



Original/Investigación animal

Effect of computer radiation on weight and oxidant-antioxidant status of mice

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Abstract

Objectives: To explore the effects of computer radiation on weight and oxidant-antioxidant status of rats, and further to confirm that whether vitamin C has protective effects on computer radiation.

Methods: Sixty Male adult ICR mice were randomly divided into six groups. each group give different treatment as follows: group A was control, group B given vitamin C intake, group C given 8 h/day computer radiation exposure, group D given vitamin C intake and 8 h/day computer radiation group E given 16 h/day computer radiation exposure, group F given vitamin C intake plus exposure to 16 h/day computer radiation. After seven weeks, mice was executed to collect the blood samples, for detecting total antioxidant capacity (T-AOC) and alkaline phosphates (ALP) content in serum or liver tissue were determined by ELIASA.

Results: No difference was found for the change of weight among six groups at different week. In the group C, D and F, the liver tissue T-AOC level were higher than the group A. In the group B, C and E, the serum ALP level were lower than the group A ($P < 0.05$).

Conclusions: The study indicate that computer radiation may have an adverse effect on T-AOC and ALP level of mice, and vitamin C have protective effect against computer radiation.

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Key words: *Electromagnetic Radiation. Vitamin C. Antioxidants.*

EFFECTO DE LA RADIACIÓN SOBRE EL PESO Y LA COMPUTADORA EL ESTADO ANTIOXIDANTE DEL OXIDANTE DE RATONES

Resumen

Objetivos: Explorar los efectos de la radiación de ordenador sobre el peso y el estado oxidativo-antioxidativo de los ratones, y además para confirmar si la vitamina C tiene efectos protectores contra la radiación de ordenador.

Métodos: Sesenta ratones machos adultos ICR fueron aleatoriamente divididos en seis grupos. Cada grupo recibió un tratamiento diferente del modo siguiente: el grupo A fue el grupo de control, el grupo B recibió vitamina C, el grupo C fue sometido a una exposición a la radiación de ordenador de 8 h/día, el Grupo D recibió vitamina C y fue sometido a una exposición a la radiación de ordenador de 8 h/día, el Grupo E fue sometido a una radiación de ordenador de 16 h/día, el grupo F recibió vitamina C y fue sometido a una exposición a la radiación de ordenador de 16 h/día. Al cabo de siete semanas, los ratones fueron ejecutados para extraer las muestras de sangre, para detectar la capacidad antioxidante total (T-AOC) y el contenido de fosfatasa alcalina (ALP) en suero o en tejido hepático fue determinado mediante ELISA.

Resultados: No se encontraron diferencias en cuanto a cambio de peso entre los seis grupos diferentes. En los grupos C, D y F, el nivel de T-AOC en tejido hepático fue más alto que en el grupo A. En los grupos B, C y E, el nivel de ALP en suero fue más bajo que en el Grupo A ($P < 0,05$).

Conclusiones: El estudio indican que la radiación de ordenador puede tener un efecto adverso en los niveles de T-AOC y ALP de ratones, y que la vitamina C tendría un efecto protector contra la radiación del ordenador.

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Palabras clave: *Radiación electromagnética. Vitamina C. Antioxidantes.*

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Introduction

With the development of modern science and technology, more and more electronic products gained popularity in daily life, so that human surrounded by electromagnetic fields(EMF) and extremely low frequency fields(ELF). Much research have shown that the electromagnetic radiation is harmful to human body. In a study it can be concluded that electromagnetic fields are harmful and can have adverse effect on human body depending upon the intensity and frequency of electromagnetic field. An increasing number of people report subjective symptoms and hypersensitivity to a wide variety of electromagnetic sources including power lines, radio and TV broadcasting stations, cellular phones, and computer monitors. Among the environmental risk factors of human, ELF-EMFs may have a possible association with childhood malignancy, especially leukemia, cancer, cardiovascular, neurological, and psychological diseases in adults¹⁻⁴. Therefore, people gradually pay attention to the potential harm of electromagnetic radiation, especially in the computer widely available at the present.

Recently, several studies reported that long-term exposure to radiation leads to reduction in serum testosterone levels. In vivo and in vitro experiments pointed the enhancement of free radical presence after electromagnetic field exposure⁵⁻⁷. Excessive production of free radical specifically reactive oxygen species, have been reported in wide variety of clinical disorders⁸⁻¹⁰. Vitamin C (vit C), as a powerful antioxidant, it may have benefits in diseases. Existing studies have shown that vitamin C provides a protective to body in some organs and tissues^{11, 12}.

Despite the limited research shows vitamin C could enhance the antioxidant defense systems in the liver and kidney of irradiated animals. Based on our knowledge, there is little study in investigating the possible protective effects of vitamin C against radiation generated by computer^{13, 14}. Thus our study has two aims: The first purpose is to confirm that whether computer radiation have a adverse effect on serum and liver tissue. Next, we will investigate the protective effects of vitamin C on serum and the liver tissue after exposure to the radiation of computer.

Methods

Sixty male mice (average 12g and four weeks old, in puberty period) were divided into Six groups (control=A, vitamin C=B, exposure to 8 h/day=C, exposure to 8 h/day plus vitamin C=D, exposure to 16 h/day=E, exposure to 16 h/day plus vitamin C=F). Every group includes ten Male ICR rats. Group A served as a control, group B was given orally vitamin C at a dose of 500 mg/kg and the remaining four groups, C,D,E and F were exposed to radiation generated by main-frame of computer . At the same time, group D and F

was given orally vitamin C at a dose of 500 mg/kg^{15, 16}. Group C and D were exposed to computer radiation for 8 hours daily and group E and F were exposed to computer radiation for 16 hours daily for the period of 7 weeks. During the study, all the animals were house in 6 cages in the similar environment and were fed with standard pellet diet and water ad-libitum.

At the end of the study period, killed the rats to collect the blood samples of serum and the liver tissue of homogenizes. The upper, clear part of serum and homogenizes was used in the measurements. Serum ALP and T-AOC levels were measured from the supernatants. ALP levels were measured by alkaline phosphates assay kit. T-AOC was measured by total antioxidant capacity assay kit with ABTS method. Additionally, the liver tissues were submitted for histological and morphologic examinations.

The study was approved by the Ethics Committee of Wannan Medical College.

All statistical analyses were carried out using R software programming language¹⁷. Data were given as mean \pm standard deviation (mean \pm SD). In the statistical evaluation of the results, One-way analysis of variance test was performed; Bonferroni's Multiple Comparison Test was used for Post test. Statistical significance was defined as a p value lower than 0.05.

Results

Figure 1 showed the change of weight by week, no difference was found among six groups at different week. The table I, figure 2 and figure 3 showed that the serum T-AOC , ALP level and liver tissue T-AOC level in all group .In the group C, D and F, the liver tissue T-AOC level were higher than the group A. In the group B, C and E, the serum ALP level were lower than the group A (P<0.05).

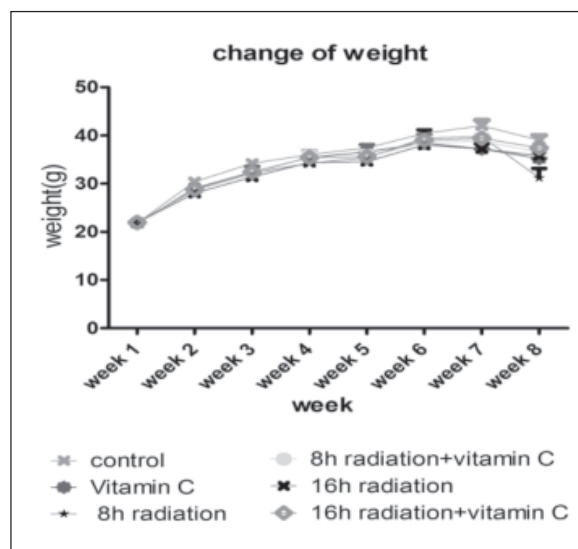


Fig. 1.—Change of weight by week.

Table II
The mainframe of computer radiation effect in the serum and liver tissue (Mean±SD)

Groups	Serum T-AOC level (mM)	Serum ALP level (mM)	Liver tissue T-AOC level (mmol/g)
A	1.058±0.339	1.536±0.338	1.522±1.466
B	1.318±0.278	1.202±0.237*	2.471±0.643
C	1.383±0.269	1.149±0.497*	3.351±0.945*
D	1.043±0.418**	1.278±0.301	3.207±0.691*
E	1.066±0.089	1.141±0.299#	3.228±1.257#
F	1.091±0.289	1.337±0.326	2.145±0.768##

The asterisk indicates a $p < 0.05$ compare with group C. The double asterisk indicates a $p < 0.05$ for group C versus group D. The sharp indicates a $p < 0.05$ for group A versus group E. The double sharp indicates a $p < 0.05$ for group E versus group F. ($F=4.016, P=0.0041$).

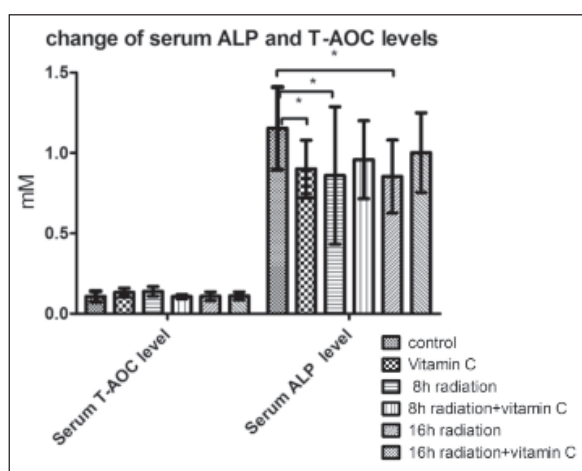


Fig. 2.—Compare of level of serum T-AOC and ALP among six groups.

Discussion

Our present study finds the change of total antioxidant capacity (T-AOC) and alkaline phosphates (ALP) level between the experimental group and the control group. The serum T-AOC, ALP level and the liver tissue T-AOC level are significant difference when the mice were exposed to computer radiation for 8 hours daily, which reveal the effect of exposure to low frequency fields. Increase the exposure time, when the rats were exposed to computer radiation for 16 hours daily, we also find that seems to have differences compared to control group. Vitamin C (vit C) is a powerful antioxidant so that counteract oxidative stress^{11, 12, 18}. Another discover of our study is that the difference was found between group D exposure to 8 h/day computer radiation plus vitamin C and group C exposure to 8 h/day computer radiation in serum T-AOC level.

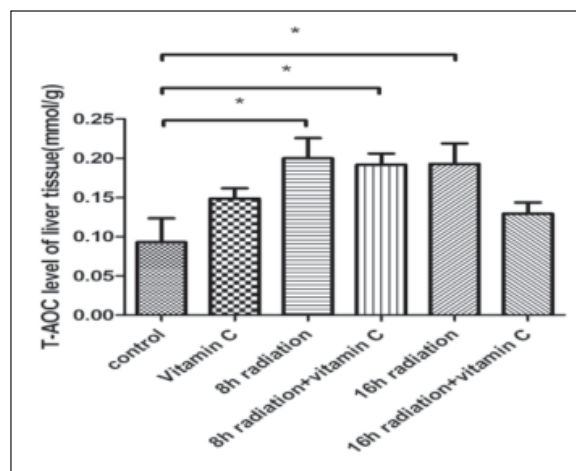


Fig. 3.—Compare of level of liver tissue T-AOC among six groups.

In the exposure to 16 h/day plus vitamin C group, the liver tissue T-AOC level was significantly lower, compared with the exposure to 16h/day group.

The increasing number of people fall into the dilemma which surrounded by electromagnetic fields, when they are using computer. In response to public concern, the government take measures to decline the harm, for instance to develop safety standards. In order to provide reliable evidence, scientists have made a contribution to the research in the related field. ELF-EMFs may affect biological systems by increasing free radical life span and the concentration of free radicals^{19, 20}. Recent studies have suggested that human and animal exposure to cell phone radiation lead to a significant overproduction of ROS (reactive oxygen species)²¹⁻²³. There are some studies have confirm the relation ROS with superoxide dismutase (SOD), glutathione Peroxides (GSH-Px), malonaldehyde (MDA), catalyses (CAT)^{11, 18}.

In conclusion, exposure to mainframe of computer radiation has a negative effect on mice. The antioxidant, vitamin C maybe reduces the damage from the long-term radiation. There is a need for further study in order to get more reliable conclusions. For instance, adjust the dose of vitamin C and Increase in exposure group to explore dose-response relationship.

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Disclosure of conflict of interest

None.

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