most common frequencies for mobile phones are 800-900 MHz.

According to Adair [1994] the RF energy absorbed by humans may be less because the phones are low power and the RF energy emitted from them are generally very low. Although exposures are very low, but once the energy (thermal and non thermal) is absorbed by the biological matter, it can cause long lasting damage to it. It might take years for the damage to produce noticeable symptoms but harmful changes are manifest.

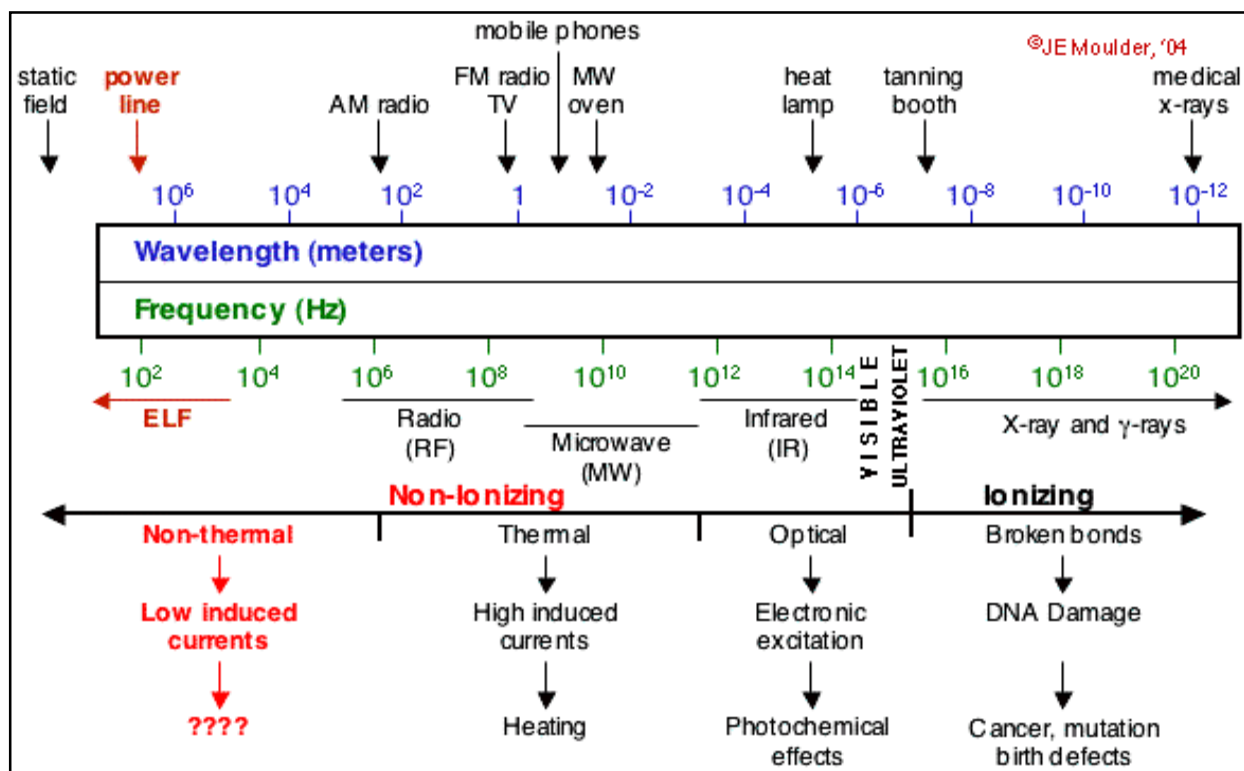


Figure 1: The Electromagnetic (EM) Spectrum

In the print and electronic media we can repeatedly observing the dreadful stories regarding mobile phone and its base station, the exposure form them has been accompanied by public debate on the possible adverse effects on human health. As people use cell phones to make calls, signals are transmitted back and forth to the base station. The RF waves produced at the base station are given off into the environment, whenever people send or receive the call they can be exposed to them.

Now a days the mobile base stations are mounted on the top of the building invariably. The people living on the top floor are close to the antenna so there are more chances to exposure to the energy emitted by antenna. The RF energy absorbed by humans may be less because both the phones and the base stations are low power, the RF energy emitted from them are generally very low [Adair, 1994], but once the energy is absorbed by the biological matter, due to persistent use or frequent exposure to source can cause damage to human health. Therefore, the aim of the present study is "Are Electromagnetic Field Radiation Targets Blood Cells?"

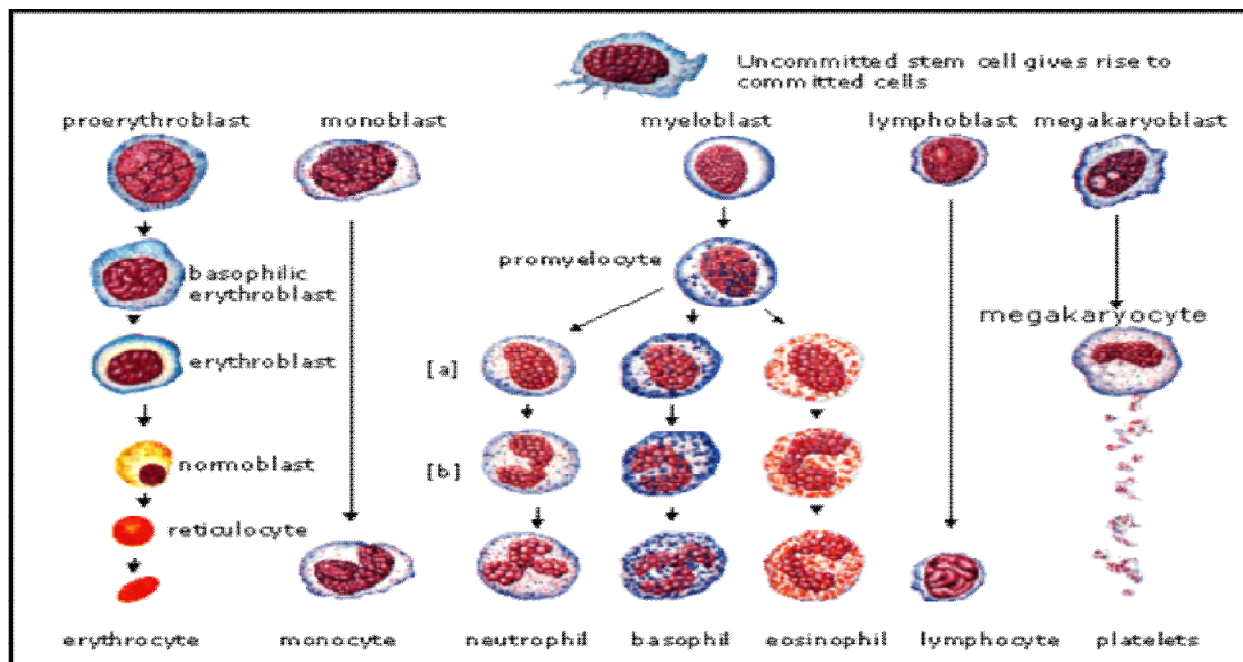


Figure 2: Formation of blood cells

AIMS & OBJECTIVE

Electromagnetic field radiation emitted by mobile/cell phone is targets blood cells in human being.

MATERIAL AND METHODS

The present study was conducted over a period of three years. This covers urban as well as rural areas of Surat districts. In the present study, a total of 114 subjects were invited. The protocol was explained to the subjects, who volunteered for the present study and written informed consent was obtained from each of the participant. The sample was predominantly male with age ranging from 18-42 years were participated in this study.

Selection of Study Group

Healthy normal subjects i.e. control group (Group-I) were selected who were neither users of mobile phone nor exposed to radiations emitted from the base station as a control group. From randomly chosen registries were matched to the study group and it was approximately mirror image of the age and education distribution of the included cases, as to increase efficacy in the analyses.

Selection of Mobile phone users

Mobile users (Group-II) were specified and selected for the study based on inspection of the local conditions. In that, at the time of first meeting with them we adjusted the new call time by call manager setting and after six days we calculated the average mobile operating time. The persons were identified who had fulfilled the following basic requirements:

- a. The mobile user must have been using his phone for more than 25 hrs/month.
- b. The mobile user must have been operating the mobile phone for at least one or more than one year.

Selection of base station residents

The network providers were identified in the residential regions where the persons were residing (Group-III) that fulfilled the following requirements:

- a. The antenna must have been operating and the person is residing in the area for not less than one year.
- b. The distance of the base station from the place of residence was not more than 25 feet or 8 meters.
- c. There was no other base station nearby (this could only be achieved in rural areas)

Twenty one base stations were specified, from which 11 were selected for the study based on inspection of the local conditions.

Selection of Combination of Group II & III

In this group (Group-IV) we selected subjects who were fulfilling the criteria mentioned for group II & III, i.e. those who were using mobile phone for more than 25 hrs / month and residing not more than 25 feet or 8 meters away from antenna, from the last one or more than one year.

Data Collection and measurements

After a 12-hours fast of the previous night, participants provided blood samples that were collected in vacuum vials with EDTA anti-coagulant and samples were analyzed for the various hematological test like white blood cell count (TLC), differential leukocyte count, platelet count, total red cell count (RBC), hemoglobin estimation, haematocrit (Hct) and the microscopic examination of blood. Ethical approval (letter no. GMC's/Stu./18796-108 dated: 05/09/2008) and other aspects were taken into consideration while planning the experiments.

Subjects having any systemic illness, neuropsychiatric disorder, cognitive disorder, and / or receiving psychotropic medication were excluded from all the study. The analysis was performed by using Statistical Package for Social Sciences (SPSS) software version 17 for windows.

OBSERVATION & RESULTS

Table: 1: Comparison of Hemoglobin (gm %)

| Group | Control | Mobile User | Base Station Resi. | RBMU |
|---------------------|----------------|--------------------|---------------------------|-------------|
| At Start | 14.16 | 14.10 | 14.36 | 14.15 |
| After 1 Year | 14.23 | 13.88 | 14.16 | 13.77 |

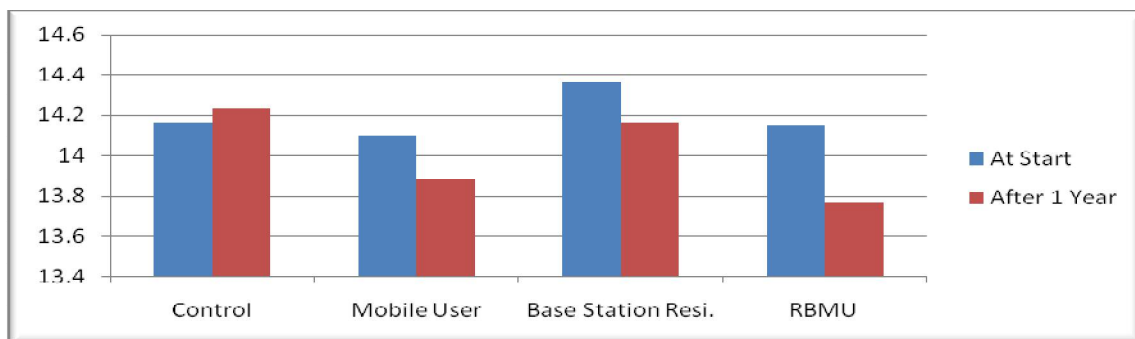


Table: 2: Comparison of Pack cell volume

| Group | Control | Mobile User | Base Station Resi. | RBMU |
|--------------|---------|-------------|--------------------|-------|
| At Start | 41.62 | 41.75 | 41.19 | 40.92 |
| After 1 Year | 41.06 | 40.89 | 40.91 | 40.42 |

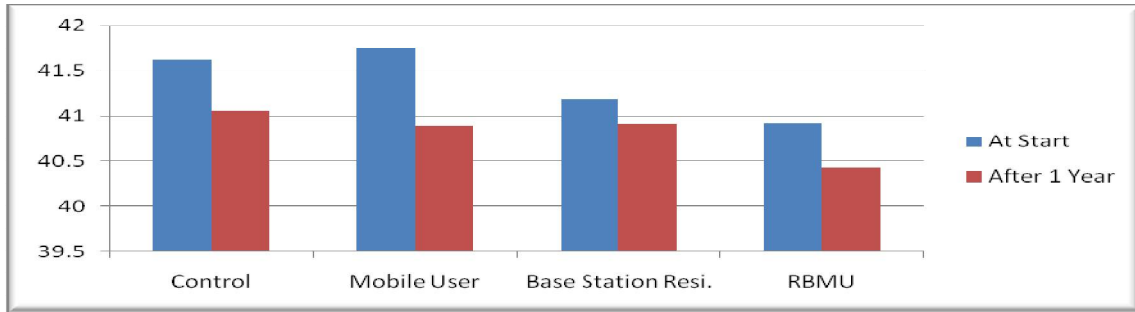


Table: 3: Comparison of Total WBC (cell/cu. mm)

| Group | Control | Mobile User | Base Station Resi. | RBMU |
|--------------|---------|-------------|--------------------|---------|
| At Start | 7689.71 | 7909.72 | 7632.81 | 8358.33 |
| After 1 Year | 8067.65 | 7902.78 | 7998.44 | 8258.33 |

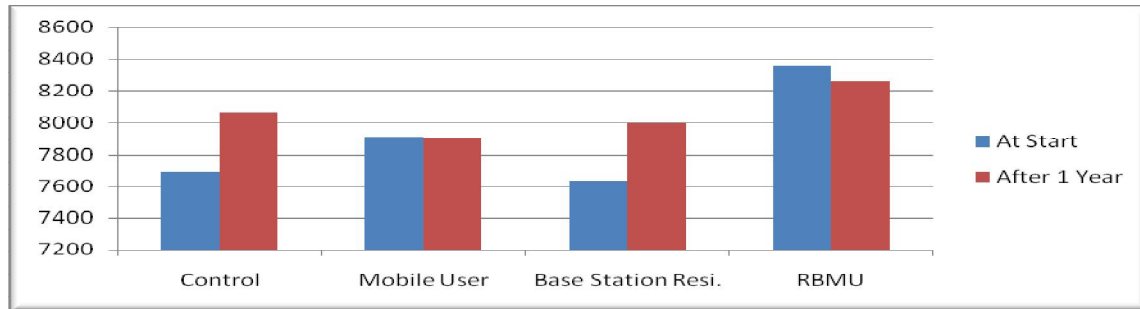


Table: 4: Comparison of Platelets (lacs/cu.mm)

| Group | Control | Mobile User | Base Station Resi. | RBMU |
|--------------|---------|-------------|--------------------|------|
| At Start | 4.34 | 4.39 | 4.30 | 4.08 |
| After 1 Year | 3.96 | 4.08 | 4.02 | 3.94 |

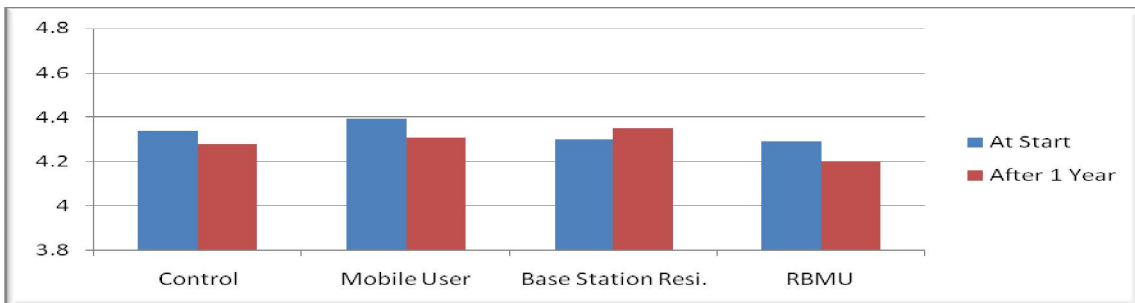
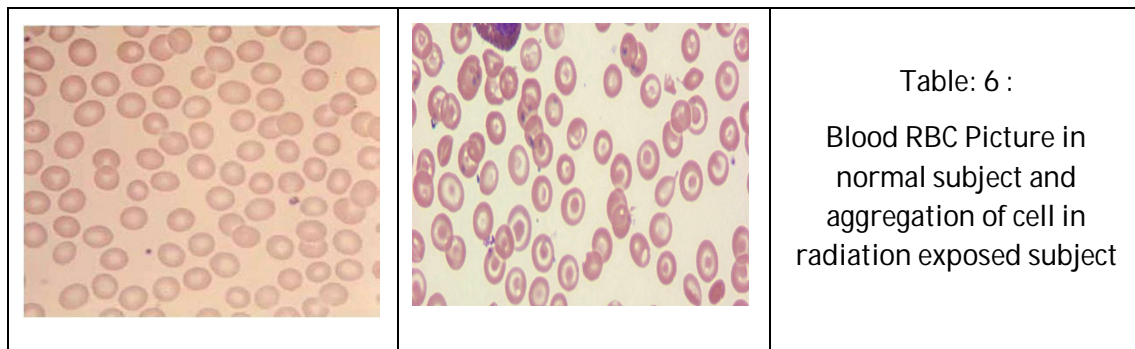
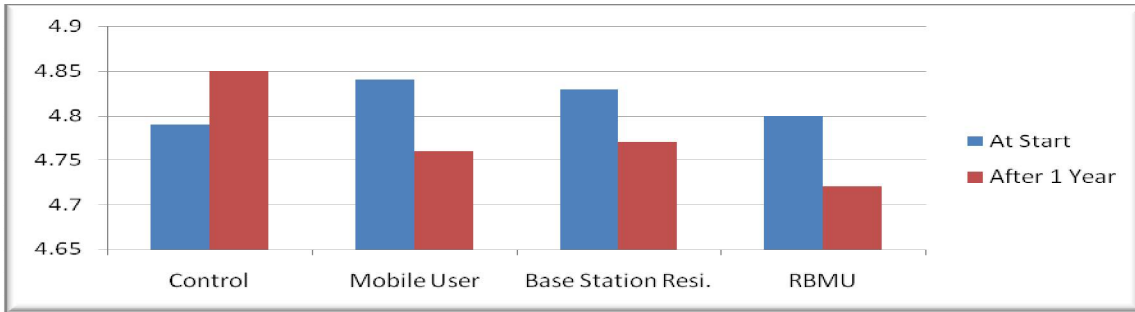


Table: 5: Comparison of Red Blood Corpuscles (million/cu.mm)

| Group | Control | Mobile User | Base Station Resi. | RBMU |
|--------------|---------|-------------|--------------------|------|
| At Start | 4.79 | 4.84 | 4.83 | 4.80 |
| After 1 Year | 4.85 | 4.76 | 4.77 | 4.72 |



The hemoglobin, pack cell volume and red blood corpuscles (RBC) values are decreased with prolonged exposure. Whereas the total WBC count value are not shown any pattern so we cannot predict whether values are increased or decreased. But the situation gets change when we observe the blood picture before and after the exposure, before exposure blood picture shows cells are separated and after exposure it shows aggregation of cells (rolls of coins) may be because of the cells loses its polarity and integrity. Once its start aggregating at one place its surface area will reduce and it results in hypoxia or cells are not that capable to providing sufficient amount of oxygen to the body organ like brain. Even in case of RBC count value is not increased but slightly increased reticulocyte count value shows effects of exposure on bone marrow activity. Secondly this change in polarity and integrity of aggregated cells (rolls of coins) will also increase the risk of thrombosis, which is another alarming situation.

SUMMARY & CONCLUSION

Although radiation exposures due to mobile phone and base station are very low, but once the energy is absorbed by the biological matter can cause severe and long lasting damage to human health. It might take years for the damage to produce noticeable symptoms. According to that we performed the study and we found that, the haematological analysis shows that blood parameters were within the range, some of the parameter might increase or decrease as compared to control group but all the changes in the physiological limit only as the normal value range in blood count is very vast on the basis of changes what we got will not able to highlight the effect but some of the alarming situations were sparking like 'rolls of coins' in RBC's which raises the risk of thrombosis

or transport of oxygen, change in reticulocyte count may tell about bone marrow activity and so on. Based on this, we would like to conclude that the persistent & prolonged exposure under the cellular mobile phone & cellular phone base station is a risk factor.

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