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The Effect of Weak Magnetic Field on the Albino Rats Investigated on Their Haemogological and Histological Parameters

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Abstract: This study presents the study of effect of weak magnet fields on the haemotological and some Histological parameters of Albino rats exposed for a period of 6 h per day for 2 weeks. Analysis on these parameters clearly showed that no significant differences were observed in both the haemotological and histological studies and therefore poses no serious health risk of any kind. It however recommends that GSM users should not be scared of the usage of their cell phones but to avoid abuse at instantaneous period because the somatic changes might result in late biological injury.

Key words: Weak magnetic field, haemotological, histological, Albino rats, health risk, GSM

INTRODUCTION

Various organizations have been sounding the alarms about threat to the environment. These include the United Nations Educational, Scientific and Cultural organization, the United Nation Environment Programme and other related bodies. Ever since ancient times mankind has been aware that radiation at remarkably weak field can have very adverse or important beneficial biological effects on living things and plants, respectively.

Baum *et al.* (1976) showed that Electromagnetic Pulse (EMP) radiation presents no biological hazard from current flow or thermal heating on a body insulated from the ground. However, it was observed that the rapid rise and fall of electric and magnetic fields could induce changes at the molecular level which would result in either acute injuries or which would manifest themselves in later life due to earlier somatic changes. Late or delayed manifestation of somatic radiation are those which do not appear until after a latent period of months, years or the remaining life span of the exposed individual. The late effects occur in slowly or non proliferating tissues, such as lung, liver, kidney, heart connective tissue, nervous tissue and bone. Research particularly from Mikotajaczyk (1998) confirmed that Magnetic Field (MF) can exert adverse effect on the living organisms including human. Blood is known to be a means of transportation in living organism which has water fluidity as a major component, believed to be partially conducting. Previous works on pure water exposed to Weak Alternating Magnetic Field (WAMF) have shown some extreme changes in the coefficient of refraction n, tangent of dielectric loss angle (tan ∂) and heat transfer coefficient ã and in the super cooling ability (ΔT) below 0°C of water (Kiselev *et al.*, 1990).

Comments and various mails from readers as compiled by EMF link Information Venture Inc. (1994-2004) expressed various opinions, anxieties and reservations about health risk associated with any mechanisms or devices having to do with electrical and magnetic field. Research has made it clearly known that radiation on bodies has the physical property of ionizing some biological materials by which the radiation is absorbed hence the curiosity prompted this research work. This therefore, motivated the authors' belief to understudy the present research on the Albino Rats, to investigate the effect of weak magnetic field on their Heamatological and some Histological parameters and to make appropriate recommendations based on its findings.

Within the same frame, Lai and Singh (1996) reported that short exposure to mobile radiation 2 h on adolescent rats may destroy cells in parts of the brain important for memory, movement and learning and could possibly conceivably premature onset of illness such as Alzheimers. Their researches also reported that if this effect was transferred to young mobile users, this effect could be terrifying. They concluded that they observed reduced brain reserve capacity, meaning those who might normally have got Alzheimer's or dementia in old age could get it much earlier.

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These days of Information Communication Technology (ICT) and the use of Global System for Mobile Communication (GSM) by young ones particularly under-aged (8-17 years) with mobile phones often abuse the usage by exposing themselves to more than 120 min of radiation equivalent to typical intensive mobile phone use. Animals exposed to medium and high level radiation had many dead neutrons in their brains as reported by James (2005), Science correspondent, Daily mail on the cynicism of the mobile phone firms.

The authors are concerned about the ill-feelings of GSM users and related devices. The GSM operators have not sponsored any meaningful research to enlighten the public on the adverse effect of their devices namely; base stations mounted within the household and community places all around the towns and cities in the name of security. It is always recommended that mobile phone radiation exposure would have to be followed by brain biopsy which can cause epilepsy later, permanent brain damage, stroke or even death, which is not within the coverage of this study. However, the study to investigate the effect the weak magnetic field is constrained on rats as no human being would subject him/herself to such exposure for investigative purpose.

MATERIALS AND METHODS

All relevant physics texts explain that magnetic field are generated in coil when electricity is passed through it in form of a solenoid where solenoid is defined as a coil of wire with a length that is large compared with its diameter.

At a point inside the solenoid and on its axis, where the ends subtend semi angles $è_1$, $è_2$, the magnetic flux density B is given by:

$$B = \tfrac{1}{2}\mu_0 nI\left(\text{Cos}\theta_1 + \theta_2\right)$$

where, n is the number of turn per unit length, I is the current and μ_0 is the magnetic constant, neglecting end effects. This afforded us to construct the field generator tin cylinder of length 17.6 cm and diameter 13.5 cm.

A length of 4,050 cm of insulated copper with 27.0 cm was wound round the tin cylinder to create a solenoid chamber of 300 turns, having a hollow of 17.5 cm.

Two terminals were established having the input and output. The maximum voltage corresponding to the diameter of the Copper wire was 9 volt. The resistance of the wire measured across the coil without load was 15 Ω.

There were four of those coils constructed, each operated at different voltages of 7.8, 6.2, 5.0 and 4.0 V simultaneously for the experiment, but the same parameters as stated above save the voltages.

The distribution of the magnetic field produced in the magnetic field generator described above was investigated experimentally and the results were obtained for the different voltages at constant frequency of 50 Hz. When an alternating current was connected to the coil, an alternating magnetic field was produced by the coil. The alternating magnetic field was explored by means of an axial search coil connected to the oscilloscope. The search coil with number of turns of 5000 and resistance of 2 kΩ, which when placed in an alternating magnetic field an electromotive force (emf) was induced. The induced voltage was found to be directly proportional to the rate of change of flux through the coil and therefore, to the amplitude of the alternating field. The amplitude was measured using an oscilloscope and the induced emfs were calculated using the root mean square method.

In the coil, Perspex sheets were used to construct a habitat for the rats so as to stay comfortably in the coil while the experiments were going on. The magnetic fields of the coil were investigated with the presence of the Perspex sheet in them. The Perspex sheets were perforated to allow aeration of the coil cavity and good ventilation for the rats.

The axial investigation of magnetic field in the generator is as presented in Table 1.

The male Albino rats were used for the experimentation which was housed in cages in four different groups and the control as another group in one cage totaling five cages in number. Each group consisted of three rats except for the control with four which made it a total of 16 rats in all and labeled A, B, C and D while the control was labeled "Control". In each group the rats were differentiated with the following labels namely "Head", "Left leg", "Right Leg" and "Tail" with marks put on these parts of their bodies.

All heads correspond to the 7.8 V source, left legs to the 6.2 V source, right legs to the 5.0 V source and the Tail to the 4.0 V source for each group. The rats groups A to D were introduced into the weak magnetic field with the coil placed on the horizontal position to the earth magnetic field. They were exposed to the weak field for 6 h each day for a total of 2 weeks. They were introduced in turns according to the label for each voltage source for minimum of 6 h each for 2 weeks.

Table 1: The axial investigation of magnetic field in the generator with Perspex sheet

	7.8 V		6.2 V		5.0 V		4.0 V	
Length (cm)	Amplitude 50 mv/cm	EMF 10^3	Amplitude 50 mv/cm	EMF 10^3	Amplitude 50 mv/cm	EMF 10^3	Amplitude 50 mv/cm	EMF 10^3
17.5	2.6	3.6	2.2	3.0	2.0	2.8	1.4	1.9
15.0	2.8	3.9	2.6	3.6	2.0	3.6	1.6	2.2
13.0	3.0	4.2	3.2	4.4	3.0	4.2	1.8	2.5
11.0	3.4	4.7	3.0	4.2	2.8	3.9	2.0	2.8
9.0	3.4	4.7	3.2	4.4	2.8	3.9	2.2	3.0
7.0	3.4	4.7	3.0	4.2	2.6	3.6	2.2	3.0
5.0	3.2	4.7	2.8	3.9	2.4	3.3	2.0	2.8
3.0	3.1	4.3	2.6	3.6	2.3	3.2	1.8	2.5
1.0	2.8	3.9	2.4	3.3	2.0	2.8	1.6	2.2

The haemotological parameters were investigated in the whole blood collected from the rats in the departments of Physiology in the Faculty of Basic Medical Sciences, Obafemi Awolowo College of Medicine (OACHS) of the University, the address of the authors:

- Pack Cell Volume (PCV)-This is the amount of erythrocytes in the whole blood.
- The Red Blood Cell (RBC)-This contains the haemoglobins responsible for oxygen transportation in the blood.
- White Blood Cells (WBC).
- Haemoglobin (Hb)
- Main Corpuscular Haemoglobin (MCH)-This is the average haemoglobin content (μμg) of a single red cell.
- MCHC-This is the percentage of haemoglobin in 100 mL of the red cell.
- MCV-This is the average volume of the single red cell in cubic micron.

Histological study was similarly carried out on the following tissues namely kidney, spinal cord, liver, Muscle and Heart. The full methodologies of investigation of both Haemological test and Histological processing of tissues were elucidated in Baker (1962) with all precautions carefully adhered to.

RESULTS AND DISCUSSION

An analysis of variance was carried out on the data obtained from the haemotological observation on the whole blood of the rats which is similar to analysis work by Coghill (1999).

The result of analysis showed that there is no significant difference of the effect of the magnetic field on the parameters of haemotology of the whole blood recorded as depicted in graphical representation in Fig. 1. This was proved by carrying out a multiple range test, for which the difference between two means of the group is significant if the Duncan test with significance level is 0.05, but there existed none at this level.

On the analysis of the histological slides under light microscope there were no effective significances seen on the tissues. Electron microscope would have been used to probe further investigation but only light microscopes were available as at the time of these experimentations in year 2000. Observations on the haemotological analysis at a considerable low weak magnetic fields showed that the effect is more pronounced as depicted in Fig. 1 than the higher fields which suggests that the experiment is better performed at considerably low weak magnetic field at short exposure time. However, its significant effects may be achieved if the short exposure period is increased in longer days of probably 2 or more months. Body resistance to external stimuli can be a factor to explain this anomalous since they have the tendency to resist the effect within a short period of exposure, as it is in the case of the present study.

The little effect noticed in the experiment even though not significant shows that weak magnetic can have initial effect on the rats but after the full working operation of the immune systems, the significant is overcome and hence no serious health risk except the exposure is grossly abused for much longer days, 2 months or more.

While, it is difficult to prove the absence of minute biological injury, it might be unequivocally stated that if EMP radiation caused such effects then it presented no biological hazard to the rats of the present study. It agreed with earlier work of Baum *et al.* (1976) on biological measurement in rodent exposed continuously through their adult life to probe electromagnetic radiation.

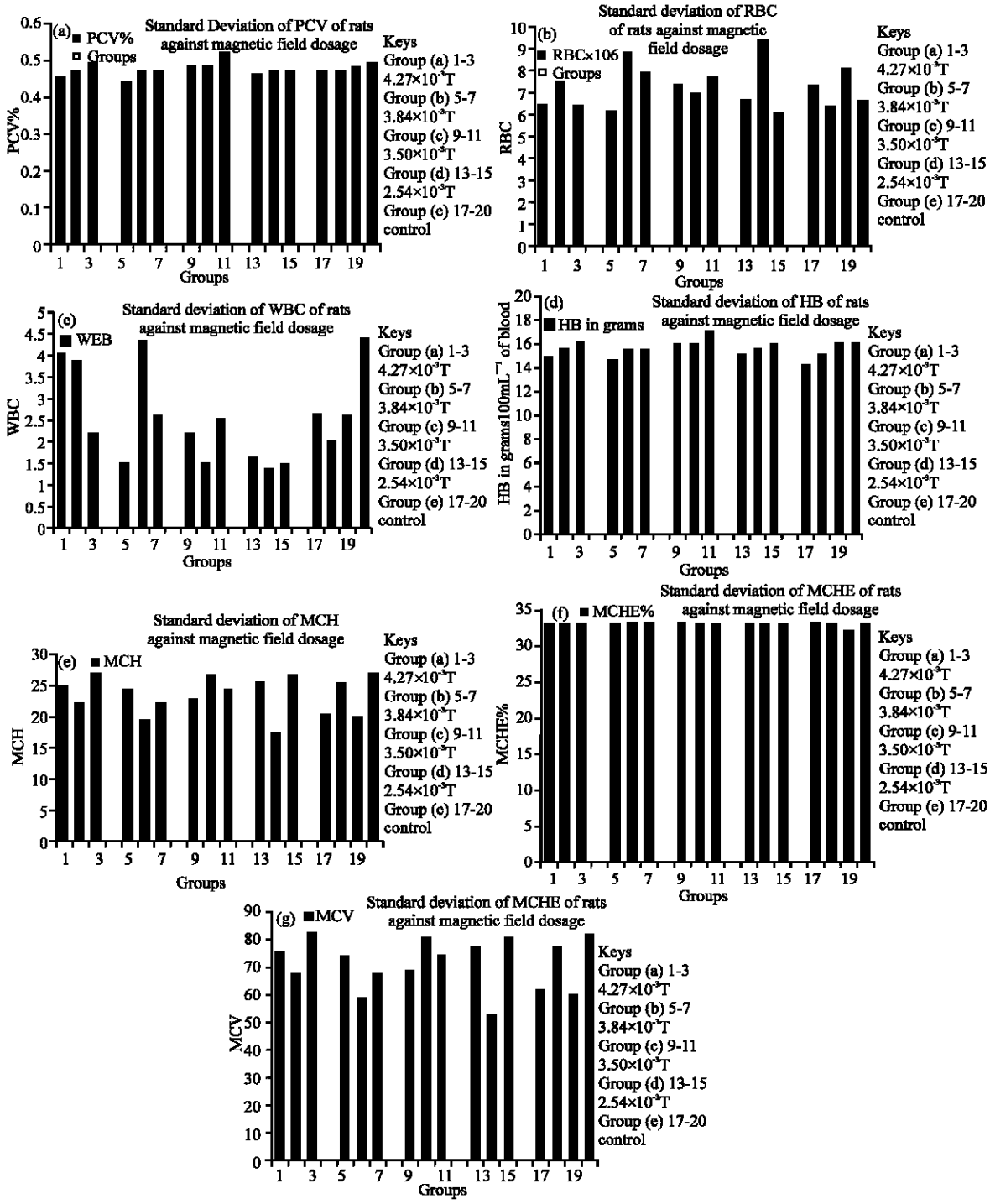

Fig. 1: The hamotological analysis at a considerable low weak magnetic fields

CONCLUSION AND RECOMMENDATIONS

The authors however warned that the young ones are discouraged from carrying with them mobile phones as their immunity or resistance to field irradiation would not have manifested protectively. While the risks of mobile phones are still unclear consumers need all the information to make their decision. One of such is SAR which means Specific Absorption Rate and it measures the number of watt-watts

(of energy) per kilogram (of human tissue) which have seeped through the skull into the brain.

Researches have shown no scientific evidence that mobile phones cause adverse health effects and our handsets operate within World Health Organization guidelines but the higher the SAR rating, the more is absorbed. Therefore, manufacturers are advised to provide more information on the technologies of their sets particularly radiation level and materials for the devices to identify the level of radiation toxicity of the materials when fatigued.

The GSM users are therefore advised to avoid abuse of their cell phones at any instantaneous period to avoid reaching the threshold of their immune systems (suppression of their immune system) for effective protections.

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