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Electromagnetic Field Exposure – A Health Hazard

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Abstract

The world around us produces electromagnetic fields. However, these are generally of low intensity. We cannot see or hear these radiations. Technological products generate intense electromagnetic fields. Bioelectrical signals are produced in the human body also. The electromagnetic field around the body does influence the internal bioelectric fields and holds the potential to disrupt the physiology and cause health risks. Mobile phones are one of the common devices that are used near the body and hold the potential to be a health hazard. This paper comprehensively reviews the electromagnetic fields, their effects and suggested preventive measures against their ill effects.

Keywords-Electric field; Electromagnetic field; Magnetic field; Microwave radiation; Radiofrequency radiation.

1. Introduction

Electromagnetic field (EMF) is invisible with no odor and color. We are continuously being exposed to electromagnetic radiations. Human body does produce radiations due to electric activity of heart and brain. Earth has an EMF around us. Earth's EMF is observing a change. It is due to an unprecedented increase in the number and diversity of EMF sources. Electric field and magnetic field together are referred as electromagnetic field. EMF associated with electric and electronic devices is produced only when the devices are operational. It cause biological effects and appears to be an emerging disaster. It is now being recognized as public health problem.

Radiations produce an electromagnetic field. The ionizing radiations alter the atomic structure of the material and hence produce deleterious effects on the body. However, the non-ionizing radiations do not ionize the material as they do not take electrons from atoms in their path. These have varying frequencies.

The high frequency EMF radiations have range from 0.1 MHz – 300GHz. These are also called as Radio Frequency (RF) or Micro Wave (MW) or

Wireless radiation or Cellular radiation. RF and MW radiations have insufficient energy to ionize atoms. These are very directional but easy to block. Their sources include wireless communication devices, Radar, television, Wifi, wireless phones, blue toothless communication system etc.^[1]

The extremely low frequency EMF radiations have range from 0-300 Hz. These are emitted from electric and electronic appliances. These are not directional but hard to block as compared to radiofrequency waves. These frequencies are lower than the visible light and much lower than the ionizing radiation.

2. Potential Hazards

Effects of RF fields on different biological systems have been investigated. Although the majority of studies have found no evidence of significant effects, there are a few positive findings that should be followed up. Some in vitro studies provide evidence that gene expression is affected at RF exposure close to the guidelines. Much of the work has focused on genotoxic effects, although there has been no prior indication that non-thermal RF fields induce DNA damage. However, some reports indicated genotoxic effects from RF fields. The

potential vulnerability of children to RF fields have raised concern due to the potentially greater susceptibility of their developing nervous system; also, their brain tissue is more conductive than that of adults since it has a higher water content and ion concentration. RF penetration is greater relative to head size and they have a greater absorption of RF energy in the tissues of the head at mobile telephone frequencies. In addition, children are likely to have a longer lifetime exposure.

Continuous exposure to multiple EMF radiation surrounding us holds the potential to seriously dent our health and environment. Various sources of EMF are operated close to the human body such as mobile phone while other sources are operated far away from the human body such as base station. The extremely low frequency (ELF) radiations pose health risk when exposure is for extended periods. The strong RF and MW radiations can enter into body and disrupt any system in the body to produce mild to severe symptoms. RF radiations are absorbed in the deep body parts while the MW radiations are absorbed near skin. The higher frequency radiations are more hazardous than the low frequency radiations.

There are conflicting reports in technical literature regarding the adverse health effects of EMFs. It has emerged as a potential threat to human health. It is considered as a potential carcinogenic agent and may cause brain tumor.^[2] MW radiations have been observed to produce neuropsychiatric effects.^[3] The genotoxic effect have been highlighted, however, individual sensitivity coded in the genetic diversity influence the outcome. The adverse effects of the radiations are primarily due to non-thermal effects. These include dermatological effects, melatonin production and intracellular effects. Research is needed to confirm the fact that there may be thermal effects also. Nuclear magnetic resonance needs special attention regarding its potential hazards.

3. Use Of Mobile Phones

The mobile phones are being used by over a half of population in many countries. These phones emit non-ionizing radiations which can be absorbed by the tissues close to phone i.e head region.

Cellular radiation is a radiofrequency emitted from cellular devices. Mobile phones are a source of radiations with a range of 600 MHz – 2200 MHz from its antenna. The effect of use of the mobile phones depends upon the variables including phone

technology, distance from body and phone towers and the extent of use. Children are more vulnerable to brain cancer due to the ill effects of radiations.^[4]

4. Electromagnetic Hypersensitivity Syndrome

Electromagnetic Hypersensitivity Syndrome (EHS) refers to a condition characterized by awareness and/or symptomatology in response to extremely weak EMF. It was first reported in 1970 from Soviet Union and was termed as Microwave Syndrome.^[1] It is affecting 10% of the population but only 3% are aware of it. Geographical variation has also been observed. Prevalence is high and is on the rise. The number of affected has increased in last ten years. A person can feel electromagnetic radiation or experiences symptoms due to exposure to EMRs. It presents as non-specific symptoms including headache, chronic fatigue, joint pain, memory problem etc.

The status of EHS as a health issue is unclear. EHS has not been universally accepted as a health problem. It is considered as disability problem for the individual. It has not been established as a medical diagnosis. Sweden is the only country that has accepted EHS as functional impairment. It is proven that it is a physiological condition. EHS has been considered as environmentally inducible neurological symptoms.^[5] Children are observed to be more vulnerable.

EHS has been linked to placebo effects also but this is invalid. It is a genuine somatic illness. WHO recommends that symptoms are real. It has to be accepted as health related problem.^[6] The recommended treatment for EHS by Australian Medical Association and American Academy of Environmental Medicine is to decrease the exposure to radiation.

5. Recommendations

WHO recommends precautionary principle as there is high degree of scientific uncertainty regarding impact of EMF. Hence need to take action for potential risk without any scientific research results. To prevent the ill effects, avoidance is the best. Turn off the devices around whenever possible or at least at night. Keep them away from the body as far as possible since the intensity drops with distance inversely. Use of devices with cord is highly recommended over the use of cordless devices

whenever possible. Mobile phones should not be used in car without external antenna as it generates high degree of radiations. Many devices have an inbuilt safe mode that can be put to use whenever permissible. Use of hands free to decrease radiation to head may be a helpful practice. The wireless access points or mobile phone towers should be avoided near school and hospital. The best way is to incorporate a shielding mechanism in the design of the mobile phone itself. Although the exact role of the external shields is not clear as it blocks only a limited segment of the device.

6. CONCLUSION

Non-thermal lower frequency radiations act via calcium channels and produce diverse neuropsychiatric effects. It may be a disaster in waiting putting human beings under experiment without their consent. Research is required in bioelectromagnetics to assess potential health impacts EMFs. It is advisable to adopt precautionary measures and monitoring safety till conclusive evidence is available. Prospective long term follow up studies are recommended as a powerful surveillance system for potential endpoints including cancer and to fill the gaps in the knowledge.

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