*International Research Journal of Environmental Sciences*_____ ISSN 2319–1414
Vol. **6(4),** 51-54, April **(2017)** *Int. Res. J. Environmental Sci.*

Short Review paper

Electromagnetic radiations: hazardous or not?

Jain Aanchal[1*] and Bansal Sumit[2]
[1]Bhaskaracharya College of Applied Sciences, Delhi University, Delhi, India
[2]Sterlite Technologies -Elitecore, Delhi, India
aanchaljain.ucoe@gmail.com

Available online at: www.isca.in, www.isca.me
Received 6th March 2017, revised 15th April 2017, accepted 22nd April 2017

Abstract

Worldwide there is a huge concern over the electromagnetic radiations emitted by various electronic and electrical products that we use in our daily lives. Many people are worried if these radiations are really harmful to human health. Many researchers are working in this field and there are numerous studies related to these radiations. This paper reviews the studies of those who say that these radiations have severe adverse effects on human health and environment as well as the studies which have the contrasting results to this. This paper tries to draw a comparison between the two ideas and examine the limitations and shortcomings of the studies being conducted. In our study, it has been founded that at this stage it is not possible to draw a conclusion that whether these radiations have negative effects on human health. More extensive study is needed to be conducted to reach any conclusion.

Keywords: Electromagnetic radiations, Health effects, Mobile phones, Cell towers.

Introduction

Electromagnetic radiation is one of the four fundamental interactions of nature. Electromagnetic radiations consist of electric and magnetic waves that travel at the speed of light through the space[1]. Electromagnetic radiations have become as vital to human existence as air. These radiations are present everywhere in the universe. Things that we use in our daily lives like cell phones, microwave, laptop, computer, medical devices like X- Ray machines etc, all emit radiations. These devices have become an indispensable part of our lives. Table-1 is describing examples of sources of radiations[2].

Table-1: Sources of Radiation.

Sources of Radiation	Examples
Natural	Sun, electrical discharges in earth etc.
Man-made (Artificial)	Mobile phone, computer, laptop, microwave, cell towers, medical devices, electric heaters etc.

Does electromagnetic radiations pose any health hazards?

Due to rapid increase in the usage of electronic and electric products, effect of the radiations on human health is a topic which is of great concern today. There are many theories exist that say these radiations are harmful while there are other theories which have contrasting results to this. A lot of research is going on in this field worldwide. Here both the views have been attempted to present.

First view: Electromagnetic Waves are Hazardous.

Effect on body organs: Electromagnetic waves, both low frequency and high frequency, have severe adverse effects on human body system[3].

Effect on brain by electromagnetic radiations has been described by Aakanksha Aggarwal et al[4]. According to them, production of melatonin, which is a natural hormone produced by the brain, decreases when brain gets exposed to radiations. Melatonin is antioxidant and antidepressant which provides immunity to brain to fight against various diseases. Author has stated the risk of various diseases like arthritis, schizophrenia, cancer etc. if the level of melatonin decreases in the body[5].

Roshakimah M.I. et al described the changes in human brain activity, observed due to the exposure of electromagnetic radiations through mobile phones[6]. They conducted their research on 45 people, divided in three categories. In first category, people were given mobile exposure through their left ear, in second category; people were exposed to mobile radiations through their right ear. In the last category, mobile phone in off state was kept near the ear of people. Before, during and after exposure to mobile radiations for five minutes, electroencephalography was conducted on each of them. In their study, they found out that alpha and beta waves got decreased in both the groups that were exposed to mobile radiations through left and right ear.

Brain waves were found to be increased in the third group in which a switched off mobile phone was used. So, they concluded that mobile phone radiations affect the functioning of brain waves and can cause adverse effects on brain functioning.

Age and gender related effects: Neha Kumar et al states that children and pregnant ladies are more likely to be affected by radiations. Skulls of children are not being developed at their age, so they are more vulnerable to radiations[5].

Electromagnetic radiations are absorbed by human body when it gets exposed to radiations as human body consists of 70% fluid. Cell tower wavelength is much smaller than the human height, as a result multiple resonances occur which can lead to many problems like drying up of fluid around eyes, brain, heart etc.[5,7] In this paper author has stated that adverse pregnancy outcomes, like miscarriage, stillbirth, testicular abnormalities, offspring congenital defects, are linked to EMF exposure[8].

Draper G et al conducted a study and found a relation between leukaemia in children and proximity to high voltage power lines[9]. They stated that children who were born within 200m of high voltage power lines had comparatively high risk of leukaemia than the children whose birth address exceeds 600m from these power lines.

Other biological effects: Radiation effects can be divided into two categories- thermal and non thermal. Thermal effects are the effects caused by thermal motion of the charged particles. They are emitted when temperature is greater than absolute zero in any matter. If phone is kept near the ear for a long time, warming sensations near the ear can be felt. These are nothing but thermal radiations. Non thermal effects are long term effects and are observed after around 8 to 10 years of exposure[7].

When electromagnetic radiations interact with head, they generate heat. Incurable diseases like brain tumour, cancer etc. can be caused because skin and some tissues in the head can absorb heat[10].

M.S. Qasimzade et al have stated that an electrician is more prone to adverse effects of radiations than a person of any other occupation. An electrician has the risk of suffering from brain cancer 13 times more than any other occupation person[11].

In this paper author has mentioned that those who live near power lines were significantly more prone to symptoms like depression[8]. There is a potential correlation between exposure to radiations from electricity with medical conditions like attention deficit disorder, asthma, diabetes etc.

Electromagnetic radiations deeply penetrate the living tissue thereby affecting the biological system adversely. Chances of fatigue, headache, decreased blood pressure etc are increased due to exposure to radiations[2].

This study states that an average use of cell phone for about half an hour for more than ten years can lead to brain cancer[12].

Effects on animals and environment: Adverse effects of radiations have been observed in the case of animals and environment as well. Bees, pigeons, sparrows etc are vanishing due to these radiations. Animals like dogs, cow and sheep are also being affected due to radiations. Effects of radiations have also been observed on vegetation which is not a good sign for human population[7].

Second View: Non conclusive evidence: Through the above mentioned statements it can be said that electromagnetic radiations may have harmful effects on human beings and environment.

But the other side of this also exists. There are various studies that says that these radiations do not have harmful effects or there is no conclusive evidence based on which it can be said that these radiations have adverse health effects.

Though there have been complaints of headache, nervousness, sleeplessness and other such symptoms, supposedly due to the presence of cell phone base station antennas. But some service providers claimed that in some areas complaints were reported even before the antennas were in operation. So, it cannot be stated with certainty that these symptoms were because of antennas. Some other factors may be responsible for these symptoms. They may or may not be a reason for complaints of people[13,14].

No harmful effects: As per the report published, if radiations from the mobile phones are capable of causing health hazards then radio waves should have done much damage as they exist from so long. A group of 25 researchers and professors from different IITs of the country have stated that Indian cell tower radiation norms are among the safest norms in the world[15].

This study states that everyday gadgets give transitory stimulus. Cells get a chance to repair themselves as, for example, a person cannot stand and do not stand in front of a gadget, say microwave, for 24 hours a day. When electromagnetic radiation is allowed to bombard a cell continuously, then problem can arise. Though cells have an automatic repair system, it becomes hazardous when there is a disparity between damage and repair[16].

World Health Organization (WHO) views: International Agency for Research in Cancer (IARC), which is a part of World Health Organization (WHO), has classified cell phone radiations as Group 2B- possible human carcinogenic. Agents which do not have sufficient proof of carcinogenicity in humans but some or sufficient proof of carcinogenicity in animals are placed in this group. But WHO also mentioned that further extensive research in long term needs to be conducted to verify it. Till then some precautionary measures can be taken for public health[17].

TV and radio towers also emit electromagnetic radiations but they are generally located far away from residential places and in isolation, so there effect become very less.

No relation to brain tumours: International Agency for Research on Cancer co-ordinated a project called the INTERPHONE project that was a 13 nation project. The main aim of this study group was to determine whether mobile phone use have any adverse effect on human health or not. This study group comprises of 21 scientists and this is considered to be the largest study of its kind ever taken. This project did not find any prominent relation between mobile phones and brain tumours[18].

Another study was conducted by Joachim Schüz et al on Danish cell phone users[19]. Standardized Incidence Ratios (SIRs) is defined as the ratio or percentage about the mortality of the population of approximately the same age under study and experience of general population had they had the same mortality experience of the comparison population. In this study the author calculated the SIRs of observed cancer numbers. 420095 people of the approximately the same age were observed in this nationwide study. 14249 total cancer cases were observed. And no increased risk on tumours, leukaemia, or overall cancer was observed due to cellular phones.

In United States, researchers at the National Cancer Institute found no increase in glioma and cell phone usage[20].

Case of radiation by sun: Former Coordinator of WHO electromagnetic fields project, Michael Repacholi said that the radiation emitted by the sun is above 250 Watts per square metre which is far more than the radiations emitted by the wireless phone towers. International Commission on Non-Ionising Radiation Protection (ICNIRP) has prescribed power density limit for mobile phones to be 4.5 watts per square metre while India adopted stricter norms for the radiation from Base Transceiver Station to be 1/10th of the International norms that is 0.45 Watts per square meter. But Michael criticized this step taken by the government as he thinks that the government should have created awareness instead of taking such a step based on speculations[16].

Positive aspects of radiations: Electromagnetic waves have been used in the field of medicine since ancient times for curing diseases. X- Rays are being used since a long time to detect diseases.

EM waves are used to decay undesired cells and tissues that can lead to diseases. Studies have shown that by the method of electric field heating, uterine cancer cells can be destructed[21]. Using caustic effect of electricity blood clotting can be enhanced. The technique can even help in muscle relaxation and help people from muscular pains and strains. It can be used in burning fat tissues also[22, 23]. Diathermy, which uses EM waves to destroy the cells by deep heating, can help in diseases like arthritis, poliomyelitis and pelvic diseases[24].

Limitations and research challenges

We have seen that there are reports that state radiations have adverse effects on human health. On the contrary, there are other researchers who have stated that radiations do not affect the health, or at least there is no definitive link that can prove with certainty that radiations can cause health issues.

The research that is carried out in this field faces several obstacles, several challenges.

It is not ethically possible to perform trials by exposing some participants to potentially dangerous exposures and then comparing the results with unexposed group. Hence, the studies present results which may be erroneous. Due to long gaps between exposure to radiations and illness, studies that have short follow up periods may not produce correct result as these studies do not provide proper opportunities to manifest.

Conclusion

As there are studies that prove that electromagnetic radiations are hazardous for human health as well as environment, at the same time many studies have also proved that there are no strong evidences or direct link based on which it can be confirmed that these radiations are harmful. Man- made electromagnetic radiations have been around us since ages. If even a small hazard did exist, by now it would have turned up into a major threat to the human survival. So it can be concluded that at present stage it cannot be stated with certainty that electromagnetic radiations cause health problems. More work is needed to be done to establish a strong relation between electromagnetic radiations and its effects.

References

1. Mobile Communication Radio Waves and Safety (2012), Department of Telecommunications, Ministry of Communications and IT, Government of India, http://www.auspi.in/emf/02_Mobile-Communication-Radio-Waves-and-Safety-10th-sept-12-final.pdf
2. Maini S., Singh A. and Marwaha A. (2009). Biological Effects and Therapeutic Applications of Electromagnetic Radiations. Excerpt from the COMSOL Conference, Bangalore
3. Aly Ashraf A., Safaai B.D. And Nazar Z. (2008). Research Review on the Biological Effect of the cell phone Radiation on Human. International Conference on Innovations in Information Technology, IEEE, Poland, 16-18 December, 140-144.
4. Aggarwal A. and Gupta A. (2011). Effect of Electromagnetic Radiations on Humans: A Study.

Proceedings of the IEEE Students Technology Symposium (TechSym),IIT Kharagpur, 14-16 January, 75-80.

5. Kumar N. and Kumar G. (2009). Biological Effects of Cell tower radiation on Human body. International Symposium on Microwave and Optical Technology, New Delhi, 16-19 December, 1365-1368.

6. Isa R. M, Pasya I. and Taib M.N. (2012). High frequency Brainwaves comparison due to Mobile Phone Radiofrequency Emission. Third International Conference on Intelligent Systems Modelling and Simulation, IEEE, Malaysia, 8-10 February, 191-196.

7. Prof. GuhaK.S., Prof. Neogi S. and Prof Kumar G. (2011). Report on Cell Phone towers Radiation Hazards. https://www.ee.iitb.ac.in/~mwave/Cell-tower-rad-report-WB-Environ-Oct2011.pdf

8. Genuis S.J. (2008). Fielding a current idea: exploring the public health impact of electromagnetic radiation. *Journal of the Royal Institute of public health*, Elsevier, 113-124.

9. Draper G., Vincent T., Kroll M.E. and Swanson J. (2005). Childhood cancer in relation to distance from high voltage power lines in England and Wales: a case-control study. *British Medical Journal*, 330(7503), 1290.

10. Rajan S., Sukanesh R. and Vijayprasath S. (2012). Performance Evaluation of Mobile Phone Radiation Minimization through Characteristic Impedence Measurement for Health- Care Applications. International Conference on Advanced Communication Control and Computing Technologies, IEEE, Tamil Nadu, India, 23-25 August, pp 1-4

11. Qasimzade M.S., Aydayev F.S. and Salahov V.M. (2004). Ecological problems of power engineering- electromagnetic compatibility and electromagnetic safety. Kluwer Academic Publishers, Springer, Netherlands, 217-223.

12. Kovach S. (2011). World Health Organization: Cell Phones May Cause Cancer, Business Insider.

http://www.businessinsider.com/cell-phones-cause-cancer-2011-5?IR=T

13. Lin J.C. (2004). Controversy over Cellular mobile telecommunication base station antenna installations. *IEEE Antennas and Propagation Magazine*, 46(1), 155-156.

14. Moulder J. (2005). Mobile Phone (Cell Phone) Base stations and Human Health. *Medical College*, Wisconsin University http://www.mcw.edu/Radiation-Oncology/Radiation-Biology/Mobile-Phone-Cell-Phone-Base-Stations.htm, Accessed: 20/02/2017

15. IIT professors call cell tower rules safe, doctors advise caution (2013). http://timesofindia.indiatimes.com/city/mumbai/IIT-professors-call-cell-tower-rules-safe-doctors-advise-caution/articleshow/22906255.cms, Accessed on 03/01/2017

16. Expert says radiations from mobile towers not harmful (2013) Express News Service, Bangalore, http://archive.indianexpress.com/news/expert-says-radiation-from-mobile-towers-not-harmful/1203020/, Accessed on 16/01/2017

17. International Agency for Research on Cancer, World Health Organization (WHO) (2011). IARC classifies radiofrequency electromagnetic fields as possibly carcinogenic to humans press release N° 208. Lyon, France: International Agency for research on Cancer (IARC). http://electromagnetichealth.org/electromagnetic-health-blog/iarc-rf-carc/, Accessed: 01/02/2017

18. International Agency for Research on Cancer (2010). Interphone study reports on mobile phone use and brain cancer risk. Press Release N° 200, *World Health Organization.* https://www.iarc.fr/en/media-centre/pr/2010/pdfs/pr200_E.pdf

19. Schuz J., Jacobsen R., Olsen J., Boice J., McLaughlin J. and Johansen C. (2006). Cellular Telephone Use and Cancer risk: Update of a Nationwide Danish Cohort. *Journal of the National Cancer Institute*, 98(23), 1707-1713.

20. U.S. population data show no increase in brain cancer rates during period of expanding cell phone use (2012), National Cancer Institute, https://www.cancer.gov/news-events/press-releases/2012/Glioma cellphoneuse, Accessed: 23/01/2017

21. Tydnyuk V.Z., Aleev S. and Khodakovskii N.I. (2006). Field interactions and distinctive features of development of devices for diagnostics and correction of states of biologically active points. *Cybernetics and Systems Analysis*, Springer, 42(2), 291-297

22. Zabolotnyy P.I., Yatsunenko A.G. and Grinyuk V.A. (2003). Prospects of EHF EM medical technologies. 13th International Crimean Conference on Microwave and Telecommunication Technology, IEEE, 112-113.

23. Kntor G., Witters D.M. and Greiscr J. W. (1978). The Performance of a New Direct Contact Applicator for Microwave Diathermy. *IEEE Transactions on Microwave Theory and Techniques,* 26(8), 563-568.

24. Surducan V., Surducan E., Ciupa R. and Roman M. (2010). Embedded System controlling Microwave generators in hyperthermia and diathermy medical devices. IEEE International Conference on Automation Quality and Testing Robotics, 2, 1-6.