
Effect of electromagnetic field exposure on brain tissue of sd rats from cellular wireless system

**Dhirajkumar Gokulchand Agrawal^{*1}, Dr. Paresh J. Shah²,
Dr. Krishnakant P. Adhiya³**

^{*1, 2}Department of Electronics and Telecommunication Engineering, Kavayitri Bahinabai Chaudhari North Maharashtra University, Jalgaon, India

³Department of Computer Engineering, Kavayitri Bahinabai Chaudhari North Maharashtra University, Jalgaon, India

**Corresponding Author: Dhirajkumar Gokulchand Agrawal*

Abstract:

Epidemiological and experimental studies have attempted to evaluate EMF exposure and its effects on living organism by different researchers in their work. The main goal of this paper is evaluate effect of EMF exposure on brain tissue of SD rats from cellular wireless system through test group animals were exposed to electromagnetic field radiations for eight hours per day for thirty days. During exposure period, test animals were placed in Plexiglass boxes. Electromagnetic field radiation transmitter was fitted to the roof of the cage from inside. Rats were exposed to EMR radiations emitted from the transmitter. Control rats were not given any exposure. Histopathological evaluation and oxidative markers measurement were performed on brain tissue, significant decrease in SOD, GSH-PX, CAT, GR (Oxidative markers) level were observed. Brain tissue showed major histopathological alterations as compared to control groups represents that the EMF radiation exposure is a major factor related to EMF radiation toxicity.

Keywords:

Electromagnetic Exposure, Radiation, Cellular Wireless System, SD, SOD, GSH-PX, CAT, GR.

1. Introduction:

The exposure caused by the transmission of electromagnetic (EM) waves, that are associated with the use of electrical power and various forms of natural and artificial lights, is referred to as EM field (EMF) exposure. In the earlier period, a large amount of investigation hard work have been devoted to first recognize how human beings are affected by EMF exposure and, then, to design tools to measure the exposure and characterize exposure metrics; these measurement tools and metrics being in turn useful for setting exposure guidelines and preventive the possible adverse effects of EMF exposure on human beings. In the past few decades the growth of wireless cellular communication system has been so relentless that it is now one of the most important sources of EMF exposure in the general surroundings. [1]

Electromagnetic radiation (EMR) emitting from the normal surroundings, as well as from the use of manufacturing and daily appliances, continuously influences the human body. The effect of this type of vigor on living organisms may exert a variety of effects on their performance, although the mechanisms conditioning this observable fact have not been completely much more attention due to the fewer investigates. It may be expected that the communications between electromagnetic radiation and the living organism would depend on the quantity and constraint of the transmitted power and type of tissue exposed. Electromagnetic waves exert an influence on human living things in depth because an electromagnetic radiation can be viewed as the combination of an electric field and a magnetic field; therefore, both components are important in the analysis of exposure in case of the detection study of the same. [3]

Electromagnetic Fields (EMF) are invasive in daily living. Antennas, including GSM (Global System for Mobile Communication) antennas for cellular phones in resident area rendering most of the human residents to emission at several frequencies, mainly Radio Frequency (RF). Much research in the last decade has depicted variations in the biological parameters of living organisms after get in touch with EMF. A number of sections of the residents may be additional susceptible to potentially unsympathetic effects stemming from work exposure or individual vulnerability. Significant epidemiological and investigational studies have attempted to estimate EMF revelation and its belongings on various hazardous diseases and disorders and the individual residents at huge or precise groups that may incur larger risk due to additional straight exposure. [10] Effects of EMF radiation can be studied in two ways i.e. bio-effects and health effects:

Bio-effects are measureable responses to a stimulus or to a change in the atmosphere and are not

necessarily harmful to our health. Biological effects can be two types i.e. Thermal and Non-Thermal effects. Thermal Effects: Refers to the heat generated due to absorption of EMF radiation. While using a cell phone, most of the heating effect occurs at the surface of the head, causing its temperature to increase by a fraction of a degree. Prolonged thermal effect may lead to increase in body temperature. Non-Thermal Effects: Non-thermal effects are attributed to the induced electromagnetic effects inside the biological cells of the body which is possibly more harmful.

Electromagnetic Hypersensitivity (EHS): One potentially harmful effect of radio-frequency radiation is dielectric heating due to absorption of EM radiation⁸. However, if the temperature increase is small, the brain blood circulation is capable of disposing the excess heat by increasing the local blood flow. This is the normal cellular response to increase in temperature and does not have any adverse effect on the body.

Some also argue that there are other various symptoms like fatigue, sleep disturbance, loss of memory, disturbance indigestion etc. which have been attributed to exposure to low-level EM radiation from wireless devices. These symptoms are collectively known as Electromagnetic Hypersensitivity (EHS).

However, a study conducted by the WHO⁹ concluded that EHS is characterized by a variety of non-specific symptoms that differ from individual to individual. The symptoms are certainly real and can vary widely in their severity. Whatever its cause, EHS can be a disabling problem for the affected individual. However, EHS has no clear diagnostic criteria and there is no scientific basis to link EHS symptoms to EM radiation. Furthermore, EHS is not a medical diagnosis, nor is it clear that it represents a single medical problem. The rest of the paper is organized as follows, in section 2 proposed approach with system design for experimental set up and histopathological evaluation of brain tissue is elaborated. Section 3 provides the detailed discussion about the obtained results. Finally, we concluded the paper in section 4.

2. Proposed approach:

2.1. System design for experiment:

This paper proposes an effect of electromagnetic field radiation from cellular wireless system on SD rats. SD rats were exposed for Electromagnetic field radiations for 30 days, daily at a rate of 8

hours per day (10.00 AM to 17.00 PM). During exposure period, test animals were placed in Plexiglas boxes. Electromagnetic field radiation transmitter was fitted to the roof of the cage from inside. Rats were exposed to EMR radiations emitted from the transmitter. Control rats were not given any exposure.

The analysis of electromagnetic field radiation exposure from cellular wireless system is expected to become more and more important in research field so that researchers can provide the solution of the effect of electromagnetic field radiation on human living things.

Table. 1: Animals grouping

Group	Treatment	No. of Animals
I	Test group-Exposure of EMF radiation for 8 hours/day for 30days	03
II	Control group-Without exposure of EMF radiations	03



Figure. 1: Electromagnetic field radiations exposure

2.2. Histopathological evaluation of brain tissue:

Histopathological evaluation and oxidative markers measurement were performed on brain tissue, significant decrease in SOD, GSH-PX, CAT, GR (Oxidative markers) level were observed. Chronic exposure of EMF radiation elevates oxidative stress in brain, it was indicated through depletion in antioxidant enzymes i.e. SOD, Catalase, reduced glutathione. Brain tissue showed major histopathological alterations as compared to control group.

Brain tissue effects of biological analysis initially detected through histopathological evaluation of tissues from studies of SD rats under chronic exposure of EMF radiation from wireless cellular systems. This article summarizes the changes and fundamental affirmation for modifications to the histopathological evaluation of the brain tissue system during oxidative markers measurement studies conducted by the experimental set up used for SD rats.

Group I- (Test group) Exposure of Electromagnetic field exposure for 8 hours/day for 30 days.

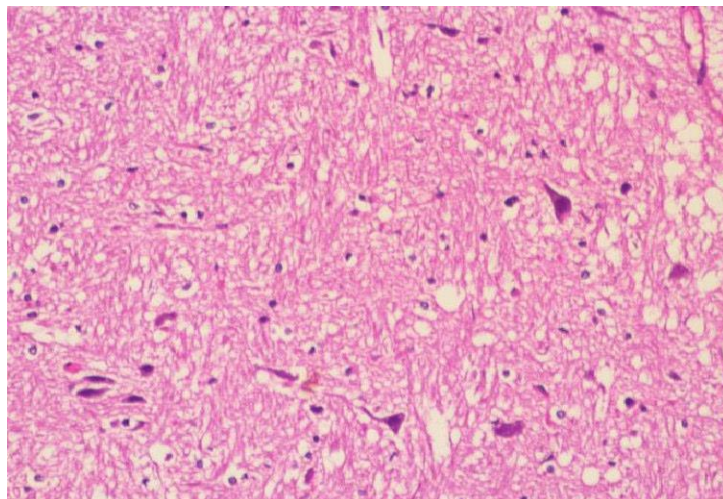
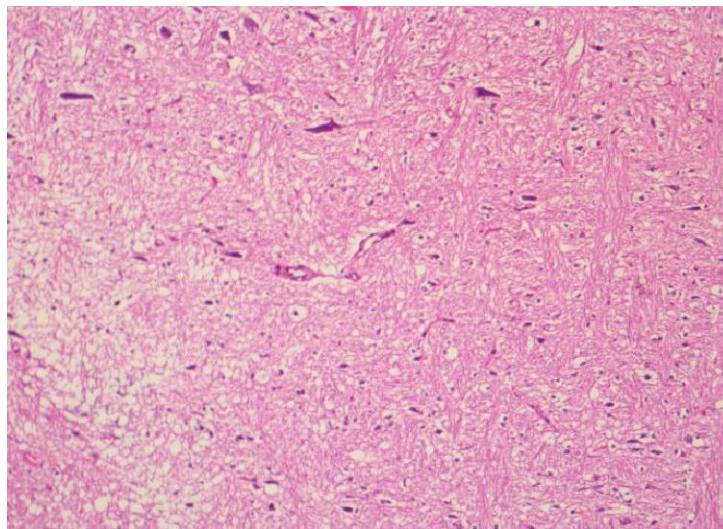


Figure. 2: BRAIN (Striatum): Micrograph for brain of rats showing normal histological structure striatum region with oval shaped neuron. (H&E sectioning, 200x Magnification)

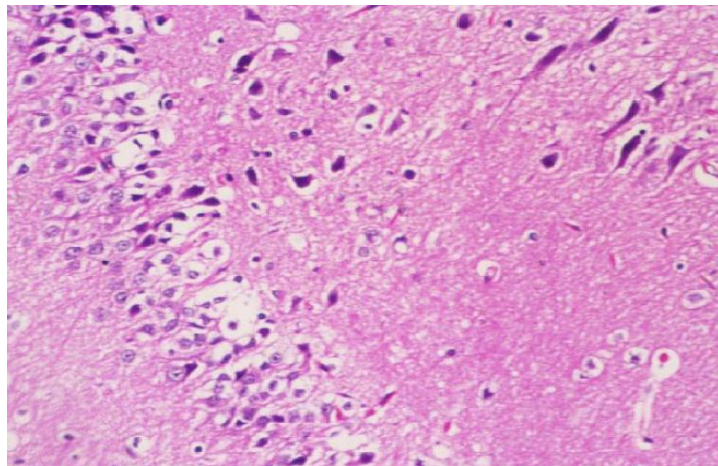
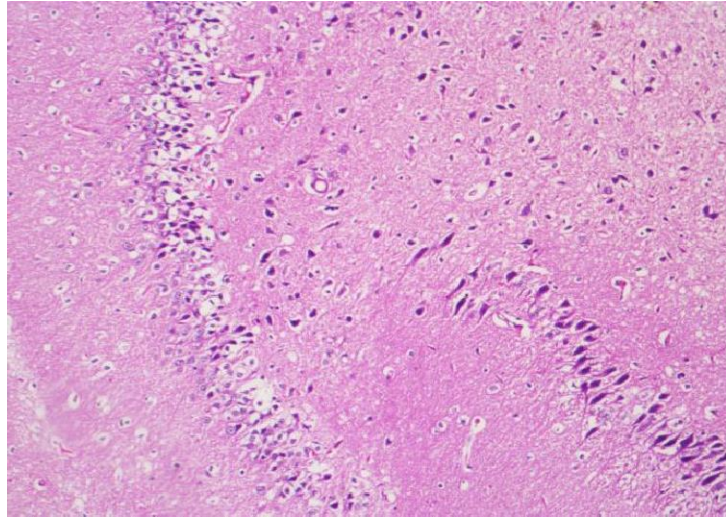
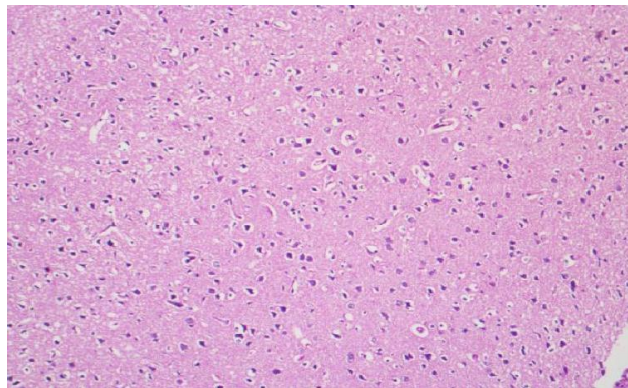


Figure. 3: BRAIN (Hippocampus): Microscopic appearance of hippocampus showing reduced layers of small pyramidal cells of CA1, CA2 and CA3 region with vacuolation of neuron. Molecular layer with shows degenerative glial cells among neuronal processes, (H&E x 200)



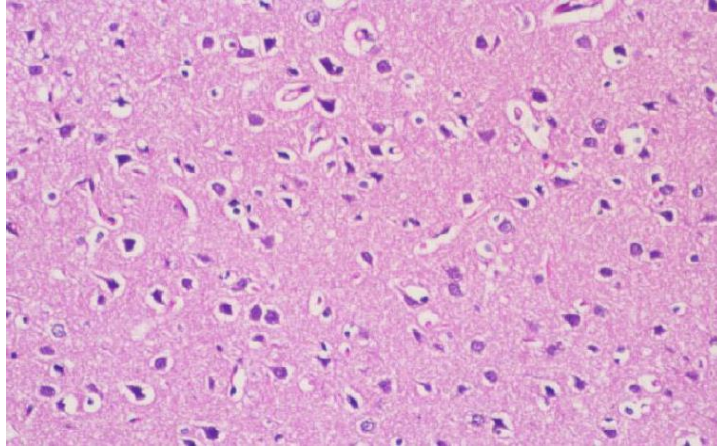
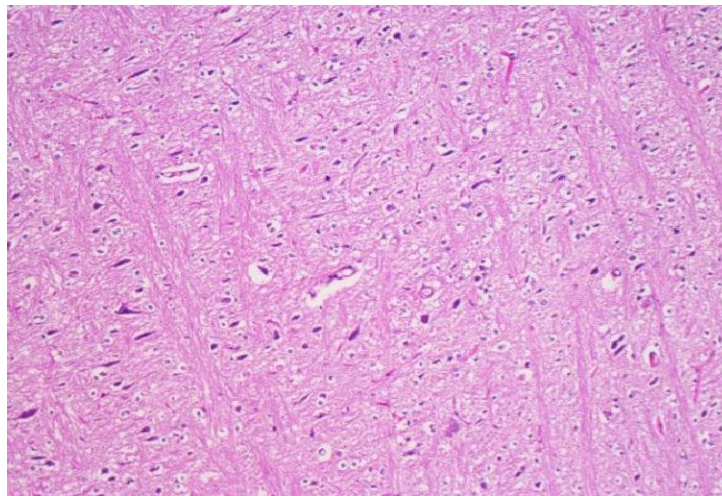


Figure. 4: BRAIN (Cortex): Microscopic appearance of cortex of brain showing round to oval neuron. No any abnormality detected in cortex region. (H&E sectioning, 200x Control group II-Without exposure of Electromagnetic field radiations



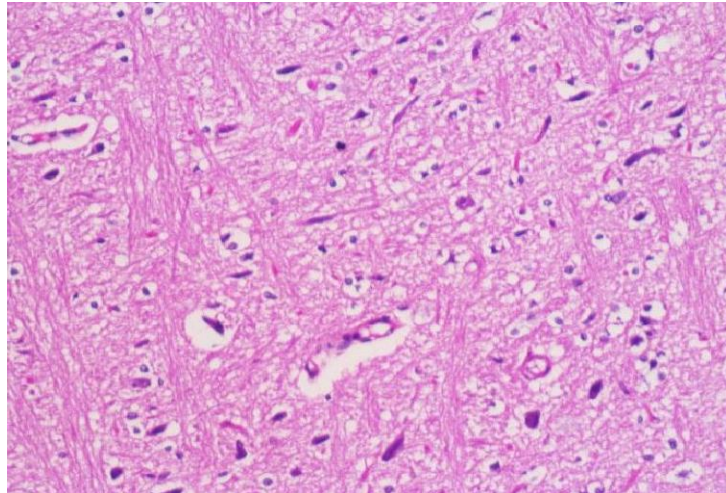


Figure. 5: BRAIN (Striatum): Micrograph for brain of rats showing normal histological structure striatum region with oval shaped neuron. (H&E sectioning, 200x Magnification)

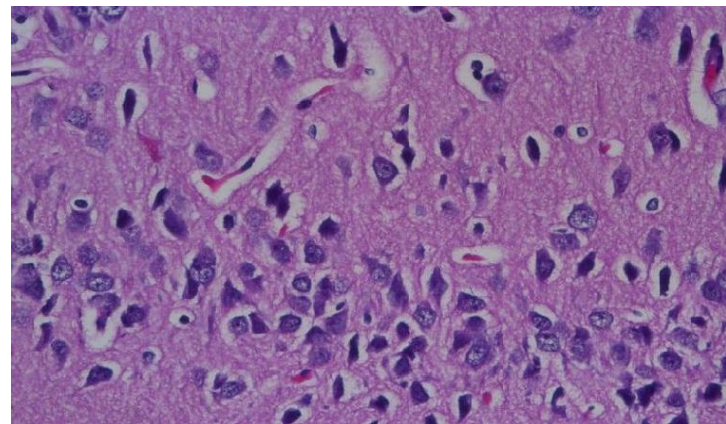
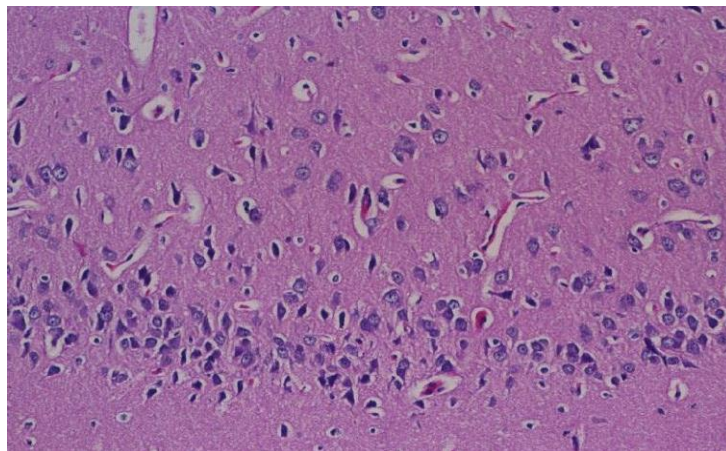


Figure. 6: BRAIN (Hippocampus): Microscopic appearance of hippocampus showing normal 5-6 compact layers of small pyramidal cells of CA1 and CA2 region with most of vesicular nuclei. Molecular layer with shows many glial cells among neuronal processes. Intact pyramidal cell nucleus, No pyknotic neuron cells and no any

abnormal changes observed (H&E x 200).CA-cornu ammonis, DG-dentate gyrus

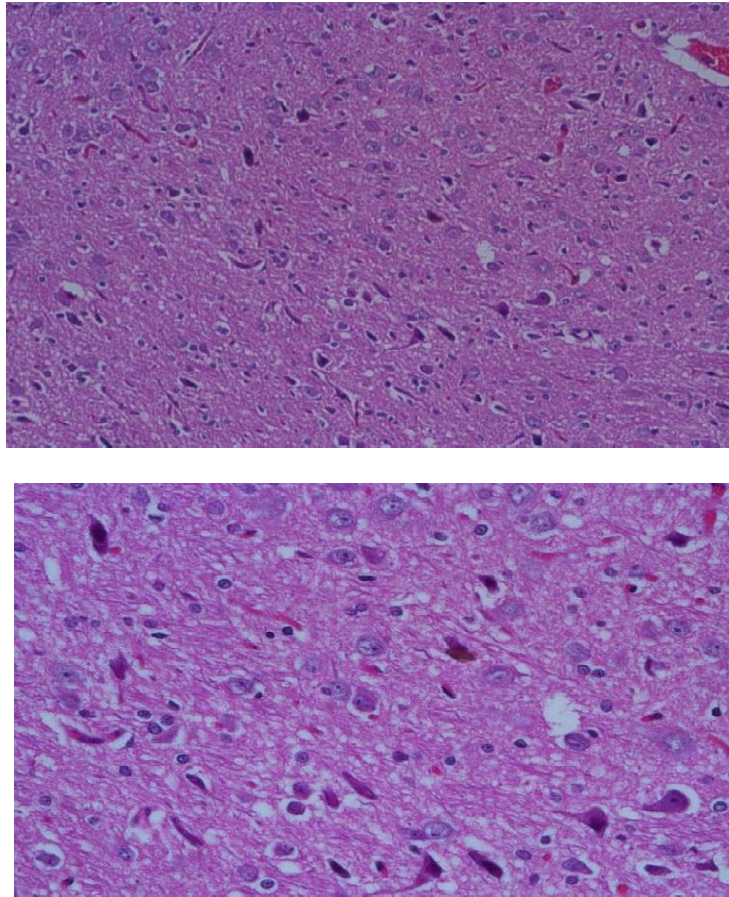


Figure. 7: BRAIN (Cortex): Microscopic appearance of cortex of brain showing round normal histoarchitecture. No any abnormality detected in cortex region (H&E sectioning, 200x magnification)

3. Results and discussion:

This section provides the experimental results of Histopathological evaluation of brain tissue through Group I- (Test group) Exposure of Electromagnetic field exposure for 8 hours/day for 30 days and Control group II-Without exposure of Electromagnetic field radiations. Brain tissue were collected and processed for histopathological and oxidative markers evaluation. EMF exposure alters GSH level brain tissues. GSH content was significantly decreased after EMF radiation exposure, prominently in brain tissue. Factors such as enzymes involved in the intracellular degradation of O₂ and H₂O₂. It represents the activity of SOD in the liver and brain tissues. In this study, biochemical, histopathological analysis, connectivity of brain damage to examine the structural and functional integrity in EMF radiations exposed animals.

In Group I- (Test group), Micrograph for brain of rats showing normal histological structure striatum region with oval shaped neuron. (H&E sectioning, 200x Magnification) and Microscopic appearance of hippocampus showing reduced layers of small pyramidal cells of CA1, CA2 and CA3 region with vacuolation of neuron. Molecular layer with shows degenerative glial cells among neuronal processes, (H&E x 200). Microscopic appearance of cortex of brain showing round to oval neuron. No any abnormality detected in cortex region. (H&E sectioning, 200x Magnification)

In Control group II, Micrograph for brain of rats showing normal histological structure striatum region with oval shaped neuron. (H&E sectioning, 200x Magnification) and Microscopic appearance of hippocampus showing normal 5-6 compact layers of small pyramidal cells of CA1 and CA2 region with most of vesicular nuclei. Molecular layer with shows many glial cells among neuronal processes. Intact pyramidal cell nucleus, No pyknotic neuron cells and no any abnormal changes observed (H&E x 200). CA-cornu ammonis, DG-dentate gyrus. Microscopic appearance of cortex of brain showing round normal histoarchitecture. No any abnormality detected in cortex region (H&E sectioning, 200x Magnification). Figure 2 to figure 7 represent the obtained results through the experimental set up.

4. Conclusion:

It is very difficult to recognize the mechanism of electromagnetic field absorption in the living body so as to find accurate and effective approaches to deal the consequences. Scientific studies on the mechanism of biological effects are also required. Our results represents that the EMF radiation exposure is a major factor related to EMF radiation toxicity. Study revealed that EMF radiation exposure caused neuronal damage.

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