A PILOT STUDY OF THE EFFECTS OF GSM RADIOFREQUENCY RADIATION ON BLOOD PARAMETERS

Olatunde Micheal Oni [1,*], Dauda Biodun Amuda [1], Celestine Etumonu Gilbert [2], Ife Fortunate Aseweje [1]& Felicia Adeola Akinola [1]

[1] Department of Pure and Applied Physics
Ladoke Akintola University of Technology, Ogbomoso, Nigeria
[2]University Health Centre
Ladoke Akintola University of Technology, Ogbomoso, Nigeria
*Email:olatundeoni@yahoo.com; omoni@lautech.edu.ng

ABSTRACT

Radiofrequency Radiation (RFR) have long been used for different types of information exchange. Mobile phones, sometimes known as cellular or handset have hitherto lately formed an integral part of modern/ wireless telecommunication and are fast becoming a social lifestyle. The radiation emanating from these communication devices have been found to be of a finite possibility in contributing adversely to the radiation exposure to man, thereby capable of affecting the health of the user if the devices are in close proximity with the laboratory samples like blood which is the basic index of health. Samples of blood collected from donors were exposed to RFR emanating from GSM phone while in active (talk) mode. The hematological parameters of both the exposed and control blood samples were analyzed. The results have indicated that some blood parameters are significantly affected by exposure to RFR. Thus the findings in this work translate to the possibility of RFR from GSM phones being capable of altering the parameters of blood samples particularly those meant for transfusions which inadvertently are exposed to the GSM RFR by the handlers.

Keywords: *Radiofrequency radiation,Blood, Hematological parameters, GSM mobile phones, Blood transfusion*

1. INTRODUCTION

The wide use of mobile phone has inevitably raised the question of whether they have any implications on human health or could possibly cause some unexpected adverse health effects in human. It has been suggested, for example, that use of mobile phone induces brain tumors or promotes cancer development and have other effects on biological systems. Most of these effects are traceable to even small thermal fluctuations [1, 2]. These health concerns however have led to extensive media debates and also sometimes hasty political decision to initiate extensive biomedical research programs in several countries of the world.

The telecommunication industry is experiencing a robust growth on the global scale. Since the introduction of mobile phones in mid 80s there has been a substantial growth and significant increase in the number of base stations installed at residential and industrial areas thus making access to telecommunication facilities easier thereby increasing the mobile phone users. Mobile phones, sometimes known as cellular or handset form an integral part of modern/ wireless telecommunication and are fast becoming a social lifestyle. The individual mobile phone operates by communicating with fixed installations known as a base station or a telecommunication structure. The emanating waves from base stations which serve as carriers of information during communication with the use of mobile phones belong to the radiofrequency radiation category of the electromagnetic spectrum in the frequency range of 30 Hz to 300 GHz [3]. At 2.4 GHz, an unlicensed frequency, other communication devices making use of radiofrequency radiation (RFR), and which are in close proximity with the body include laptops, for surfing the web and for other applications. The microwave oven is another device involving RFR at 2.4 GHz. This device is found in homes and hospitals for heating purposes, food inclusive.

Several researchers have reported various health effects due to RFR emanating from the use of these devices. These effects vary from depletion of essential minerals in the food heated by microwave oven to effect on DNA [4, 5, 6]. Exposures to RFR emanating from mobile phones at 800 – 900 MHz on body fluids have been reported by various researchers to be significant. Among such works are Esfandiari *et al.* [7] and Agarwal *et al*. [8].

Despite various safety precautions and awareness on the safe use of communication devices operating on the frequency band of the global systems of mobile communication (GSM), many accidents have been inadvertently caused by mobile phones users, either during making or receiving calls. A sizeable number of automobile accidents in Nigeria are traceable to the use of mobile phones while driving. However, due to the thermal and other physical effects of exposure to RFR from GSM on human hematological parameters [9, 10], there exists a possibility of difference in hematological parameters of blood having been inadvertently exposed to RFR during making or

receiving calls by laboratory worker while holding the blood samples for transfusion or analyses. Thus, in this pilot study, our objective was to ascertain the possibility of cause - and – effect relationship between RFR emitted from mobile phone in active (talk) mode and changes in hematological parameters.

2. MATERIALS AND METHODS

2.1 Sample Collection and Exposure

Blood samples were collected from ten (10) healthy donors. All specimens were collected by vein withdrawal procedure. Each sample was divided into two aliquots: control group (sample not exposed) and exposed group (sample exposed to mobile phone radiation).

One aliquot of each divided blood sample was exposed to RFR emitted from a mobile phone in talk mode (Nokia 5130 at 850 MHz frequency). This phone model had an integrated antenna at the top back of the handset. The distance between the phone antenna and each specimen was kept at 2.5cm [8]. The exposure time of the exposed samples was chosen following responses of the duration of time spent on GSM calls at work by 50 workers. An average of 20 minutes from the survey was however used as time of exposure in this work. For proper identification, all the samples were marked for exposure and identity of donors. Figure 3.1 shows a picture of the experimental set-up.

Figure 1: The experimental set-up

2.2 Blood Analysis

Both aliquots (Control and Exposed) of the blood samples were analysed for full blood count parameters: white cell count platelet count and packed cell volume (PCV). In carrying out the counting, EDTA and heparin were used to stain the samples. Micro- heamatocrit reader was used to read the PCV while a microscope was used for the white cell and platelet counts.

2.3 Statistical Analysis

In this study, we hypothesized that the exposure of blood samples to RFR emanating from GSM phones has no significant effect on the hematological parameters considered. The effect of RFR exposure on the blood parameters between exposed and unexposed groups was done using Analysis of Variance (ANOVA). The hypothesized statement (null hypothesis, Ho) was rejected when the P value was found to be below the chosen level of significance, taken to be 0.05.

3. RESULTS AND DISCUSSION

The effect of the RFR exposure on hematological parameters considered in this work is presented in Table 1. The time of exposure, chosen as 20 minutes was the average of the daily duration of mobile phone use by laboratory workers surveyed by an oral instrument of data collection.

By inspection, the values of all the parameters were noticed to be different for the exposed and unexposed samples. A reduction in values of the packed cell volume (PCV) and monocytes was observed for samples exposed relative to the unexposed samples. The white blood count (WBC) and lymphocytes were noticed to be higher in value when exposed. The neutrophils, Eosinophils and Basophils were observed to show no difference in values when the exposed and unexposed samples were compared.

On the general study of effect of RFR exposure, the statistical procedure revealed however that at the chosen 0.05 level of significance, only the Neutrophils, Eosinophils and Basophils were not significantly affected by the blood sample being exposed to RFR from mobile phones.

4. CONCLUSION

The effect of RFR from GSM phones on blood parameters have been studied in this work. This pilot study had shown that there are significant effects between exposed and unexposed blood parameters. Thus translating that blood intended for transfusion could have its parameters altered as a result exposure to RFR from GSM phones used in close proximity to the blood samples.

Table 1. Values of the hematological and the statistical analyses

	PCV		**WBC**		**Neutrophils**		**Lymphocytes**		**Monocytes**		**Eosinophils**		**Basophils**	
	Exp	*Une*	*Exp*	*Une*	*Exp*	*Une*	*Exp*	*Une*	*Exp*	*Une*	*Exp*	*Une*	*Exp*	*Une*
Count	50	51	4700	3600	52	52	41	40	6	7	1	1	0	0
S.D.	0.52	0.52	29.67	30.27	0.53	0.32	0.07	0.49	0.16	0.20	0.07	0.07	0.01	0.02
P	0.000116		1.23×10^{-24}		0.054		1.63×10^{-7}		6.29×10^{-10}		0.748		0.520	
n	10		10		10		10		10		10		10	
F	24		6643.6		4.236		67.74		140.11		0.105		0.430	
$F_{critical}$	4.414		4.414		4.414		4.414		4.414		4.414		4.414	

Exp = Exposed ; Une = Unexposed; S.D = Standard deviation; n = number of sample

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