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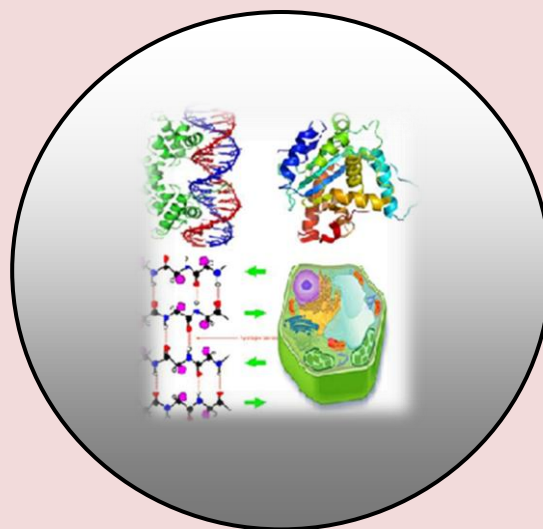
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Electromagnetic Field and its effect on Human Health: An Analytical Study

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ABSTRACT

The “electromagnetic field” and its radiations are attracted towards human beings because they have electrical conductivity in them and as human beings all other living systems are based on “electromagnetic energy.” Each and every cell of the living body including plants, rocks, planets are made up of energy, and the “electromagnetic radiations” that are made up by humans are the only source of “random photons” in the atmosphere. But the problem is that the frequency of these photons which is used by the environment is not encountered. The function of the inter action between the “agent (substance),” “environmental context,” and “susceptible host (man)” is the health effects of an element on the human body. Some evidence were witnessed where the public have faced some collection of symptoms such as “headaches, anxiety, suicide and depression, nausea, fatigue and loss of libido” when they exposed to low level of electromagnetic field at their homes. Even though there are very minimum effects of electromagnetic field on the human but still they are asked to take precautionary and preventive measures against EMF (electromagnetic field).

Keywords: *Electromagnetic field (EMF), Human Health, Electromagnetic radiation, Health effects, Hazards, Frequency.*

INTRODUCTION

The “electromagnetic fields are the “oscillating waves” that are generated when an “electric current” flows through an “electric field.” They transmit the information from one place to another and form the foundation of telecommunication and broadcasting all over the globe. The “electromagnetic field” is produced by all the “Mobile telephones, television and radio transmitters, and radar” which is non-ionizing but still it generates heat. In early 20s, the world was besieged when the sources of “electromagnetic field” like “telecommunication,

electricity, appliances, medical equipment, and many other apparatus that we use in our daily life” was increasing day by day. In spite of the fact that the “electromagnetic field” that is produced by this equipment’s is causing health risks and hazards to human, these new technologies are becoming unavoidable and important for everyone.

There are so many studies that show the relation between “electromagnetic field” exposure and the increased rate of the diseases such as “Leukaemia, cancer, brain tumours, and other health problems.” But at the same time, some uncertainties are still there between the real mechanism responsible for human hazards and the type of “electromagnetic field” to which they are exposed. Since exposure to these “electromagnetic fields” is very disastrous, it is very important to take all the necessary precautions and reduce our exposure to “EMF” as much as possible. There are some regulatory authorities like “IEEE, WHO, ICNIRP, and other likewise organizations” that have set the RF safety standards and the guidelines for the ones that are involved and are affected by the exposure of “EMF.” Duhani (2016) had stated through the study that failing to take immediate action to these guidelines is very dangerous and becomes the reason for high epidemic risk of potentially fatal diseases in the time ahead. The electrically charged particle produces “electromagnetic waves” which are also called “electromagnetic radiation” and can travel through empty spaces, air and other substances as well. The low frequency “electromagnetic waves” are referred to as “electromagnetic field” and high frequency “electromagnetic waves” are “electromagnetic radiations” (SCENIHR, 2010). They can also be classified as “ionizing” or “non-ionizing” radiations (NIR) according to their “frequency, and energy.”

Type	Frequency range	Source
Static	0 Hz	Natural Video MRI Industrial electrolysis
Extremely low frequency (ELF)	$(0 < f \leq 300 \text{ Hz})$,	Powerlines Domestic distribution Electric engines in cars, train and tramway
Intermediate frequency (IF)	$300 \text{ Hz} < f \leq 100 \text{ kHz}$	Monitors, Anti theft devices in shops, Hands free access control systems, Card readers Metal detectors
Radio frequency (RF)	$100 \text{ kHz} < f \leq 300 \text{ GHz}$	Broadcasting and TV; Mobile telephony Microwave oven Radar Portable and stationary radio transceivers, Personal mobile radio.

*Adopted from: Possible effects of Electromagnetic Fields (EMF) on Human Health. Scientific Committee On Emerging And Newly Identified Health Risks (SCENIHR) 19 July 2006 MRI: Magnetic Resonance Imaging

There are so many effects of “electromagnetic field” on biological systems. There are evidences that were witnessed for “cellular effects” of “EMF,” but generally there is no direct hazardous effect of “EMF” in human health if the frequency is low. There are studies that show some undesirable effect at cellular level when the human are exposed to high frequency of “electromagnetic radiations” (Panagopoulos and Margaritis, 2010) and (Schuz et al. 2010).

Literature Review

Sharma and Kumar (2010) and Balmori (2009) found in their study that there is a relation between “electromagnetic field” and “disappearance of bees” which is known as “colony collapse disorder” in Europe and US, and it is get into the way of bird migration. There are so many positive aspects of “technologic innovation” that is making the life easier but it is also involving the elements that impairs the ‘quality of life” with some “negative effects” also. There are so many man-made and natural resources that generate “electromagnetic waves” that can travel from one place to another and are playing very important part in day to day life such as “Radiofrequency zone (RF)” are used in “communications, radio and television broadcasting, cellular networks and indoor wireless systems.” With the increase in “technological innovations” the use of “electromagnetic fields” are also increased and as a result, the people are exposed to “electromagnetic waves” which is above the level of tolerance and thus causing effects to them. The scientists and the researchers had started discussing about the biological effects of “electromagnetic effects” due to widespread of technology based products in our daily life such as the use of mobile phones. The users of mobile phones are significantly increasing which is the reason behind the potential damage as people are exposed to “radiofrequency waves.” There is a question behind the impact of mobile phone networks on human health because while using the phones are placed very close to them and number of large base station antennas were used (Roosli, 2010). Different dimensions of “electromagnetic waves” were revealed through many studies that say that there is no DNA damage on different lines and no evidence is witnessed to show the direct mutagenic effect of “radiofrequency signals” on human cells. On the other hand, there are studies that have shown their concern about the biological and cellular effect of “electromagnetic fields.” It is found that “static” or EMF with “low frequency” may lead to biological effect that is linked with redistribution of ions. Along with this it is also observed that “EMF” with low frequency penetrates deep into tissues and result in biological effects.

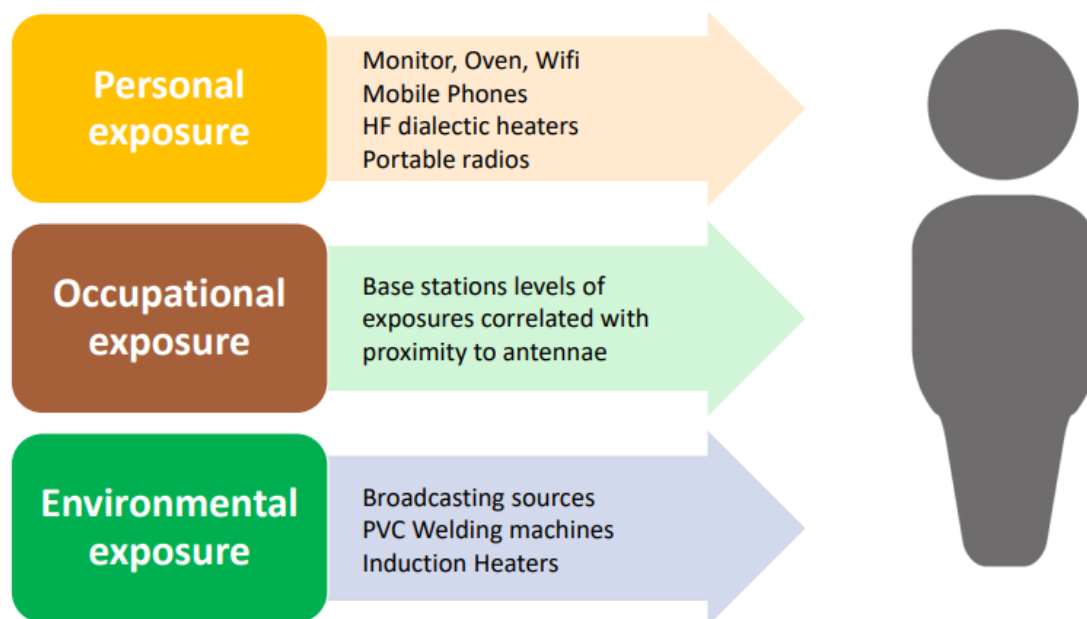


Figure 1. Exposure of electromagnetic field on Human Beings.

Foletti et al. (2009) and Wolf et al. (2005) found in their study that “electromagnetic fields” with extremely low frequency have affected some cellular functions like “proliferation and differentiation,” and there are number of other studies that shows its effect on apoptosis, it also effects “DNA synthesis, RNA transcription, protein expression, ATP synthesis, hormone production, antioxidant enzyme systems, metabolic activity, and NFkB (nuclear factor kappa light chain enhancer of activated B cells) and cell destruction.” It is demonstrated by Giladi et al. (2008) in their study that “electromagnetic field” in its intermediate frequency is very effective as it arrests the growth of human cells and it is indicated by Kirson et al. (2009) in their study that the direct inhibitory effects of “EMF” on the growth of the cell can be used for therapeutic purpose to treat the cancer in human beings. There are some studies in which the effects of “electromagnetic fields” were examined on in-vitro “peripheral mononuclear cells,” after analysing the changes in the “cell viability, rates of apoptosis, proliferation indices and cell surface antigenic structures” the results shows that there is no effect of “electromagnetic waves” on the “cell viability, rates of apoptosis, proliferation indices.” There are “thermal” and “non-thermal” effects of “electromagnetic field” with high frequency on the biological system and these thermogenic effects are mainly linked with the intensities of “EMF” that are expressed as “Specific Absorption Rate (SAR).” Philips et al. (2009) found in their study that various changes can be seen in the cellular functions that can be result in disruption of cells due to thermal effects. There are some studies that show that there is no significant effect on the biological system if the “electromagnetic field” is weak. The “static magnetic field” and the “microwave radiations” that were emitted from the phones also induce the mercury vapour which is released from “dental amalgam.” These dental amalgams increase the concentration of the dissolved mercury in saliva and the “amalgam bearers.” The brain tissues are affected the most due to the mobile phones and the “electromagnetic waves” that are emitted from it. It is the fact that no evidence is witnessed that can show that exposure to “electromagnetic wave” can lead to cancer during epidemiological trials and the studies of almost last 30 years show no evidence related to direct or indirect DNA damage as an effect of “electromagnetic field” on various cell lines. Vijayalaxmi et al. (2009) had exposed the “peripheral blood cells” to “electromagnetic field” of 935 MHz and 2450 MHz and they had concluded that there is no damage in the cells at DNA level in the duration of 2 hours. Other studies were conducted with 2450 MHz of EMF on “human glioblastoma cells and mouse fibroblast cell lines” and concluded that there is no DNA damage in the cell even after 24 hours. There are studies that show DNA damage in leukocytes with 837 and 1909.8 MHz radiofrequency for 3-24 hours.

Some changes in the organisms at the level of free radical are observed as a result of “extremely low frequency of electromagnetic field (ELF-EMF)” effects. There are two path ways through which the body eliminates free radicals. In the 1st path way which is non-enzymatic path way, “glutathione, vitamins, carotenoids and flavonoids” were included and the 2nd path way that depends on the enzyme activity is the most effective path way. Catalase and superoxide dismutase are the key enzymes that are included in the path ways where free radicals were converted into less active molecule and eliminates them due to “ELF-EMF.” In the process, the “production” and the “elimination” of the free radicals is balanced with each other otherwise if the process is not balanced it will lead to oxidative stress that later on results in cell destruction. Malondialdehyde is the marker that indicates the cell destruction and this is also the end product of lipid per-oxidation (Genestra, 2007).

The effects of “extremely low frequency of electromagnetic field (ELF-EMF)” is been evaluated and analysed by Martinez et al. (2010) in their study on “antioxidant system” in liver, kidney, and plasma,” where all these were exposed to 60Hz of “electromagnetic field” for about 2 hours and it is observed that there are some early changes in “free radical level.” It is also seen that “superoxide dismutase (SOD) activity in plasma and glutathione (GSH) content” were decreased in “heart and kidney,” but no changes were observed in lipid peroxidation. Electro hyper sensitivity (EHS) is seen in some people and this means that they are at higher risk for “electromagnetic field” exposure as compared to any other individual and the pathophysiology of Electro hyper sensitivity (EHS) is still not to anyone. There are studies and their authors’ claims that it is related to exposure of heavy metals where these heavy metals bound the protein within the tissue, and the organ is thought to have low toxicity. The association between the “mobile phone base station (MPBS) radiation” and the development of “acute symptoms” just after the exposure or during the time of exposure is not been studied and investigated by any study. Some random and blind trials were conducted in the laboratories and no evidence is found for the association between “mobile phone base station (MPBS) radiation” and the development of “acute symptoms.” It is also found that if the exposure is of low level for a longer period of time, it show no harmful effect in the daily environment. But the increased number of mobile phone users is increasing the concerns regarding “EMF” effects. It is expected that the exposure to “radiofrequency electromagnetic fields (RF EMF)” can have harmful effects on “acute health” especially in the children and adolescents. The “human cognitive” and “performance effects” of “electromagnetic field” which is related to phone concludes that EMF from mobile phones were not seem to “induce cognitive” and “psychomotor effects” and the effects that follows the chronic exposure should also be assessed. In spite of the fact that the “electromagnetic field” that is produced by this mobile phone is causing health risks and hazards to human, these new technologies cannot be avoided and are becoming important for everyone.

CONCLUSION

In spite of the fact that these electronic devices, mobile phones and the development in communication field are making the life easier, it is also involving so many negative effects. The negative effect is very important in the “electromagnetic field.” There are so many resources whether it is natural or made by the human beings generate “electromagnetic waves (EMW)” that can travel to longer distances and are playing very important part in routine life such as “Radiofrequency zone (RF)” that are used in “mobile phones, radio and television broadcasting, cellular networks and indoor wireless systems.” The increase in “technological innovations” and the utilization of “electromagnetic fields” are also increased and due to this the people are more exposed to “electromagnetic waves” which causes harmful and dangerous effects to them, especially on children and adolescents.

It is observed in so many studies that there are number of disease like Leukaemia, cancer, brain tumours, and other health problems are the result of “electromagnetic field” and its effects. It is a great concern that there are the biological and cellular effects of “electromagnetic fields EMF with “low frequency” that may lead to biological effect and is linked with redistribution of ions. It also penetrates deep into tissues and result in biological effects.

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