Abstract
The present investigation was carried out by exposing the adult male albino rats to the magnetic field of 202 μT against the control group and both were analyzed for haematological and biochemical changes. The results showed that the magnetic field exposed (MF) animals showed significant increase in RBCs, WBCs, Hbs and platelet count as well as decrease in Red blood cell indices values of MCV, MCH and MCHC. In addition, the MF exposed group also showed significant increase of AST and ALT levels in plasma indicating the involvement of MF on liver cell membranes. The haematological parameters and liver enzymes were affected by the electromagnetic field exposure suggesting the possible induction of hazardous biological effects during the exposure to magnetic field.

Key words: Electromagnetic field, blood indices, liver enzymes, AST and ALT, Rats.

Introduction
Magnetic radiation is well associated with vast areas like industries, military and medical fields etc. The radio frequency portion of magnetic field is in the range of (0.5 MHz-100GHz) which can affect various organs and physiological systems (1,2). Generally, magnetic fields are generated by the physical movement of the electrical charge (or) current. The preponderance of evidence suggested that the low-power, low frequency, electromagnetic radiation associated with household current does not constitute a short or long term health hazard but some haematological and biophysical mechanisms will be affected and results in cancer (3).

Several haematological and biochemical variables are sensitive to exposure to magnetic field in animals as well as in humans which can act on various ions of all organs thus altering the cell membrane potential as well as the distribution of enzymes and cellular functions (4). It is also reported that magnetic field can also influence on the enzyme action, signal transduction, protein synthesis and gene expression (5, 6). On the other hand non-ionizing electromagnetic field on the human body are useful for various therapeutic purpose. The exposure of MF of 128 mT for 1h/day for 10 consecutive days on albino rats induces an increase in hematocrit, hemoglobin (3) and tissue enzymes released within the blood. Moreover the high magnetic fields exposure also induces the behavioral and neural changes in rats (7).

The main damaging role of magnetic fields may be on the cellular membrane of living organisms which is complex process, but it is of more interest to give an insight into the expected hazards and the proper ways of its use and how organism can be protected from MF (8, 9). AST and ALT are the liver enzymes which are affected by the applied magnetic field. The elevation of AST and ALT in the plasma is an indicator of hepatotoxicity (6,10,11,12). Earlier studies have reported that the effects of chronic exposure of magnetic field and there is a few reports on the effect of acute exposure of magnetic field on
albino rats. Hence this study was aimed to investigate the haematological and biochemical parameters on acute exposure of magnetic field on rats.

**Material and Methods**

Adult male albino rats weighing in the beginning of the experiment from 150 to 180 gm were taken for the study and were divided into two groups namely, control (n=6) and study group (n=6). The institutional animal ethical committee approved the experiment protocol of the study. All the animals were housed in plastic cages and normal ventilation, water and food were provided.

**Exposure system:** The exposure of magnetic field was done in specially made MF chamber consisting of two circular coils fixed with a small distance in between the coil whose diameter was 35cm. These coils having 1000 turns and was connected in series to avoid the maximum heat generation of coil and to provide the magnetic field of 202\(\mu\)T at the center of the coil where the rats were placed. The magnetic fields of the instrument were measured manually according to standard protocol. A uniform magnetic field was produced over a coil (Fig.1). In one cage, six rats were placed in the center of the coils. The experimental groups were exposed to MF for 6 hours (202\(\mu\)T) and the control animals were not exposed to MF.

**Biochemical analysis**

_Estimation of activity of Alanine Transaminase (ALT) (EC. 2.6.1.2) and aspartate transaminase (AST) (EC.2.6.1.1):_ Alanine Transaminase (L-Alanine: \(\alpha\)-oxoglutarate amino transferase) and Aspartate transaminase (L-Aspartate: \(\alpha\)-oxoglutarate amino transferase) levels was estimated by the method of Reitman and Frankel (1957). 500ml of ALT and AST substrate was incubated individually with 0.05 ml of serum or liver tissue homogenate along with standard tubes having standard pyruvate, taken at a concentration ranging from 0.2 to 0.8 \(\mu\)M in separate tubes, at 37\(^{\circ}\)C for 30 min for ALT and 1h for AST. The reaction was arrested by addition of 1.0 ml DNPH and all the tubes were left at room temperature for 20 min. simultaneously, a control each for serum and liver tissue homogenate was prepared separately. These tubes contained ALT substrate alone and the serum and liver tissue homogenates were added after addition of DNPH. Finally, the colour was developed in all above tubes by addition of 5 ml of 0.4N NaOH and their absorbance was measured at 540 nm against blank using spectrophotometer. ALT levels in serum are expressed as IU/L and in tissue as IU/gm tissue.

**Results and Discussion**

The Fig. 2. Summarizes the blood parameters of RBC, WBC and Hb and shows the significant increases of RBC, WBC and Hb values when compared with the control group. Fig.3. shows the Red cell indices values where there is a significant decrease of MCV, MCH and MCHC which may be attributed to decreasing RBC. Fig.4 and 5.shows a significant increase of platelet.

![Fig. 1. Magnetic Field exposure system](image1)

![Fig. 2. Effect of electromagnetic field exposure on blood indices - RBC, WBC and Hb](image2)
count and plasma liver enzymes, respectively. The liver enzymes AST and ALT were increased in the study group of rats when exposed to the magnetic field as compared to the control groups. The acute exposure of rats to the magnetic field of 202 T showed a general increase in RBC, WBC and Hb. This increase in values can be due to harmful effect of magnetic field exposure which stimulates the haemopoietic system to release of RBC, WBC and Hb (3). There was a significant increase in Red cell indices values due to significant increase of RBC and Hb in the blood stream. The Mean corpuscular volume was decreased as the RBC level increases. Similarly the MCH and MCHC is also decreased. The above results concurs with the earlier studies of Robert et al., where they proved that the applied magnetic field affects erythropoietin levels in rats of the study groups (2,4).

The significant increase of the liver enzymes AST and ALT which are known biomarkers of liver were observed in our study thus indicating a form of biomagnetic injury in organs due to the effect of magnetic field (6,7,13,14). In general, this magnetic field having radiofrequency range of wavelength which can easily penetrate into the cell having the same inter atomic distance which affects the dipoles of the cells (13). This changes the membrane potentials and likewise produces injuries to the entire organs.

The AST and ALT concentration was increased in the plasma after acute exposure of magnetic field in our study when compared to the control (15). This magnetic field identifies itself as a type of acute stress in rats and during this stressful condition most of the biochemical parameters changes are well documented in many earlier studies. To summarize, the MF of strength 0.5 MHz-100 GHz can affect the hematological parameters and AST and ALT levels in albino rats and this type of acute magnetic stress can also induce behavior changes in these small animals.

**Conclusion**

Based on the above hematological and biochemical analysis, this study could suggest that similar changes in humans can also occur when they are exposed constantly to various
magnetic fields of various home electronic appliances.

References


