

Effect of exposure to radio frequency waves on cardiovascular system in albino rats with reference to vitamin (C and E) supplements

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Abstract

Background: Human body has its own electromagnetic radiation. Human body generates and emits extremely low intensity radiation in the form of a microscopic packet of light energy called photons. We know what happens to any medium transmitting an electric current. All changing electric current create an electromagnetic field around them (EMF). The biological effects of electromagnetic field (EMF) have been and are being investigated at different levels of organization. On the level of human population, epidemiological studies are used whereas on the level of individual human, animal and plant in vivo experiments are carried out. Furthermore, on the level of organs, tissues and cells in vitro investigations are employed. Finally, on the sub-cellular level, biochemical and molecular techniques are utilized. **Materials and Methods:** This study is conducted in the Department of Physiology in Santhiram Medical College, Nandyal. Total 56 (28 males+28 females) albino rats will be included in this study. Total 56 albino rats divided into 7 groups. Each group comprising of 8 rats. They are maintained under controlled temperature of 22- 24°C and exposed to 12 to 12 hours light dark cycle. Throughout the study, animal experimental protocol is followed as per local IAEC and CPCSEA guidelines. **Findings:** After the experimental period (8 weeks) the animals were sacrificed. Blood samples were collected in an EDTA container to determine hematological parameters and gel vacutainer for biochemical parameters. parameters the values represent the mean within the same column significantly different at $P < 0.05$. for radiation group. **Conclusion** The values of biochemical parameters showed less increase in animals exposed to EMR than control group. Thus, indicating that long time exposure might pose detrimental effects to blood components heart and their functions. **Key Word:** Electromagnetic Field, Specific Absorption Rate

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INTRODUCTION

Human body has its own electromagnetic radiation. Human body generates and emits extremely low intensity radiation in the form of a microscopic packet of light energy called photons. We know what happens to any

medium transmitting an electric current. All changing electric current create an electromagnetic field around them (EMF). All magnetic materials are capable of transmitting an electric current and therefore will create a magnetic field around them. The human body is made up largely of water. Salts are present in the water and salts are also full with various minerals. Each of these minerals and salts will resonate at different frequencies to differentiate one from other. The water is therefore superb conductive medium. The millions of electrical currents flowing through the body at one moment will indisputably create a complex magnetic field around it. Remember every time we think it causes an electric current to flow through our body and our brain. this in turn creates magnetic field around body. Even subtle change to the earth' magnetic field from such activities as sunspot solar flares has been clearly shown by researchers

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that it can influence blood clotting and even the whole cardiovascular system and cell membrane, the effect to the nucleus and DNA should also be considered. These radiations penetrate in our body and effect on the cell's DNA (The DNA is genetic material of cell that is sensitive to ionizing radiation. With the ionizing radiation the DNA of cell can be changed.^{3,5} Hence it is evident that changes to the normal and natural magnetic field of human body may cause harm to the health. Every single biological function in our entire body is triggered by a small electrical signal. Mobile phone exposes us and others nearby to large electromagnetic radiation. So whether we are talking or messaging on mobile phone, using a hands free kit, or even if our phone is just turned on – everyday we are being constantly bombarded with damaging electromagnetic radiation. The mobile telephony revolution took place in the last decade with an ever increasing number of cell phone users all over the world. As per the latest literature available, there are more than 6 billion subscriptions worldwide. Mobile phones use electromagnetic radiation in the microwave range. Other digital wireless systems, such as data communication networks, hand phones, base stations and transmitters produce similar radiation. So far, the only known mechanism that mobile telephone radiation has had an effect on living tissue is heating. The rise in temperature on the surface of the brain caused by radio waves is 0.3 degrees at the most which is not known to have biological significance. Only after a five degree increase in temperature do cells become damaged. Several studies in several countries have tried to find out other effects apart from heating. The cell phone safety regulations throughout the world permit a maximum allowable Specific Absorption Rate (SAR) of between 1.6 W/kg (USA) and 2 W/kg (most of the world) for cell phones held close to the head. The biological effects of electromagnetic field (EMF) have been and are being investigated at different levels of organization. On the level of human population, epidemiological studies are used whereas on the level of individual human, animal and plant in vivo experiments are carried out. Furthermore, on the level of organs, tissues and cells in vitro investigations are employed. Finally, on the sub-cellular level, biochemical and molecular techniques are utilized. Several studies have indicated that exposure of biological systems to low level radio frequency radiation caused adverse biological effects. Most scientific and public attention on the issue of the safety of cell phone radiation has focused on evidence suggesting an increased risk of brain tumours. Studies on the haematological effects will serve as a useful general indicator of the potential of RF radiations to cause adverse effects on exposed organisms. This is because the blood is a patho -

physiological reflector of the whole body and therefore blood parameters are important in diagnosing the structural and functional status of organisms exposed to toxicants. In response to public and governmental concern, WHO established the International Electromagnetic Fields (EMF) Project in 1996 to assess the scientific evidence of possible adverse health effects from electromagnetic fields and generated a formal risk assessment of all studied health outcomes from radiofrequency field's exposure by 2012. The International Agency for Research on Cancer (IARC), a WHO specialized agency, reviewed the carcinogenic potential of radiofrequency fields, as from mobile phones.

AIMS AND OBJECTIVES

1. To find out the impact of exposure to radio frequency waves (900 to 1800 MHz) on male cardiovascular system as a whole in albino rats.
2. To monitor any signs of nitro oxidation stress in cardiovascular system after exposure to radio frequency waves (900 to 1800 MHz).
3. To explore any association of the exposure of radio frequency (900 to 1800 MHz) units to apoptosis in myocardial of albino rats.
4. To evaluate the effects of vitamin C and vitamin E intervention on male albino rats exposed to radio frequency waves (900 to 1800 MHz).

MATERIAL AND METHODS

This study is conducted in the Department of Physiology in Santhiram Medical College, Nandyal. Total 56 (28 males+28 females) albino rats will be included in this study.

- Total 56 albino rats divided into 7 groups. Each group comprising of 8 rats.
- All animals will be maintained in a similar environment and will be fed with the standard pellets diet and water. They are maintained under controlled temperature of 22- 24°C and exposed to 12 to 12 hours light dark cycle Throughout the study, animal experimental protocol will be followed as per local IAEC and CPCSEA guidelines.
- Albino rats N=56 (28 males+28 females) randomly divided into 7 groups
 1. A - control group
 2. B- radiation exposed group
 3. C- radiation exposed group with antioxidant Vitamin C supplements
 4. D- radiation exposed with antioxidant Vitamin E supplements
 5. E- special antioxidant Vitamin C group without radiation exposure

6. F- special antioxidant Vitamin E group without radiation exposure
7. G- Radiation exposed group with Vitamin C and Vitamin E supplements.

MOBILE RADIATION EXPOSURE TO THE STUDY GROUP ANIMALS:

The roof of the cage will be designed to receive radio frequency waves from the mobile phone using a distance of five meter and from monopole radiation generator.

- Antioxidant group rats will be given vitamin C (20mg/kg IP), vitamin E (50mg /kg IM) Group will be exposed to the mobile radiations for 30min/4 cycles /day for 2 month.

LIMITATION OF THE STUDY

Electromagnetic wave exposure from other sources such as radio and mobile towers, blue tooth, Wi-Fi, and computers etc. will not be taken into account. The exposure of rodents to mobile radiation will be limited to

span of 3 months. The sample size of animals studied will be restricted to fifty six (56) in order to avoid unnecessary exposure to radiation and sacrifice of the lab animals.

STATISTICAL ANALYSIS

The data is analyzed using analysis of variance (ANOVA), to evaluate the variations between groups and for multiple comparisons among different groups. The results will be expressed as the means SD. Values of $p \leq 0.05$ will be considered statistically significant.

RESULTS AND OBSERVATION

After the experimental period (8 weeks) the animals were sacrificed. Blood samples were collected in an EDTA container to determine hematological parameters and gel vacutainer for biochemical parameters. The values represent the mean within the same column significantly different at $p < 0.05$.for radiation group.

Table 1: Hematological parameter

		RBC	Hb	Hct	WBC	Platelet
	Groups	(x106 cells/mm3)	(g/dL)	(%)	(x103 cells/μL)	(x 105/mm3)
1	control	9.28	16.96	52.84	6.2	756.75
2	R exposed	7.52	12	41.57	5	561.5
3	R +vit c	9.17	16.18	50.18	5.93	763.75
4	R+ vit E	9.17	16.18	50.18	5.93	763.75
5	vit c	9.91	17.13	54.4	5.88	682
6.	vit E	9.8	16.95	55.95	4.18	709
7.	R+Vit E and vit C	9.09	15.44	50.19	2.77	621.25

hematological parameters the values represent the mean within the same column significantly different at $p < 0.05$.for radiation group in Group 2 there is decreased values are observed.

Table 2

	Groups	ALP	AST	ALT	Na	Ca	K
1	control	63.37	29	31.67	71.75	9.88	5.8
2	R exposed	22.94	67.33	65.33	58.75	6.88	5.6
3	R +vit C	50.76	51.67	72	72.5	9.77	6.2
4	R+ vit E	76.96	59.33	63	71.75	9	6.4
5	vit C	63.69	32.67	35.67	76.5	9.88	7.8
6.	vit E	68.69	37	32	71.25	9.99	6.4
7.	R+Vit E and vit C	62.22	36.33	37.33	61.75	9.25	5.8

R = radiation , Vit E = Vitamin E , Vit C = Vitamin C

Table 3

	Groups	Troponin I	Troponin c
1	control	NEGATIVE	NEGATIVE
2.	Radiation exposed	POSITIVE	POSITIVE
3.	Radiation exposed + vitamin C	NEGATIVE	NEGATIVE
4.	Radiation exposed + vitamin E	NEGATIVE	NEGATIVE
5.	Vitamin C	NEGATIVE	NEGATIVE
6	Vitamin E	NEGATIVE	NEGATIVE
7.	Radiation exposed + Vitamin C and E	NEGATIVE	NEGATIVE

DISCUSSION

Troponin T

Troponin T is muscle proteins are present in cardiac and skeletal muscle but the cardiac type can be different from the skeletal muscle. Cardiac muscle proteins are highly sensitive marker and they can be useful in diagnosing cardiac disease and ECG changes (Moses, 2003). It appears to have prognostic value in patients admitted with unstable angina. Raised levels indicate the myocardial infarction.

Troponin I

Troponin I can be used to indicate re-perfusion following thrombolytic therapy, as levels are washed into the bloodstream and as a guide to extension of an MI. It is also very useful for the diagnosis of pre operative MI Even small increases indicate myocardial damage.

Creatine phosphokinase

This enzyme's primary function within the cell is that of energy production. There are high concentrations in the heart, skeletal muscle and brain (Clancy and McVicar, 2002). The people having large muscle mass and physically active are having high values in men. recently CK was the most specific cardiac enzyme available. Isoenzyme is CK-MB, which is more cardiac-specific, helps discriminate an MI at a very early stage when thrombolysis may be needed (Swanton, 1994). Since 1975 CK-MB plays an important role in detecting MI

Lactate dehydrogenase.

LDH catalyses the conversion of lactate to private, providing adenosine triphosphate (ATP) for energy during periods of anaerobic metabolism within cells. This enzyme is not cardiac-specific, unfortunately. LDH is often used to confirm the diagnosis of acute MI

Aspartate aminotransferase

This enzyme is found in the cell cytoplasm and mitochondria where it catalyses amino acid activity. AST is found in all tissues. Raised levels of this enzyme are found in approximately 70 per cent of MI patients. In this study important findings were obtained. the mobile phone radiation induces oxidative stress in myocardial tissues. Secondly It was found that with intake of the powerful antioxidant vitamin C and E significant in corrections of the oxidative stress. findings are obtained With regard to the effect of EMF on the cardiovascular system, EMF might interfere with work of cardiac muscle. Mobile phone could induce constrictive effect on the blood vessels and blood parameters. And Cardiac markers are biomarkers measured to evaluate heart function. They are often discussed in the detecting the of myocardial infarction. The present study also showed that CPK, CKMB and LDH enzyme activities increased in the heart tissue in EMF exposed group. And decreased in supplements groups. The exposed group that

supplemented with Vit. E and C Oxidative stress in the heart tissue was associated with a significant decreased in the activity all cardiac markers. The present study revealed that the exposed group of rats that supplemented with Vit C and/ Vit. E showed good amelioration in the levels of CPK, CK-MB and LDH in heart tissue. Since the activities of these enzymes nearly returned to the normal levels compared to the control group. It have been reported that Vit C had a cardio protective activity noticed in all serum marker Vitamin E could prevent or delay coronary heart disease (CHD) which comes from several sources. Vit. E inhibits oxidation of low-density lipoprotein (LDL) cholesterol. They added that Vit. E might also help to prevent the formation of blood clots that could lead to a heart attack. In the present study serum electrolytes sodium and calcium levels are decreased due to expose. And there is markedly improve with the vitamin E and C supplements

CONCLUSION

It is concluded that there is change in biochemical and serum electro lights after exposure, but there is increase in weight of animals which is seen to be affected by increase in exposure period. Among the hematological parameters, the values of RBC, HGB, WBC and PLATELETS were observed to be higher in animals exposed to EMR. The values of biochemical parameters showed less increase in animals exposed to EMR than control group. Thus, indicating that long time exposure might pose detrimental effects to blood components, heart and their functions. Further research is needed between EMW and chronic disease, and the extent to which antioxidants may reduce oxidative stress and protect health From different health issues.

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Conflict of Interest: None Declared

