SUB CHRONICAL EFFECTS OF ELECTROMAGNATIC FIELD EXPOSURE OF ADULT FEMALE RATS ON SOME HORMONAL, BIOCHEMICAL AND HEMATOLOGICAL PARAMETERS.

Bushra F Hassan
Physiological dept. - College of Veterinary Medicine - University of Basra.

ABSTRACT

This study was achieved on 20 mature female rat, ten of them were exposed to electromagnetic field of 104μT for 30 minutes daily for 21 days. The other ten rats served as control. Blood samples were collected from treated and control rats as well. Results revealed that there were significant (p<0.05) decrease in progesterone, total serum protein, RBC count, PCV and Hb concentration. There were significant (p<0.05) increase in thyroxine, T3, serum cholesterol and total WBC count. Statically magnetic field also caused an increase in estrogen but not for the significant level.

Key words: Electromagnetic field, Female rats, hormonal, biochemical, hematological parameters.

INTRODUCTION

Studies considering adverse effects of electromagnetic field on health have yielded variable results in animals and human (Mostufa, 2005). Some efforts have been made recently to investigate the incidence of electromagnetic field on human and animal physiology and behavior (Mustafa et al., 2006, Mustafa et al., 2002 ). The possible health effects of magnetic field on reproduction and endocrine system have been extensively studied (Braune et al., 2002, Marino et al., 2001). However, results of similar studies have often differed markedly from one to another (Mustafa et al 2006). The characteristic biological effects of magnetic field appear to be functional changes in the central nervous system, endocrine and immune system (Ahlbom, 2001). Numerous biochemical studies have been carried out to evaluate the effects of electromagnetic field on the metabolism of the animal and human. The studies showed significant disturbances in the metabolism of carbohydrate, lipids and protein reflected by altered blood glucose level and by accelerated glycolysis and glycogenolysis (Kula and Drozdz, 1996 a,b). The level of

Received for publication Jan. 9, 2011.
Accepted for publication April. 10, 2011.
total protein was also changed. Magnetic field penetrate the animal body and act on all organs, altering cell membrane potential and the distribution of ions and dipoles (Berg, 1993). These alteration may influence biochemical processes in the cell. Several investigations have demonstrated on increase in childhood leukemia and other related disease in children from population exposed to magnetic field (Thomson et al. 1988). Moreover many reports indicate that magnetic field is involved in cancer induction as acocarcinogenic factors able to be enhance the effect of other mutagenic substances (Baum et al., 1995, Mevissen et al., 1995). Magnetic field exposure of rats increased significantly Hb, RBC, WBC and platelets (Salem Amara et al., 2006). This study aimed to investigate the effect of sub chronic electromagnetic field exposure of mature female rats on some hormones (progesterone, estrogen, T3 and T4) and some biochemical parameters (total serum protein, total serum cholesterol) in addition to some hematological parameter (RBC count, WBC count, PCV and Hb concentration).

MATERIALS AND METHODS

Twenty adult female rats were used, their mean body weight was 200 grams; they were randomly divided into two experimental group of ten animals for each. First group was exposed to electromagnetic field. The second group severed as controls. All animals were kept at similar conditions at room temperature and they were kept as each 5 animals in one cage under normal periods of light/dark with free access of food and water. Animals of experimental groups were exposed to electromagnetic field in physiological department, college of veterinary medicine. The intensity of magnetic field was measured and standardized at 104μT and influx density of 175 gauss. Adult female rats were exposed to static magnetic field (SMF) 30 minute a day for twenty one successive days and regarded as sub chronic exposed group. The control rats group was positioned at the same place for 30 minute a day for 21 days without applying magnetic field - Tested and control rats were sacrificed immediately after the last exposure. Blood samples (0.5 ml) were collected in vials containing EDTA for hematological investigation, other blood (1.5)ml were collected in vial without any coagulant agents and immediately centrifuged to get serum which were frozen at -20 C° for hormonal and biochemical analysis later.

Hormonal analysis:

Used T3, T4 enzyme immunoassay test kit catalogs number:
125-300 Total triiodothyronine product code:
225-300 Total thyroxin product code:
Both from monobind inc. Lake forest, CA92630, USA
Enzyme Immunoassay Test KIT Catalog Number: BC-11 Estrogen (E2).
Enzyme Immunoassay Test KIT Catalog Number: BC-1111 Progesterone.

**Biochemical analysis:**
Total serum cholesterol determination kit (cholesterol CHOD-PAP. Biocon Diagnostic hek8, Germany).
Total serum protein determination using special kit (Human / Total protein liquicolor, Germany).

**Hematological analysis:**
Red Blood Cells count (RBC) (Cell/mm³) and Total White Blood Cell count (WBC) (Cell/mm³) were obtained according to (Dasice and Lewis, 2001).
Hemoglobin concentration (Hb) (g/dl) was measured by the use of (Sahli appliance).
Packed cell volume (PCV) (%) was measured by the use of microhematocrit method (Schalm et al., 1975).
Differential WBC count the slide was stained with leishman’s stain.

**Statistical analysis:**
Data were reported as means ±SEM. Statistical significance of the difference between mean was assessed by students t-test according to (16). The level of significance was set at (p<0.05).

**RESULTS AND DISCUSSION**
Exposure of female rats to electromagnetic field at 104 µT caused a significant decrease at (p<0.05) in progesterone, total serum protein, total RBC count, PCV% and Hb concentration (table 1) as well as significant (p<0.05) increased in T3, T4, total cholesterol and total WBC count. Static magnetic field (SMF) also caused an increase in estrogen hormone but this increase did not reach to the significant level. All the above measured parameters of treated female rats were compared with control ones. The results showed that exposure of rats to electromagnetic field originated different metabolic and hematological disruption which appeared to be related to the duration and intensity of exposure.

Table(1) showed that treatment caused a significant decrease in hemoglobin concentration, red blood cells count and PCV%. Those results were on the contrary of those found by (Salem et al 2006) when they found significant increase in the above parameters; they hypothesized that action of SMF on the geometrical conformation of hemoglobin was reinforced by the fact that SMF induced a prominent effect on hemoglobin structure.
The only significant increase in hematological parameters in this study was in WBC count which is in agreement with what is found by (Salem et al., 2006) and also regarded as a some trends of (Stains et al., 2001) in lactating ewes exposed to a pulsed electromagnetic field. The present data showed that SMF exposure significantly decrease the plasmatic total protein level suggesting the change in protein metabolism of stressed rats, also this result is not in accordance with the findings of (Salem et al., 2006), but it is the same findings of (Boguslaw et al., 1999) when showed a significant decrease in total serum protein level. This discrepancy could be attributed to the difference of the intensity of SMF and the exposed scenario and duration. The mechanism of SMF action in biological system
can be examined by it is interaction with moving charged and enzymes activities rats in cell free systems increasing transcript levels of specific genes(Good man and Blank 2002).Its likely however, SMF also intract directly with electrons in DNA to affected protein biosynthesis (Good man and Blank 2002).

In relation to cholesterol level, this study found significant increase in this biochemical parameter which is opposite to results found by (Boguslaw et al 1999) in human and also that of (Sedghi et al. 2006) in guinea pigs. results of progesterone and estrogen of this study showed similar significant decrease found by each of (Al-Akras 2008, Aydin 2009). Further studies will be needed to explore the relation between exposure to magnetic field and catecholamine according to (Sabolsky1985), The stress induced catecholamine which may cause significant effect of LH; estrogen and progesterone. Exposure of rats to SMF in this study caused significant increase in T4 and T3 which is the same findings of (Chemysheva 1990, Gorczynska et al 1991) when they mentioned that SMF is to be strongly biolytic and glycogenolytic in rats which caused prominent increase in thyroxin level.

REFERENCES


Aydin M. 2009. Evaluation of hormonal change, biochemical parameters a histopathological status of uterus in rats exposed to 50 Hz


دراسة التأثيرات تحت المزمنة لتعريض إناث الجرذ البالغة لمجال كهرومغناطيسي في بعض الصفات
الهرمونية والكيميائية والدموية

يفضى فليح حسن
فرع الفسلجة - كلية الطب البيطري - جامعة البصرة.

الخلاصة

أجرت هذه الدراسة على عشرين أنثى جرذ بالغة، عرضت عشرة منها إلى مجال كهرومغناطيسي بشدة 104 مايكروتسل/لمادة نصف ساعة يوميا ولفترة 21 يوما ، أما العشرة حيوانات الأخرى فلم تعرض إلى المجال المغناطيسي واعتبرت كمجموعة سيطرة. جمعت نماذج دم من جميع الحيوانات المعاطلة والسيطرة على حد سواء. أظهرت النتائج انخفاض معنوي عند مستوى المعنوي (5%) في كل من هرمون البروجسترون والبروتين الكلي لمصل الدم والعدد الكلي لكرات الدم الحمراء وحجم كرات الدم المرصوصة وتركيز الهيموغLOBين بينما تم الحصول على زيادة معنوية عند مستوى (5%) في كل من هرمون الثايروكسين وثلاثي ايوديد الثايروكسين وكولسترول مصل الدم الكلي والعدد الكلي لكرات الدم البيض وكذلك سبب تعرض الحيوانات إلى المجال الكهرومغناطيسي زيادة في هرمون الاستروجين إلا إن هذه الزيادة لم تصل إلى مستوى المعنوي.