Effectes of Low Frequency Pulsed Magnetic Field on Blood Clotting Time in Male Rabbits

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Abstract

Background: This research was under taken to estimate the effects of low frequency pulsed magnetic field (LFPMF) on blood clotting time in rabbit males.
Aim of this research;
The purpose of this study is to evaluate the effects of low frequency pulsed magnetic fields in blood clotting times in male rabbits.
Methods: Eight rabbits male were included in this study , four of them were used as a control groups and other four rabbits were used as an exposed groups. They were exposures to six gausses of Low Frequency Pulsed Magnetic Field (LFPMF), at different times (6,12,18,24,30,36,42,48 hours) respectively.
Results: The results of this research show that by using compared t-test there was highly significant difference, at period of times (12,18,24,30,36,48hours) of exposure to(LFPMF), between experimental and control groups of male rabbits in clotting time of blood, but there was non significant difference between them in period of times of exposures shown in periodic times(6,42 hours) respectively.
Conclusions: The application of low frequency pulsed magnetic fields on blood clotting time, concluded to increasing the blood coagulation time in experimental group of rabbits as compared with control group of rabbits. The mechanism indicated increases in body temperature, ionic exchange, enzymatic and hormonal.
Key word: Bioelectromagnetics, low frequency pulsed magnetic field, 15Hz, blood clotting, and rabbits.

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Introduction

Electrical phenomena are found in all living organisms, Moreover electrical current existing in the living organisms is capable to produce magnetic field that extend outside the body, Consequently, they can be influenced by external magnetic and electromagnetic fields as well as change in the bodies natural fields may produce physical and behavioral changes[1].
There are some biological effects of static magnetic fields. Pigeons appear to use the earth magnetic field and some bacteria will align themselves in fields of only $1x10^{-4}$ Tesla. The earth has a magnetic field of about $5x10^{-5}$Tesla [2].

Electromagnetics in biology and medicine gave a good introduction to the role of electromagnetic field theory in biology and medicine [3].

Bioelectromagnetics, the basis for interaction of electromagnetic fields with living system, which is depends on the frequency, shape of the wave form, and exposure time[4].

Extremely low frequency electromagnetic fields interact with an animal or living organisms by induced electric fields inside the body. These induced fields represents the internal exposure. In living animals a variety of natural endogenous electric fields also exist internally. These fields arise from normal physiological activity , and extend into adjacent tissues throughout the body, the endogenous fields will combine by simple addition with any fields induced by external exposure to electromagnetic fields [5].

In 1775, Frans Mesmer, an Austrian physician announced that there is electricity and magnetism in the human body. He was ridiculed for his announcement[6].

Interest in electrically induced osteogenesis was wakened in 1953 when professor Iwada Yasuda demonstrated the appearance of new bone formation in the vicinity of the cathode, when a current in the (μA) range was applied continuously for three weeks in the rabbit femur. He also described stress generated potentials in bone over the side of the bone under tension become electropositive[6].

Electrical stimulation of bone marrow with (8-10) μA DC current for five days of exposures demonstrated that osteoid tissue containing osteoblasts and osteocytes develops in the bone marrow cavity. If the electrical stimulated bone marrow containing osteoid tissue is grafted the tissue directly develops new bone tissue without the process of cell proliferation and differentiation.[7]

A newer concept to understand how magnets work within the body, it helps to understand some basic anatomy and physiology, this helps to understand exactly how magnets affected the body. Blood is a living tissue that circulate around the body via network of arteries, veins and capillaries, it carries nutrients, oxygen, hormones, antibodies, heat, electrolytes, and vitamins to the body tissues. Blood contains red blood cells, white blood cells, platelets, plasma, electrolytes, hormones, minerals, and iron.[7]

In a normal healthy cell, the ions are distributed around the cell with all of the positive ions on one side and the negative ions on the opposing side. The ions which live outside of the cell in the tissues will align with those inside of the cell so that opposing poles are together with the cell membrane between them (see diagram of healthy cell below). This allows fluid, oxygen and nutrients (fluid exchange) to move freely in and out of the cell, while maintaining the
natural balance within the cell (homeostasis).[7]

In a diseased (injured) cell, the positive and negative ions do not stay on opposing sides of the cell. They are disrupted and scatter randomly around the cell. At the same time the ions on the outside of the cell membrane also become scattered as they try to find their opposing pole, this results in cellular imbalance. Extra fluid from the tissues outside the cell is able to penetrate the cell which in turn pushes vital nutrients, hormones and electrolytes (salts) out of the cell. The cell's ability to function is greatly reduced and cellular degeneration begins which if not corrected will lead to the cell dying.[7]

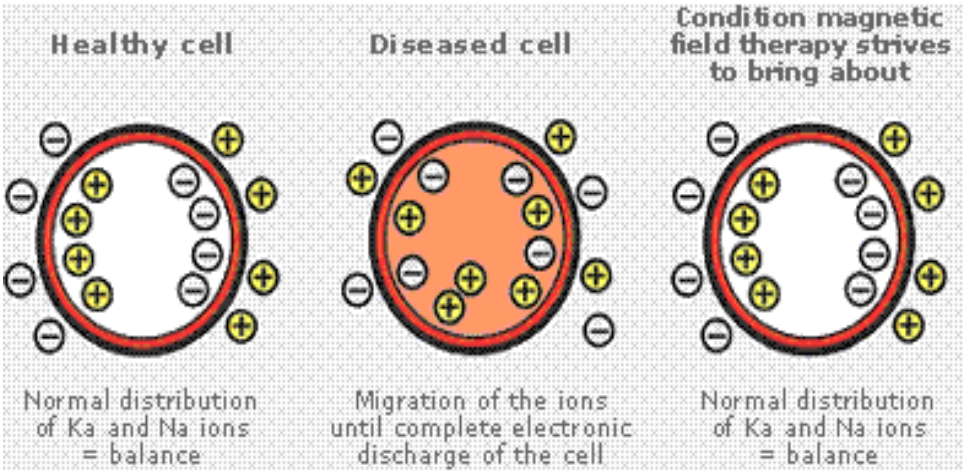

Figure (1): shows ionic distribution in healthy cell, diseased cell, and magnetic influenced cells.

When a static (fixed in place) magnetic field is applied over an injured (diseased) area, the magnetism penetrates into the tissues and surrounds the damaged cell. The magnetic field that is created around the outside of the cell will pull the ions, both inside and outside, back into alignment. The result is that the ions once again return to their correct position within the cell. The extra fluid that has penetrated the cell is pushed out (via osmosis and diffusion) and returned to the surrounding tissues. The cell regains its natural healthy balance and any damage is repaired over a period of days (see Figure (1) of a cell with a magnetic field) [7].

A biological effect occurs, when exposure to electromagnetic fields causes some noticeable or detectable physiological changes in a living system. Such an effects some times ,but not always, leads to adverse health effects , which means a physiological change that exceeds normal range for a brief period of time [8]. Let us consider the example of exposure to sun light as of the most familiar forms of non ionizing radiation.

The use of electricity has brought tremendous technological advances in 20th century. Though the quality of life has improved, there is massive increases in the production and consumption of electrical power which has resulted in increased environmental exposure to electromagnetic field both at work and at home [9], it is clear that 60Hz electric field is perceptible by rodents [10, 11 and 12], non human primates [13] and human [14, 15 and 16]. A number of research of hematological parameters and studies on blood of human alterations can lead to significant immunological effects [17].

We are exposed to extremely low frequency field (ELF) from many sources, including transmission lines, substation and various electrical appliance. Usually, exposure to low frequency fields occurs at distances much shorter than the wavelength of ELF radiation[17].

Materials and Methods

Eight rabbits male (ORYCTOLOGUS CUNICULAS) were used in this experiment. They were grouped into control groups (4 rabbits) and exposed groups (4 rabbits) for each period of exposure. The animals in exposure group were exposed to Low Frequency Pulsed Magnetic Fields (LFPMFs) with intensity 0.6mT=6 gausses

measured by Teslametar. This has achieved by locating the rabbits in special cages in the middle of 4 helmholtz coils, with a diameter of 40cm and 154 turns of each coil, which is shown in Figure (2), so that the rabbits were exposed to same field during all the time of experiment, the exposure time were (6,12 18,24,30,36,42,48 hours).

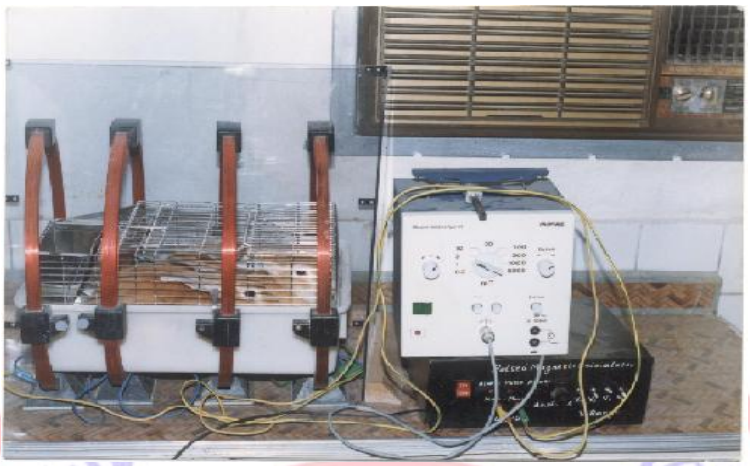

Figure (2): shows the apparatus used for exposure of rabbits to low frequency pulsed magnetic field.

Blood Sample Collection in Male Rabbits

The biological samples included primarily 4 healthy animals as a control group, and 4 other healthy rabbits taken as exposure group (experimental group). By two mL syringes, one mL of blood were collected directly from the heart of experimental and control group of rabbits. Then, at once, the blood clotting time was measured using capillary tube method with stop watch (Timer).

Statistical Analysis

Statistical package for science service was used in this study (18). All results are present as (mean ± SD), t-test were used to compare between experimental data with control group of rabbits at level of $p<0.05$.

Results

The results revealed a statistically significant difference between experimental and control group of rabbits with time exposure.

The results shown in Figure(3) with Tables(1 and 2) represents that blood clotting time increases monotonically with time exposure, during applying to the low frequency pulsed magnetic fields in male rabbits.

At the first time of exposure (6 hours) there was non significant difference at $p>0.05$ between experimental and control group of animals.

While in(12,18,24,30,36,48 hours) of exposure to low frequency pulsed magnetic field highly significantly differences were shown and demonstrated between the same groups.

Alternatively exposure to magnetic fields of this study showed that, after (42 hours) period of exposure, there was non significant difference in clotting time as shown in Table(1and2) with Figure(3) at level of $p>0.05$ between exposed rabbits and non

exposed rabbits.

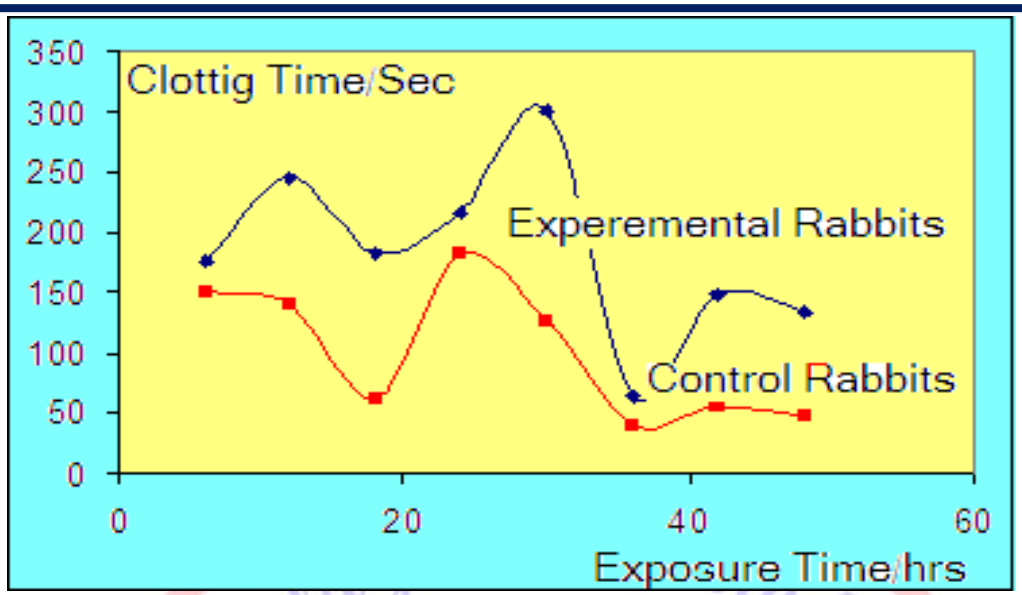

Figure (3): shows the clotting time of experimental and control male rabbits after expositing to low frequency pulsed magnetic field.

Table (1): shows the effects of low frequency pulsing magnetic on clotting time of male rabbits.

(Clotting Time of Blood/Sec in experimental and control group of rabbits)								
Exposure Time/hours	***Exp. Rabbit (1)***	***Exp. Rabbit (2)***	***Exp. Rabbit (3)***	***Exp. Rabbit (4)***	***Control. Rabbit (1)***	***Control. Rabbit (2)***	***Control. Rabbit (3)***	***Control. Rabbit (4)***
6	180	170	175	180	120	120	180	180
12	240	250	245	245	118	118	160	165
18	188	180	182	178	60	62	64	65
24	212	218	220	210	180	182	182	185
30	300	302	300	302	125	120	130	135
36	62	64	68	64	40	42	42	40
42	190	180	182	180	57	57	56	56
48	132	135	135	132	48	47	46	45

Table (2): shows the (Mean±SD) of experimental and control groups of male rabbits after exposing to low frequency pulsed magnetic field.

Exposure Time/hours	Experimental rabbits (Mean±SD)	Control rabbits (Mean±SD)	t-test p- value
6	176.25±4.78	150.00±34.64	>0.05
12	245.00±4.08	140.00±25.77	<0.01*
18	182.00±4.32	62.75±2.22	<0.01*
24	216.25±3.50	182.25±2.06	<0.01*
30	301.00±1.55	127.50±6.45	<0.01*
36	64.50±2.52	41.00±1.15	<0.01*
42	148.50±71.13	56.00±0.57	>0.05
48	133.50±1.73	46.50±1.29	<0.01*

Discussion

Electromagnetic radiation plays an important role in life, both in vivo and vitro, pulsing electromagnetic field (PEMF) at low frequency range is used increasingly today in industrial, commercial services to help better understanding of (PEMF) effects on biological system and biochemical parameters [19].

The effects of electromagnetic fields on organisms showed that the initial effects of an electromagnetic field are on metabolic bath way [19].

A significant number of studies have been carried out data to explore the relationships between exposures to electromagnetic field and illnesses including cancer, but it will be at long time of exposure and at high dose we have the results of most of these studies, described various experimental investigations with laboratory animals, tissue preparations and cells with detailed information on the bioelectric effects of electromagnetic radiation [20).

Electromagnetic radiation has the potential to interact with biological systems; however, the outcome is dependent on the radiation levels, the pulsed magnetic field may can cause visible biological effects if exposure intensity is sufficient, meanwhile low levels of radiation may have harmful effects or may not have any at all. It is not possible to verify that such effects will occur. This is due to the fact that several factors are involved especially ones related to life based science [21].

The ultimate goal of our research is the possible application of pulsed magnetic fields in the clotting time of blood in male rabbits, where it could be ionic regulation or enzymatic activities that have been altered and their restoration to normal levels is potentially useful for the rabbits. The present experimental work has not been studied previously by other researchers and there are no available literatures to our knowledge.

The present results indicate the followings:

First, the effects of low frequency pulsed magnetic fields on blood clotting time, when the male rabbits exposed to six gausses, the physiological changes were observed after exposed. The change is an increases in the clotting time shown between experimental and control group of rabbits. Pulsing magnetic field, which was supplied to the body cells which lack energy, Enable these cells to function optimally. These (LFPMFs) operate to bring about cell and body regeneration in natural way without side effects. This activates the immune system, body temperature and puts the body in a state were it can heal it. In the other hands, increase in body temperature reduce the viscosity of the blood which ultimately causes an increase in clotting time of the blood.

Second, changes in several metabolic parameters as a consequence of exposure to LFPMFs have been also observed. The frequency of the field was such to stimulate several ions may be involved in the enzymatic chains or hormonal experimentally affected. This issue needs to be analyzed in detail in the future through well designed for application.

Some review literatures reveals substantial evidence demonstrating a beneficial and harmful effects of pulsed low frequency electromagnetic field, this is characterized by three parameters of waveform, frequency and field strength [20,21,22,and 23].

Conclusion

Single exposures to low frequency pulsed magnetic field increases in blood clotting time in male rabbit's by six gausses could regulate some times coagulation time of

blood after exposures. The mechanisms for the effects of (LFPMF) on blood clotting time are not well understood yet, but may be associated to the increases in transferred time of the activity of prothrombin to thrombin and fibrinogen to fibrin by such stimulation.

Recommendations are to investigation the

1-influence of low frequency pulsed magnetic field on the molecular structure of hemoglobin (Hb).

2-influence of low frequency pulsed magnetic fields on red blood cell deformability.

3- Influence of low frequency pulsed magnetic fields on the optical spectra of hemoglobin.

4- Influence of low frequency pulsed magnetic fields on dielectric constant properties of blood.

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