



RADIO FREQUENCY ELECTROMAGNETIC RADIATION EXPOSURE CAUSES WEIGHT LOSS IN WISTAR RAT

Waghmare G. P.*, Ramrao Chavan and Dhanraj Mane

*Department of Zoology, DR.B.A.M. University, Aurangabad. India.

*Corresponding Author: Waghmare G. P.

Department of Zoology, DR.B.A.M. University, Aurangabad. India.

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ABSTRACT

Mobile phones are one of the popular and fastest growing technological advancements. It has become necessary in our modern life. The widespread usage of mobile phones in recent Years have raised concern for potential research activities (*Abdolmaleki A, Sanginabadi F-2013*). Many countries have tried to determine the effect of the emitted electromagnetic radiation from mobile phones from last two decades. Rapid growth has been seen in the number of people using mobile phones (MPHs). Humans are exposed to radiofrequency electromagnetic radiation emitted from mobile phones and this has created a need to investigate its possible ill effects on health of individuals (*Agarwal A, Singh A, Hamada A, Kesari K (2011)*). It has been revealed that exposure to various forms of radiation could lead to reversible or irreversible structural and functional changes at the cellular level. This damage depends on the frequency of the electromagnetic radiation intensity and the duration of exposure. Cell phones low-power transmitters operate on 0.75 to 1 watt of power. Cell phones emit of electromagnetic radiation. It is possible for the radiation to causes harm to the user. The mobile phone emitting 900 MHz radiofrequency electromagnetic radiation (EMR) Exposure to electromagnetic radiation emitted from mobile phones is able to induce hepatic, renal and splenic tissue damage. The degree of damage increased with time of exposure to EMR (*Clark G-1988*). Radiofrequency of electromagnetic radiation from mobile phones also induces oxidative stress in rats and different organs system (*Diechmann WB, Male J et al*). In present investigation we have exposed the wistar rats to the cell phone radiofrequency electromagnetic radiations (RF-EMR) to study its metabolic effects on the growth and Metabolic status in the wistar rat. Cell phone R-EMR reduces the Mean animal body weight in 30 days of Exposure duration in comparison to the Control Animals.

KEYWORDS: RF-EMR, Animal Body weight, Radiation Exposure.

INTRODUCTION

Mobile phones (MP) operate on wireless technology, with communication typically occurring via a 900–1800 MHz signal that is pulsed at 217 Hz. The signal carries essentially no power when the user is not talking or receiving, but when the user communicates the power of this Pulsed electromagnetic Field (EMF) reaches a maximum of 250 mW. There is concern that this pulsed EMF will reach neurons and directly affect membrane function (Adey and Bawin, 1979), and reflects this concern is theme of research testing for MP-related changes in human physiology and pathology. Research has failed to find consistent relations between use of MP and human physiology/pathology, and, coupled with the lack of theoretical framework to explain the inconsistencies, there is little consensus on the issue.

Mobile phones are used in position very close to the human body and require a large number of base station antennas. The resulting health issues have repeatedly

been raised by public and scientists. (*Atasoy A, Kaya L et al.*).

Innovations in cell phones may be associated with detrimental effects on various organs, systems and their functions (*Durney CH, Iskander MF, Massoudi H, et al 1984*) EMFs might produce a variety of adverse in vivo effects such as chronic fatigue, headaches, cataracts, heart problems, stress, nausea, chest pain, Forgetfulness, influence the learning and disturbances in memory, immune systems, and sleep. It has been implicated in adversely affecting multiple facets of human health such as brain, lung and breast tumors, leukemia, genotoxicity, and reproduction anomalies, infertility, increased risk of abortion, birth defects, childhood morbidity, depression, neurodegenerative disease, amyotrophic lateral sclerosis, and Alzheimer's disease. (*Ebrahim S, Azab AE, Albasha MO, et.al-2016*).

Previous studies showed that an association between elevated EMFs exposure and mortality of employer in

electric utility industry jobs from arrhythmia-related causes and acute myocardial infarction influence heart rate variability by changing autonomic balance. (*Azab AE, Ebrahim SA.-2017*).

Exposure to EMFs induces heart palpitations, pain in the chest area, and an irregular heartbeat. Also, exposure to EMFs causes decreases in total antioxidant capacity and plasma calcium level. Measurements of blood parameters are most important means by which to determine the health status of experimental animals. (*Soud R.-2004*). These measurements are diagnostic for certain diseases such as anaemia, leukaemia and detect the presence of the inflammation. (*Alghamdi MS, El-Ghazaly NA-2012*) Rats exposed to EMF show increases in blood pressure, the whole heart and left Ventricular weights (*Azab AE, Ebrahim SA.-2017*). Movement of haemoglobin in blood vessels is accelerated due to presence of ferric ions. (*Bansal HL-2006*).

EMFs have various chemical effects, including causing deterioration in large molecules in cells and imbalance in ionic equilibrium. Despite being essential for life, oxygen molecules can lead to the generation of hazardous by-products known as reactive oxygen species (ROS) during biological reactions. These ROS can damage cellular components such as lipids, proteins, and DNA. Antioxidant defence systems exist in order to keep free radical formation under control and to prevent their harmful effects on the biological system. Free radical formation can take place in various ways, including ultraviolet light, immunological reactions, radiation, stress, smoking, and biochemical redox reactions. Oxidative stress (OS) occurs if the antioxidant defence system is unable to prevent the harmful effects of free radicals. Exposure to EMF is known to increase free radical concentrations and trace ability and can affect the radical couple recombination. (*Kivrak EG, Yurt KK, Kaplan AA, et al.-2017*)

However, studies using actual cell-phone in a talk and listen mode are lacking. Further, the exact Body weight changes on exposure to the mobile phones EMFr in Animals continues to be investigated.

MATERIALS AND METHODS

Animals

Male albino Rats, 6-8 weeks old (b.w. 220-240 g) wistar strain were acquired from Pharmacology Animal House, SVS Medical College. Animals were kept in well ventilated polypropylene cages under standard conditions of temperature and humidity. The animals were provided with standard Rat chow and water ad libitum. All animal experiments in this study were conducted with prior approval of Institutional Animal Ethics Committee (IAEC), strictly adhering to the ethical guidelines laid down by the Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA),

constituted by the Animal welfare Division, Government of India and approved by the International Animal Ethics Guidelines. Each Group consists of 10 wistar rats.

Two animal groups are considered control and RF-EMR exposed. Control animals are not exposed to the RF-EMR and kept away from the exposure area.

Cell phone radiofrequency Electromagnetic Radiation (RF-EMR) exposure assembly

The Group of animals were exposed to RF-EMR from an active mobile phone. NOKIA-3310 is used for exposure of RF-EMR. GSM mobile phone operating in the 900 MHz band was used for this purpose. The mobile phone used in this study was a level 4 GSM mobile phone with a permitted power level of 2 W (with SAR specification 1.15 W/kg). When exposed to rats, the phone was kept in silent mode (without ring tone and vibration) and auto answer Mode. Each animal cage had two animals and to prevent the rats from contacting or damaging the device, it was placed at a bottom poly propylene wire mesh cage in the centre of the Animal cage.

Method of RF-EMR Exposure

Animals kept in Polypropylene cages are kept with mobile handset fixed at the bottom of the Cage. Mobile phone is fixed properly at the floor of the cage in such a way that it should hide between the husk animal bedding, so rats cannot interfere with the fixed handset during the study duration of 30 days. Duration of exposure, source to surface distance is determined before radiation exposure. Parameters are discussed in Materials is considered for Irradiation procedure. Animals are irradiated and exposed to RF-EMR (900 MHz) from an activated Global System for Mobile communications (GSM) mobile phone for 2hour/day (in silent mode; “no ring tone” Auto receiver mode and Talk mode) for 30 days.

Body weight Measurement

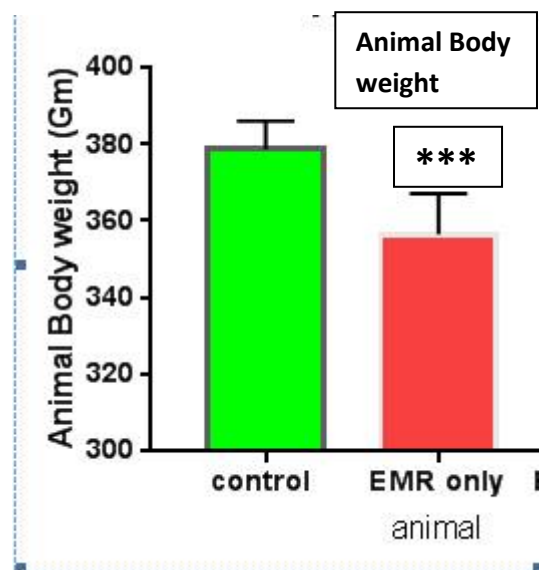
On the day 30 of the RF-EMR exposure animal body weight is measured with KENT rodent body weight measurement scale. Observed values are analysed through ordinary one way ANOVA in GRAPHPAD Analysis tool.

RESULTS

Control animals (saline treated) exhibited consistent weight gain from day 1 (250.00±8.78 gm) to 30th day (342.00±7.02 gm). EMR alone animals found with reduced body weight at day 30 post-irradiation to cell phone EMR (Electromagnetic radiation) exposure.

Table: Mean Animal weight Record after Cell phone EMF Radiation at day 30 post-irradiation.

Days post irradiation	Control Saline treated	Cell phone EMR Irradiation only
30 days	378.6 gm	356.5 gm

**Graph: Animal Body weight Post-irradiation to cell phone EMR.**

Graph depicts the effects of the 2 Hr daily exposure of Cell phone EMR exposure for 30 days to the rat body weight. EMR exposed animal group at day 30 Post-irradiation shown significant reduction in the body weight in with comparison to the control Animal Group. This reduction in the body weight is due to the disturbed food and water consumption during 30 days of experiment duration.

Food_and_water consumption is highly disturbed in the EMR exposed Animal group while control Animal shown normal metabolic sign with normal consumption of feed and water. Mean body weight of cell phone EMR exposed group was 356.5 gm, control Animal shown Mean Body weight as 378.6 gm on day 30 post-irradiation. Significant difference is observed in mean body weight in comparison between EMR alone and Control animal Group. Observed p-value is (p-value < 0.0001).

DISCUSSION

In the present study, RF-EMR alone group exhibited signs and symptoms of radiation sickness such as reduced food and water intake, diarrhoea, lethargies and weight loss. These findings of present study are in close agreement with findings of *Jagetia et al. (2004)*, *Yadav (2005)*, *Soni et al. (2006)*, *Saini and Saini (2011)* and *Gupta et al. (2013)* who also reported similar radiation sickness symptoms after exposure to different doses of radiation and its duration of the exposure.

Radiation sickness and mortality are dose-dependent and are caused due to various radiation syndromes and excessive loss of electrolytes (*Sinha, 1990*). *Yadav*

(2005) noted that the signs and symptoms of radiation sickness correspond to one or the other radiation syndrome i.e. (i) the hematopoietic, (ii) the gastrointestinal or (iii) the central nervous system (CNS) syndrome.

In the present study, significant loss in body weight of EMR irradiated alone animals was observed. Maximum weight loss was observed at day 30th day post-irradiation days, Weight loss in the initial phase may be probably due to the gastrointestinal damage following irradiation (*Quastler, 1956*).

One of the common features of radiation induced gastrointestinal syndrome is marked as loss of water and electrolytes, which may contribute to the weight loss (*Griffiths et al., 1999*). The weight loss during second phase is associated with the decrease in water intake by animals (*Nakamura et al., 1968*). Reduction in body weight following radiation exposure was also reported in mice (*Samarth and Kumar, 2003; Kumar et al., 2005; Saini and Saini, 2011; Fan et al., 2012*) and rats (*Mirjana et al., 2009; Adaramoye et al., 2011; Nwozo et al., 2013*). In the present study, weight loss in cell phone EMR irradiated animals may be attributed to the reduced food and water intake, fluid loss by diarrhoea and the diminished absorption capacity and insult of the gastrointestinal system.

CONCLUSION

Most of the Cell phone radio frequency electromagnetic radiation (RF-EMR) exposure studies with animals included no talk mode. In the present investigation we exposed animals to the Talk mode of the cell phone

through which there is higher Radiofrequency of 900 MHZ is irradiated.

Cell phone generated radiofrequency Electromagnetic radiations caused weight loss in wistar rat after 30 days of exposure.

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