

# Hematological Changes Induced By 3G Mobile Phone Radiation in Male Wistar Rats

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**Abstract** – Mobile phones have become an integral part of everyone's life. Radiofrequency electromagnetic waves emitted from mobile phone interact with biological system and lead to increase in reactive oxygen species (ROS) which alters several biochemical processes. Therefore, to investigate the harmful effect of the radiations generated from 3G mobile phones, we analyzed the changes in hematological parameters of male Wistar rats. In present study, exposure of 3G mobile phone radiation was given to ten weeks old male Wistar rats (n=8) for 2 hours/day. The exposure was continued for duration of 45 days in specially designed exposure set up. On completion of exposure time period, hematological and immunological parameters of blood were performed. A significant change in WBC and lymphocytes counts was found. Therefore this may be concluded that mobile phone radiation effect the hematological parameters.

**Keywords:** Mobile Phone Radiation, White Blood Cells (WBC), Lymphocytes, Hematological Parameters

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## 1. INTRODUCTION

In past few years there is an exponential increase in mobile phone users. Mobile phones emit non ionizing RF-EMW radio frequency waves for voice communication and data transmitting and receiving. As these waves generate electromagnetic field, there is increased concern among general people about their impact on human health. Initially 1st generation (1G) mobile phone came into existence and they operated at the frequency of 900 MHz. 2G and 3G phones function at a frequency range (1710–1880) MHz and 1900–2170 MHz respectively. Studies report that the radiations emitted from mobile phones generate iron-mediated Fenton reaction that in turn enhances the formation of free hydroxy radicals leading to cellular damage (Kesari, et. al., 2013).

Blood is an integral component of the body that helps in the transport of oxygen and nutrients throughout the body. The generated waste products are also transported to the lungs, kidney and liver for subsequent disposal by the blood (Alghamdi and El-Ghazaly, 2012). Magneto-hydrodynamics studies reveal that the external application of a stationary, transverse magnetic field to an electrically conducting fluid induces electrical currents. The cumulative generation of current and the magnetic field applied

retards blood movement by producing Lorentz body force (Sud and Sekhon, 1989).

In a survey, it has been reported, that the electromagnetic radiations (EMR) generated by Mobile phone may lead to a number of deleterious health effects such as headache, extreme irritation, increase in carelessness, forgetfulness, decrease in reflexes, sound in the ears, inner ear damage, blurring vision, eye inflammation and endometrial apoptosis. In yet another study, chronic exposure to microwave radiation at non-thermal levels, was found to elevate single strand breaks in the DNA of rat brain cells (Paulraj and Behari, 2006). In addition to this, it has also been suggested that EM radiations can cause damage to hepatic, renal and splenic tissues (Oral, et. al., 2006). Hence, the objective of the present research is to analyze the consequences of radiations generated from 3G mobile phones on hematological parameters.

## 2. METHODS

### 2.1 Animal Exposure

Healthy male Wistar rats (6-8 weeks old) were obtained from Animal house, JNU, New Delhi, India. The study included twelve male Wistar rats (10

weeks old, approximately 220 grams in weight). Animals were split into two batches; Sham exposed (n = 8) and radio frequency (RF) exposed (n = 8). The animals were kept under steady-state micro environmental conditions where temperature was maintained at 25°C with humidity of 40- 50% and were given standard laboratory food and water *ad libitum*. All experimental protocol was followed as per the guidelines and approval of Animal Ethics Committee, Jawaharlal Nehru University, New Delhi.

**2.2 Exposure Setup**

Specially designed, Plexiglas cage was used for placing the rats. The cage was ventilated by means of holes. The animals were individually placed in the cage and exposed to 3G mobile phone radiation for a duration of 2 hours/per day for a total of 45 days. We placed a monopole antenna to measure the output power of the mobile phone and recorded the power by Spectrum analyzer (Field fox Model No -N9912A, Agilent Technologies USA). The power generated inside the cage was measured at varying positions. The emitted power density of mobile phones was 0.283 mW/cm<sup>2</sup>.

**2.3 Sample Collection**

A heparin-coated capillary was used to collect 1 ml blood from the retro-orbital sinus. The collected blood was dispensed equally into EDTA coated vials and used for haematological assay.

**2.4 Hematological Assay**

Haematological parameters of blood such as Red blood cell (RBC), hemoglobin (Hb), Mean corpuscular hemoglobin (MCH), Mean corpuscular hemoglobin concentration (MCHC), HCV, packed cell volume (PCV), RDW-CV and platelets counts as well as immunological parameters like White blood cells (WBC), Lymphocytes, Neutrophils, Monocyte, Eosinophil were analysed with the help of Automated haematological analyser (KX-21, Sysmex, Transasia, India) (Gaharwar and Paulraj, 2015).

**2.5 Statistical analysis**

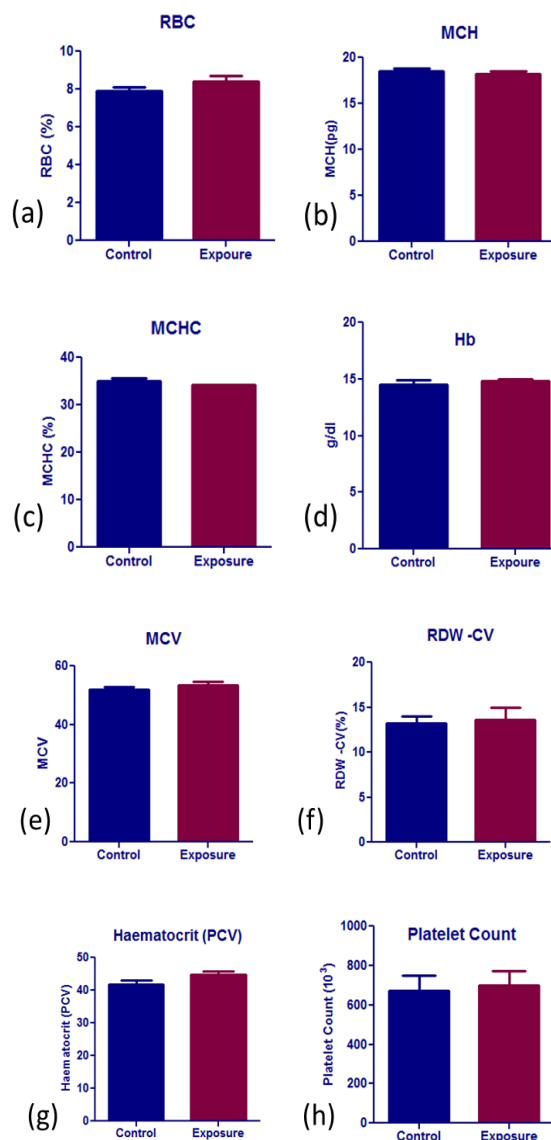
Mean ± standard error of means (SEM) was determined. Student's t test was used to carry out statistical analysis. Significance level was ascribed at p values <0.05. Analysis was done on Graph Pad Prism 5.03.

**3. RESULTS**

**3.1. Effect of 3G mobile phone radiation on haematological parameters.**

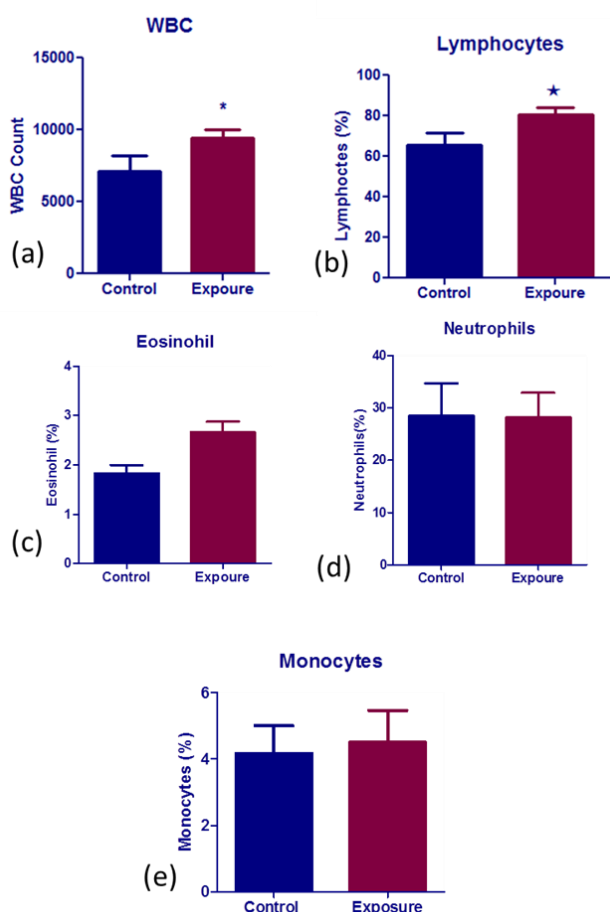
Haematological parameters have been shown in Figure 1 & 2. RBC did not show any significant changes although slight increase was observed. Mean

corpuscular haemoglobin (MCH) and Mean corpuscular Hb conc. (MCHC) did not show any significant changes. In haemoglobin (Hb) concentration also, changes were not observed. Similarly, packed cell volume (PCV), mean corpuscular volume (MCV), RDW-CV and platelets counts were found to be insignificant.



**Figure: 1.** Hematological analysis for the Wistar rats exposed with radiation. (a–h) these results show mean and standard deviation of RBC (a), Mean corpuscular Hb (b) and Mean corpuscular Hb conc. (c), hemoglobin (d), MCV (e), RDW (f), PCV (g), Platelet (h). Error bars represent standard Error. Statistical significance was determined by paired t-test. Significance was ascribed at p<0.05.

In contrast, WBC count (figure -2) were found to increase notably (P<0.05) in exposed group as compared to control.



**Figure: 2.** Hematological analysis for the Wistar rats exposed with radiation. (a–e) these results show mean and standard deviation of WBC (a) lymphocyte (b) Eosinophils (c) Monocyte, Neutrophils (d) and Monocytes (e). Error bars represent standard Error. Statistical significance was determined by paired t-test. Significance was ascribed at  $p < 0.05$ .

Similarly, Lymphocytes counts were significantly ( $P < 0.05$ ) increased in exposed rats as compared to control groups whereas, monocytes and neutrophils levels did not show any significant changes. Eosinophils were found to be elevated but in comparison to control there were no notable changes observed.

#### 4. DISCUSSION

Nowadays, 3G mobile Phone has become the life of individual as it offers multiple services to the user and also contributes towards social and economic benefits. Commonly, it is believed individuals are being exposed to electromagnetic radiation which is generated by mobile phones. So, it becomes an obligation to investigate the hazardous outcomes of these radiations on the body. In present study, we have examined the reverberations of 3G mobile phone with respect to haematological parameters.

Health status of exposed animals can be determined by measuring the blood parameters (Soud, 2004). The decrease and increase in red blood cell counts are evidence of diseases where anemia is caused due to decrease in RBC count while increased RBC count results in Polycythemia, a disorder of bone marrow (Fatayer, 2006). Decreased level of Mean Corpuscular Haemoglobin (MCH) indicates iron deficiency induced anemia and is most important parameter for anemia diagnosis (Althbyta, 2002). We did not observed any significant changes in RBC, HB, Platelets and other indices related to RBC and haemoglobin. It is reported that exposure to radiation may induce significant increase in the number of white blood cells (WBC) and furthermore the proportion of lymphocytes and these changes are associated with macrocytic anemia. Studies reported that exposure to electromagnetic waves results in increased number of lymphocytes which is associated with lymphatic leukemia, or inflammation of the lymph gland in children (Zelly, 2007). Similarly, report says that death of children living near high voltage lines than the children who do not live nearby high voltage area (London, et. al., 1991). Few reports suggest that exposure to electromagnetic field does not induce any damage in blood cells (Usman, et. al., 2012) in contrast to others which report that exposure induces changes in hematological parameters of mice (Aziz, et. al., 2010). We have observed significant increase in lymphocytes and WBC level while neutrophils, Eosinophils and basophils did not show any significant changes. This is in consonance with the previous study which reported that GSM mobile exposed group showed increased level of lymphocytes as compared to control whereas other parameters like neutrophils, Eosinophils and basophils did not show any significant changes (Oni, et. al.). Our results are in line with the antecedent researchss which suggests that exposure of animals to electromagnetic waves of mobile phone induces increased number of lymphocytes and it also confirms that mobile phone induces alterations in blood cells (Braune, et. al., 1998).

#### CONCLUSION:

It may be concluded from the present results that 3G mobile phone radiation significantly affects the blood parameter in male Wistar rats.

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