

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

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ABSTRACT

This study was achieved on 20 mature female rat, ten of them were exposed to electromagnetic field of 104 μ T 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 Drozd, 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 104 μ T and influx density of 175 gaus. 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 weresacrified 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 . was obtained by the use of haemocytometer (Dasice and Lewis, 2001).

Statistical analysis:

Data were reported as means \pm 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 μ T 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.

Table 1. Effect of electromagnetic field exposure on some hormonal, biochemical and hematological parameters of mature female rats.(means±SE.)

Parameters	Control ± SE	treated± SE
Progesterone (ng/ml)	7.37±0.19 a	1.32±0.17 b
Estrogen (pg/ml)	15.30±0.32 a	11.97±1.57 a
T4 (µg/dl)	4.92±0.46 a	20±0.52 b
T3 (ng/ml)	0.85±0.02 a	2.27±0.37 b
Cholesterol (mg/dl)	56.75±1.58 a	154.01±1.58 b
Protein (g/dl)	10.02±0.42 a	6.68±0.18 b
RBCs cell/ mm ³	5812500±71807 a	4837500±62500 b
WBCs cell/ mm ³	3400± 157 a	4683±151 b
PCV %	39.91±0.14 a	33.25±0.48 b
Hb (g/dl)	12.97±0.61 a	11.10±0.14 b

Means within a rows differed at ($p \leq 0.05$)

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 its interaction with moving charged and enzymes activities rats in cell free systems increasing transcript levels of specific genes (Goodman and Blank 2002). It is likely however, SMF also interact directly with electrons in DNA to affect protein biosynthesis (Goodman 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 (Sabolsky 1985), 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 (Chernysheva 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.

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

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الخلاصة

أجريت هذه الدراسة على عشرين أنثى جرذ بالغة، عرضت عشرة منها إلى مجال كهرومغناطيسي بشدة ١٠٤ مايكروتسلاير لمدة نصف ساعة يوميا ولفترة ٢١ يوما، أما العشرة حيوانات الأخرى فلم تعرض إلى المجال المغناطيسي واعتبرت كمجموعة سيطرة. جمعت نماذج دم من جميع الحيوانات المعاملة والسيطرة على حد سواء . أظهرت النتائج انخفاض معنوي عند مستوى المعنوية (٥%) في كل من هرمون البروجستيرون والبروتين الكلي لمصل الدم والعدد الكلي لكريات الدم الحمراء وحجم كريات الدم المرصوفة وتركيز الهيموغلوبين بينما تم الحصول على زيادة معنوية عند مستوى (٥%) في كل من هرمون الثايروكسين وثلاثي ايوديد الثايرونين وكولسترول مصل الدم الكلي والعدد الكلي لكريات الدم البيض وكذلك سبب تعرض الحيوانات إلى المجال الكهرومغناطيسي زيادة في هرمون الاستروجين إلا إن هذه الزيادة لم تصل إلى مستوى المعنوية.