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Chemiluminescence measurement for static magnetic field effect (0.1 T) of two period exposure on sheep whole blood in vitro

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Abstract

static magnetic field (SMF) may effect on biological systems such effect on activity of phagocytic leukocytes and their respiratory bursts . To know these effects have not studied in details. Current investigation studied the effects of SMF (0.1 T) during two periods (one hour and three hour) in vitro on sheep whole blood by detecting chemiluminescence (CL) . The control group samples were compared with exposed group samples to SMF. The results showed a significant increase of lucigenin-initiated CL in exposed sample with increasing exposed time However, CL of lucigenin amplified when increased free radical of oxygen in sample. So, these results suggests that SMF could increase activity of phagocytic leukocytes , respiratory bursts and the ability to produce free radicals and other reactive oxygen species (ROS) .

Keywords : static magnetic field ; chemiluminescence ; whole blood ; reactive oxygen

Abbreviations : (NADPH) Dihyronicotinamide Adenine Dinucleotide phosphate , Chemiluminescence (CL) , direct current (DC) , reactive oxygen species (ROS) , static magnetic field (SMF)

Introduction

The increasing number of scientific publications focusing on effect of magnetic field on biological tissue indicates growing interest in the broader scientific community, where humans are commonly exposed to magnetic field including extremely low frequency. The magnetic field, which is generally produced by electricity lines and many types of electric appliances. Where a number of scientists and environmental experts warned of the dangers of radioactive contamination with the so-called electronic pollution. There are some of the most dangerous types of pollution that have drawn attention in recent years, which is called electromagnetic pollution and magnetic fields [1,2]. Therefore, in this work, we study the effect of the magnetic field on whole sheep blood by (CL).

CL is one of the luminescent phenomena which can be known as the production of electromagnetic radiation (Ultraviolet, visible or infrared) by chemical reaction [3,4,5,6]. This phenomenon can be observed when an electronically excited product or intermediary formed during reaction decays to ground state by emitting a photon. CL dependent on the production of oxygen radicals during the respiratory burst. The respiratory burst is defined as an increase oxygen consumption and generation of superoxide anion and hydrogen peroxide. Also defined as a complex series of reactions beginning with assembly of a membrane bound enzyme, the Dihyronicotinamide Adenine Dinucleotide phosphate (NADPH) oxidase which is able to catalyze one reduce oxygen electron to radicals superoxide anion. A respiratory bursts indicates a coordinated series of metabolic events that occur when the macrophages are exposed to the appropriate stimuli [7,8,9]. Early in the phagocytosis,

neutrophils are exposed to a respiratory bursts, resulting in oxygen-free radical production, which, once produced, naturally decay and emit light [10]. CL is therefore enhanced by the presence of luminol and lucigenin, and can be used as a measure of phagocytic activity. Two types of free radicals are produced by neutrophils; the first type is represented by reactive oxygen intermediates which are formed in neutrophils by the activity of NADPH oxidase, the respiratory bursts Enzyme. The first type includes, superoxide anion, Hydrogen Peroxide, Hydroxyl radical and singlet oxygen. Second type includes reactive nitrogen intermediates, the first member of them nitric oxide being produced by nitric oxide synthase [11]. In this research we studied the activity of phagocytic leukocytes, respiratory bursts and the ability to produce free radicals and other reactive oxygen species (ROS), when the samples of blood exposed to SMF (0.1 T).

MATERIALS AND METHODS

Blood samples are taken from sheep 6 ml putting in a tube contain coagulation heparin and each sample divided into three samples, one sample was control and other exposed to SMF with intensity (0.1 T) for two period (one hour and three hour). Samples are exposed to SMF with direct current (DC electromagnet) (Mad in Korea, Testing range : 0 -1999 mT, Maximum output current : 5A, Maximum output voltage : 30 V, DC power supply, SK1730SBP5A). The experiment was conducted at the University of Basrah, College of Education for pure sciences, Department of Physics by Gauss meter. To study the effect of SMF on activity of phagocytic leukocytes are used CL measurement. The CL solution was prepared

by dissolving 0.01 gm of lucigenin in 50 ml Dimethyl sulphoxide to obtain 4×10^{-5} M , According to the method used in [3] .

RESULTS AND DISCUSSION

Fig (1) explains the CL curves of irradiated and radiation whole blood to SMF with one

intensity (0.1 T) and two period (one hour and three hour). It is clear that CL value of whole blood radiation increases as compared with their value before irradiation and this increasing depended on time of expose.

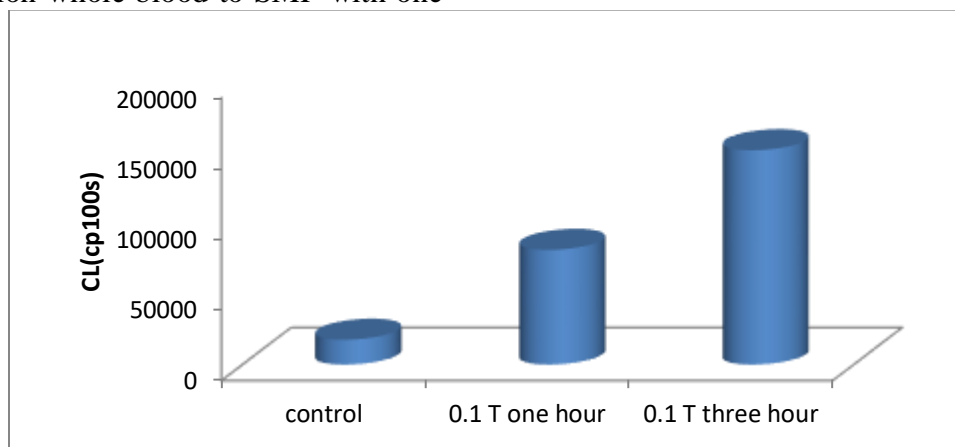


Fig. 1. The means value of CL for whole sheep blood irradiation and radiation with SMF (0.1 T)

Fig. 2. Represents the relationship between CL value and time of the sheep's blood exposed to SMF intensity (0.1 T) for two periods one hour, three hours and control. From this fig. the lowest CL values of whole blood to control sample before exposure to the magnetic field. Our results agree with [12,13,14] that examined the whole blood and

individual cell populations (neutrophils) of mammals in activated CL and fluorescence spectroscopy experiments and showed that generation of free radicals and other ROS and chlorine species increases on exposure to a combined magnetic field (CMF) with static and very weak (less than $1 \mu\text{T}$) low-frequency alternating components .

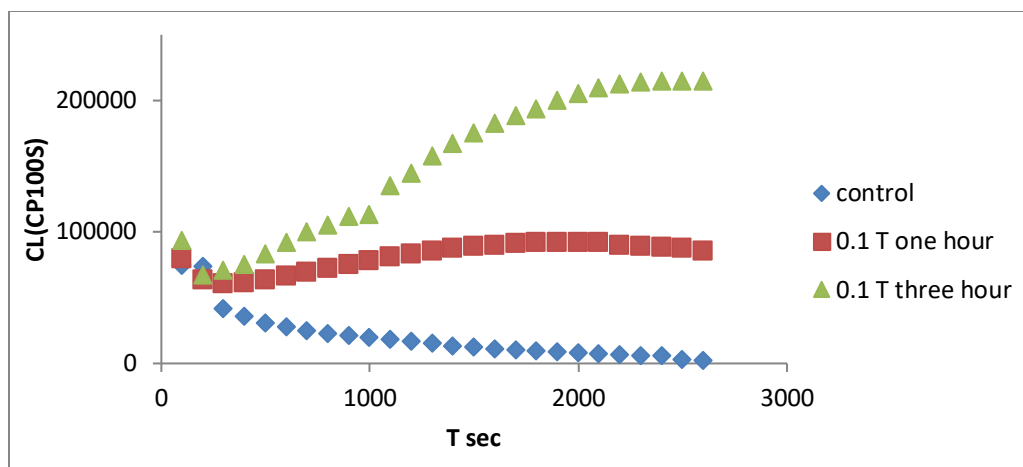


Fig. 2. Relation between CL value of whole blood irradiation and radiated to SMF (0.1 T) with time.

completely natural. Neutrophils are the largest number of white blood cells in human blood. The massive release of ROS upon the activation of neutrophils (the respiratory burst) is

a combination of processes that depend on a complex of membrane and cytosolic proteins that function in concert to respond to the action of a range of factors [16,17]. The absence of activation of this kind prevents the interaction of the components of NADPH oxidase and the subsequent response to stimulation. NADPH oxidase, which plays a decisive role in ROS production, is believed to assume a resting state in non-activated neutrophils. Phosphorylation of NADPH oxidase subunits and subsequent assembly of the

complex of several specific cytoplasmic and membrane proteins in the membrane is necessary for activation of the enzyme. A neutrophil is capable of adjusting its reactivity; this capacity is manifested as deactivation or respiratory explosion priming [17, 18].

Conclusions

This study confirmed that the SMF (0.1 T) effects on the activity of white blood cells was evident by its increase ability to produce ROS. The produce of ROS increase with increasing the exposure time to SMF.

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قياس التآلق الكيمياءى لتأثير المجال المغناطيسى الثابت (0.1 تسلا) لفترتى تعرض على دم الاغنام الكامل فى الخارج

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الملخص :

قد يكون للمجال المغناطيسى الثابت (SMF) تأثير على الأنظمة البيولوجية ، كتأثيره على نشاط كريات الدم البيضاء البلعمة والانفجارات التنفسية . لمعرفة هذا التأثير لم يدرس بكل التفاصيل . البحث الحالى درس تأثير المجال المغناطيسى الثابت (0.1 T) خلال فترتى تعرض (ساعة واحدة وثلاثة ساعات) على دم الاغنام الكامل فى الخارج بتقنيه التآلق الكيمياءى (CL) . تمت مقارنة عينات مجموعته السيطرة مع عينات المجموعة المعرضة الى (SMF) . أظهرت النتائج زياده مؤثره فى CL مَبْدُوء بالوسجين فى عينه الدم المعرضة للمجال المغناطيسى الثابت مع زياده زمن التعرض ، على كل حال ، تضخيم CL بالوسجين يكون عند زياده الجذور الحرة للأوكسجين فى العينة. لذلك تشير النتائج الى ان SMF يمكن ان يزيد من نشاط كريات الدم البيضاء والانفجارات التنفسية وقدرتها على انتاج الجذور الحرة وغيره من انواع الاوكسجين الفعالة (ROS). الكلمات المفتاحية : المجال المغناطيسى الثابت ، التآلق الكيمياءى ، الدم الكامل ، الاوكسجين الفعال