

The Effect of Electromagnetic Waves Exposure on Blood Parameters

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Abstract

Background: Now a days researchers have shown grean interest in electromagnetic waves which spread from devices such az microwaves,satellites,tv,cell phones etc,due to various reports of their devastating effects on animal growth and health.in this study the effects of these radiations on blood cells is investigated.

Methods: In the present study the effect of radiation on blood parameters in the factory workers, including welders, computer operators, individuals working in the furnace and the control group were investigated. In order to determine changes in blood parameters, blood samples were taken from the workers and then were analyzed by standard procedures and compared with control group of changes in blood parameters. Spss soft ware for data analysis and one-way ANOVA and Duncan test was used.

Results: Results have shown that individuals affected by these waves show significant increase in the amount of RBC, MCV and platelet ($P < 0.05$). While the amount of hemoglobin, the percentage of lymphocytes and WBC was reduced.

Conclusion: These effects could be due to the stimulatory effects of radiation on cell division in bone marrow cells is But the effects of radiation on living systems requires further research.

Keywords: Electromagnetic waves, Lymphocyte, Hemoglobin, Platelet

Introduction

The use of technology in developed countries and its importation to developing countries caused until its users to be exposed to adverse effects health effects caused by it.(1) One of the upheavals is employing the technology of electromagnetic waves in different parts of the industry science and medical appliances.(11) The use of electrical energy has a very important role in the development of modern societies and most modern devices are using in the homes, both use electricity or electrical energy.(8) The use of electrical energy is produced with a weak magnetic field.(4) Therefore populations that live in developed or under development countries, are constantly exposed to electromagnetic fields. In recent decades the health risk people who are exposed to such fields was considerations and many studies have been done with them.(5) Complete blood cell count (CBC) is a useful test for assessing and identifying the basic cells.(6) This measure includes counting and some morphological characteristics of the erythrocyte, leukocyte and thrombocyte in a cubic millimeter of blood.(7) Everyone is exposed to two types of

electromagnetic fields (EMFs): (a) ELF fields from electrical and electronic appliances and power lines, and (b) electromagnetic waves from wireless devices such as cell phones and cordless phones, cellular antennas and towers, and broadcast transmission towers.(22) Due to the important role of electromagnetic waves on health of living organisms, In the present study examined the effects of electromagnetic waves on blood cells that discussed.

Materials and Methods

In this study that is clinical trial of 100 factory workers who had at least 5 years work experience and were approximately 25-35years old and were 48 hours exposed to waves per week were studied. to investigate and reach more accurate and comprehensive results we choosed people from different occupations:

- 1- Furnace Workers
- 2- Welding
- 3- Operators of the computer
- 4- Control group (drivers and guards), selet ed and we have studied (Table- 1).

Table- 1. Distribution of relative frequency of individuals in terms of local employment

Place of employment	No. (n)	percent
Furnace worker	25	25%
Computer Operator	25	25%
Welder	25	25%
The driver and guard(control group)	25	25%

Table- 2. Analysis of variance of the effects of electromagnetic radiation on blood cells

		Mean	SD	N	MS	SS	F	Sig
RBC $\times 10^6/\mu\text{L}$	Control	4.25	1.19	25	0.007	0.292	7.04	0.05*
	Treatment	5.45	2.30	25				
MCV (fl)	Control	78.43	7.16	25	0.145	0.727	160.69	*0.03
	Treatment	96.73	6.94	25				
Hb (g/dl)	Control	15.16	1.23	25	0.094	0.470	343.54	0.05*
	Treatment	12.65	2.32	25				
Platlet $\times 10^3$	Control	346	3.40	25	0.112	0.560	141.18	*0.04
	Treatment	439.4	4.10	25				
WBC $\times 10^3$	Control	7.104	1.29	25	23.76	93.35	1.458	*0.02
	Treatment	3.794	1.40	25				
Lymphocyte (%)	Control	36.12	1.05	25	7.144	827.99	1.818	*0.04
	Treatment	34.32	1.04	25				

All people in investigated groups are men. Research data collected from samples of peripheral blood at the workplace and the exact results of blood tests has achieved and course changes in blood parameters of the subjects studied.

Research data collected from samples of peripheral blood at the workplace and the exact results of blood tests has achieved and course changes in blood parameters of the subjects studied. Blood parameters which investigated include the number of RBCs, MCV, platelet count, Hb concentration, percent lymphocytes and WBC count. About 5 ml blood from the elbow venous of individuals collected by Plastic syringe Spilled into plastic tube and their doors were closed with Para film to clot slowly.

For separation serum from the rest of blood contents, the tubes were centrifuged for 10 min with a speed of 3500 rpm. Then serum separated and was spilled into another tube. Also, in order to assess the percentage of white cells through a blood drops; the blood smears were collected and then stained (1cc Giemsa color + 9 cc water Spilled on the surface of the fixed blood smear. After 20 to 30 minutes, color on the slide discarded under the mild flow of tap water) the percentage of WBCs was evaluated by using light microscopy.

Measurement of hematologic parameters, by blood sampling and blood samples has been analyzed by the analyzer model PCE-170 Made in Japan. all the data collected were analyzed using spss16.0 software [SPSS, Inc., Chicago IL, USA]. Statistical models for data analysis are ANOVA and Duncan's test.

Results

In this clinical study patients affected by waves with at least 5 years work experience. results showed that under the influence of electromagnetic waves in the treated group average amount of RBCs and MCV, increased respectively, by 29/6 percent and 24 percent compared with the control group and these changes were statistically significant ($P < 0.05$). The mean platelet counted in the treated group compared with the control group had a 27 percent increase that these increase is statistically significant ($P < 0.05$). In the treated group than the control group the average number of WBCs 46/7 percent and 5 percent of lymphocytes decreased that these reduction is statistically significant ($P < 0.05$). Also in the treated group Hb 16/6 percent compared with the control group decreased that is statistically significant ($P < 0.05$) (Table- 2).

Discussion

The results of this study in hematological patients at risk factors such as the waves from electric and magnetic fields can say that the waves from electric and magnetic fields causes significant changes in the Erythropoiesis system. Studies show that within groups of furnace workers, welders and computer operators RBC count, and the MCV increased that the results confirm the results of Phillips in this field in 1983 and rejects the results Yousefi, 1996 and Marino and Baker 1997(3,9,10). LAURA et al in 2009 showed that the circadian rhythms could be inverted in rats exposed to 50 Hz magnetic sinusoid fields with an intensity of 1000 μT and 100 μT , respectively. These changes are probably due to the

direct current density or Eddy currents, induced in rats, which are conductive bodies. Also, in rats exposed to a higher frequency, the circadian rhythms could be inverted. The effects of fields on animal and human bodies depend on the intensity of electric and magnetic fields as well as on body size.(16) About the mechanism of action of electromagnetic waves, several proposals have been presented, Among Adey to increase the transcription activity of ribonucleic acid and protein synthesis under the influence of electromagnetic waves that cause shortening of cell cycle and increased synthesis of DNA refers.(18) Antonopoulos et al also studied on human peripheral blood lymphocytes were cultured in vivo and under the influence of electromagnetic waves with frequencies 380, 900 and 1800 Megahertz were no significant changes in cell cycle. Contradictions between these studies may be due to differences in the frequency of electromagnetic wave and also different courses of treatment and by conditions study.(17) From blood factors studied, the number of RBC, the average MCV and the percentage of platelets in the treated group was significantly increased under the influence of the waves while Hb level, percentage of lymphocytes and WBCs decreased. Increase the number of RBCs can be due to the stimulating effect of waves on cell division of stem cells in bone marrow. Increase in cell volume can also be due to immature cells increased or Reticulocytosis on the other hand increasing the MCV cells, Hb level is reduced.(2) Zeni in 2008 with a review of electromagnetic waves on human peripheral blood lymphocytes showed that these waves do not affect micronucleus frequency and cell cycle(13) So far, a rather great number of cytogenetic investigations were already devoted to radiofrequency radiations, including those from “mobile phone frequencies”. Most studies were negative suggesting that radiofrequency radiation is not directly mutagenic and that adverse radiofrequency radiation effects are predominantly the result of hyperthermia.(19) An increased incidence of chromosomal aberrations and micronuclei were found in peripheral blood lymphocytes from individuals who were occupationally exposed to radiofrequency radiation but in other investigations, this was not found.(20, 21) Some studies indicate that electromagnetic waves does not have genotoxic effect on human lymphocytes while the increased micronucleus frequency in human fibroblasts cultured.(14) Some researchers believe electromagnetic waves can affect the homeostasis of iron in biological systems,

thus leading to increased cytoplasmic and nuclear free iron that may through a chemical reaction produce hydroxyl radicals increase and can lead to DNA damage.(15) The waves from electric and magnetic fields in most of these groups caused increase or decrease in the values of the parameters. Therefore recommended for future work on the mechanism of electromagnetic waves on blood parameters should be studied further. Today, despite numerous studies on the effects of electromagnetic waves which has been done on humans but scientists still do not agree about the effects found.(12) Should be more research done to understand the precise effects of these waves in real terms. Also application of the precautionary approach in reducing environments possess high levels of these waves and consumption of foods containing antioxidants such as vitamin E to neutralize the possible effects of electromagnetic waves recommended.

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