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RESEARCH ARTICLE

EFFECTS OF MOBILE PHONE AND MOBILE PHONE TOWER RADIATIONS ON HUMAN HEALTH

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ABSTRACT

The mobile phone industry has been one of the fastest growing industries in modern history. Many researchers have proved electromagnetic radiation emitted by mobile phone and mobile phone towers are harmful for the health of human beings, animal and plants. Effect of electromagnetic radiation emitted by mobile phone and mobile phone towers depends upon the user time. The ongoing use of mobile phones has raised the health effects. This study is done for the people who are not aware about these radiations. After this study, it is found that electromagnetic radiation emitted by mobile phone and mobile phone towers are harmful for the people who are living nearby the transmission towers, so people should keep away from the transmission towers and people should use the mobile phone as soon as low timing.

INTRODUCTION

Mainly 800, 900, 1800 and 2450 MHz frequency of electromagnetic waves are used for the mobile phone communication. The most common mobile communication technologies in India are the digital technologies GSM 900 and 1800. To reach the signals of mobile phones on every place, the towers have situated at every corner of city and at every village of our country. These towers are essential part of mobile communication network necessary to establish connection between the mobile telephone and the rest of the network. In most Asian countries, towers have become ubiquitous to guarantee connectivity in large areas of the respective countries e. g., 18000 base stations are operated in India. The so called reference level for the exposure of the general population at 900 MHz is 4.5 W/m^2. The range of exposure of the general population due to GSM signals is typically between some few hundred mW/m^2.

High frequency electromagnetic waves (EMW's) radiated from the towers, interact with the biological tissues. This interaction is a complex function of numerous parameters. EMW's in free space are characterized by the frequency, intensity of electric and magnetic fields, their direction of propagation and polarization. Higher frequencies EMW's produce fields of varying intensity at various places and higher intensity fields exist near the towers.[1] Also, prolonged use of mobile phones affects the people because of field concentration and resonance in the vicinity of human brain. Earlier studies on the effects of high frequency EMF to human body have shown that long time high frequency exposure is very harmful for the human body (London et. Al. 1991, Karunaratha M. A. 2006). Microwave fields have become a driving force of our civilization through their numerous applications in the scientific and the industrial as well as the military and civilian world. Today, due to the development of modern technology, the field of communication, radar astronomy, navigation and power etc. and widespread use of these waves among common generation causes the adverse health effect (Lai & Singh 1997aAltamura G 1997 and Black N 2009). Much attention has been paid to health implications with high frequency electromagnetic field exposure since the last two decades. A large amount of work has been published on the biological effects of microwave radiation (Anu Karinen 2008, Hulter H. P. 2010, Panda et. al. 2010).

Since the biological substances such as blood may be scattered, reflected and absorbed depending on the field strength, the frequency, exposure time and the electric properties of the tissues. Due to the installation of numerous towers, the most of the population are in direct contact to this radiation continuously. This prolonged exposure can increase the thermal hazards many fold.

METHOD AND MATERIAL

Theoretical and Measured Radiated power

To measure the power at a distance R, an antenna is used to receive the power and a spectrum analyzer or power meter is used to measure received power.

Power Received Pr by an antenna at a distance R is given by:

$$P_r = P_t \times G_t \times G_r \times \left\{\frac{\lambda}{4\pi R}\right\}^2$$

Received power is directly proportional to the transmitted power, gain of transmitting and receiving antennas, and square of wavelength of the signal and it is inversely proportional to square of distance. For transmitter power Pt = 20 W, transmitting antenna gain Gt = 17 dB, receiving monopole antenna gain Gt = 2 dB, the received power at R = 50 m is:

At 887 MHz (tower transmitting frequency in CDMA), Pr = -3.2 dBm.

At 945 MHz (tower transmitting frequency in GSM900), Pr = -3.8 dBm.

At 1872 MHz (tower transmitting frequency in GSM1800), Pr = -9.7 dBm.

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The purpose of a cell tower is that mobile phone should receive adequate signal for its proper operation. A mobile phone shows full strength at -69 dBm input power and works satisfactorily in the received power range of -80 to -100 dBm. In comparison with -80 dBm level, the measured power level at R = 50m is at least 50 to 60 dB higher, which translates to 100,000 to 1,000,000 times stronger signal than a mobile phone requires. There are millions of people who live within 50m distance from cell towers and absorbing this radiation 24x7.

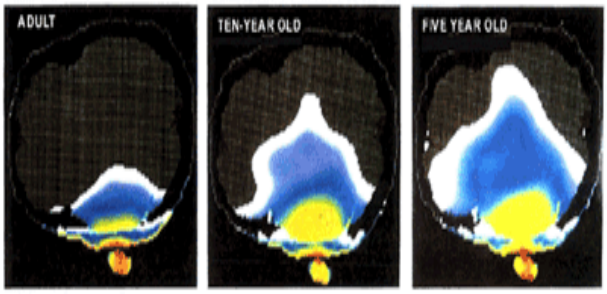

Fig. 1 - Absorption of electromagnetic radiation from a cell phone based on age (Frequency GSM 900 MHz)

Biological effects of microwave radiation

When a human body is exposed to the electromagnetic radiation, it absorbs radiation, because human body consists of 70% liquid. It is similar to that of cooking in the microwave oven where the water in the food content is heated first. Microwave absorption effect is much more significant by the body parts which contain more fluid (water, blood, etc.), like the brain which consists of about 90% water. Effect is more pronounced where the movement of the fluid is less, for example, eyes, brain, joints, heart, abdomen, etc. Also, human height is much greater than the wavelength of the cell tower transmitting frequencies, so there will be multiple resonances in the body, which creates localized heating inside the body. This results in boils, drying up of the fluids around eyes, brain, joints, heart, abdomen, etc. There are several health hazards associated with cell phones and cell towers. Some of these are described in the following sub-sections.[2]

Risk to Children and Pregnant Women

Children are more vulnerable to cell phone radiation as they:

i. Absorb more energy than adults from the same phone owing to their smaller head and brain size, thinner cranial bones and skin, thinner, more elastic ears, lower blood cell volume, as well as greater conductivity of nerve cells and the energy penetrates more deeply. Tumors in the mid brain are more deadly than in the temporal lobe,
ii. Children's cells reproduce more quickly than adults which makes cancers more deadly,
iii. There immune system is not as well developed as adults hence are less effective against fighting cancer growth,
iv. Children have longer life time exposure.[3]

Absorption of electromagnetic radiation from a cell phone (Frequency - GSM 900 MHz) is shown in Fig. 1 by an adult, 10 year old and a 5 year old child. When radiation hits the head, it penetrates the skull. The yellow area at the bottom is the location of the cell phone by the ear. The radiation penetrates the skull of an adult (25%), 10 year old (50%) and a 5 year old (75%).[4,5] The younger the child, the deeper is the penetration due to the fact that their skulls are thinner and still developing. For these reasons it is critical that children under the age of 16 use cell phones only for short essential calls as they have much bigger danger of getting a brain tumor. Brain tumors have now taken over leukemia as the biggest cause of death amongst children. Due to these reasons countries like Belgium, France, Finland, Germany, Russia and Israel have publicly discouraged use of cell phones by children. An Independent research in Sweden last year concluded there was an astonishing 420 percent increased chance of getting brain cancer for cell phone users who were teenagers or younger when they first started using their phones.[7]

A pregnant woman and the fetus both are vulnerable because of the fact that these RF radiations continuously react with the developing embryo and increasing cells. Microwave radiation can damage the placental barrier; the membrane which prevents the passage of some materials between the maternal and fetal blood, protecting the fetus, implying that pregnant woman should avoid cell phone or use during emergency.[6] In a recent finding, an association was found between a mother's cell phone use during pregnancy and greater likelihood for spontaneous abortion, congenital malformations and behavioral problems in their children. It is believed that the eggs, which form the embryo, are affected and the damage will become apparent after the child reaches puberty.[6] The Russian National Committee on Non-Ionizing Radiation Protection says that use of the phones by both pregnant women and children should be "limited". It concludes that children who talk on the handsets are likely to suffer from "disruption of memory, decline of attention, diminishing learning and cognitive abilities, increased irritability" in the short term, and that long-term hazards include "depressive syndrome" and "degeneration of the nervous structures of the brain".[7]

Effect on Skin

Radiation from cell towers and mobile phones affects human skin. People who talk often on cell phones have a higher concentration of the *transtyretin* protein than those who do not. *Transtyretin* is formed in the liver; it helps transport vitamin A in the body and plays an important role in nervous diseases such as Alzheimers.[8] The symptoms of *Morgellons* disease include those of electromagnetic hypersensitivity (EHS); may be based on how body uses electric currents to repair wounds to the skin. People who suffer from this condition report a range of skin symptoms including crawling, biting and stinging sensations; granules, threads or black speck-like materials on or beneath the skin and/or lesions (e.g., rashes or sores). EMFs degrade the immune system and stimulate various allergic and inflammatory responses. The high radiation from cell towers can result in an increase in mast cells, which explains the clinical symptoms of itch, pain, edema and erythema.[9,10]

Tinnitus and Ear Damage

Tinnitus, popularly known as "Ringxiety"- is the psychological disease of hearing phantom sound and sensation of cell phone ring and it has been reported among millions of cell phone users in the world. People with severe tinnitus may have trouble hearing, working or even sleeping. The radiation emitted by mobile phones may damage the delicate workings of the inner ear**,** and long-term and intensive mobile phone use for more than four years and for longer periods than 30 minutes in a day are at a higher risk of developing hearing loss, which cannot be reversed.[11] This auditory perception has been shown to occur when a person's head is illuminated with microwave energy. The microwave pulse

upon absorption in the head, launches a thermo-elastic wave of acoustic pressure that travels by bone conduction to the inner ear. There it activates the cochlear receptors via the same process involved for normal hearing, which explains the "clicks" heard by people exposed to microwave radiation.[12] Today, more and more young people between 18 and 25 years of age are suffering from hearing loss, which doctors say is due to excessive use of mobile phones and other gadgets. Good hearing depends on the health of some 16,000 hair cells present in each inner ear. Bu increasingly, doctors have been treating people whose hair cells have been damaged by the high radiation emitted from cell phones. Hearing problems occur because these cells do not Regenerate. Anyone who spends two to three hours on the cell phone every day runs the risk of partial deafness over three to five years. Most of the marketing and tele-consulting professionals are in their 20s, and their jobs demand long conversations on cell phones. The problem starts with a pain in the ear that gradually develops into tinnitus or a ringing sensation which finally leads to hearing loss.[13]

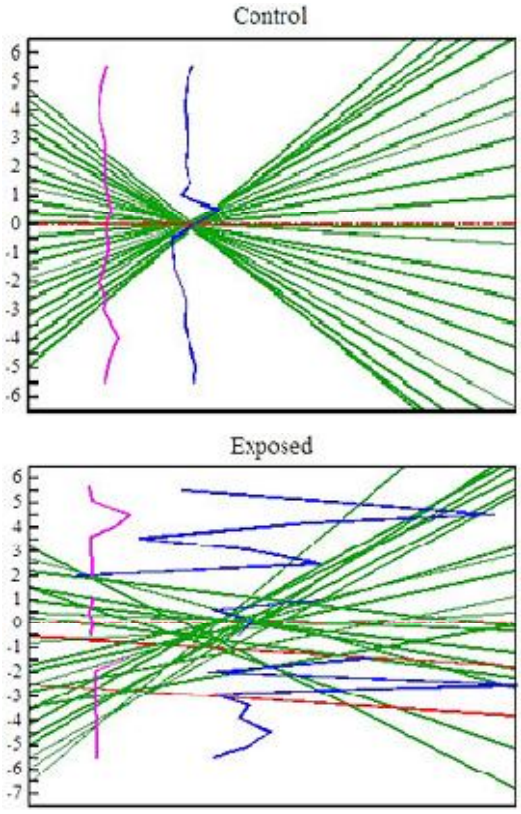

Fig. 2 – Left - Good quality lens - all rays passing through the lens have similar focal length. **Right** - Exposed lens, showing considerable variability in the focal length of the beams passing through the lens.

Effect on Eye/ Uveal Melanoma

Frequent use of mobile phones can also damage the visual system in many ways and cause uveal melanoma i.e. tumor of the eye. Tumors involve the choroid (98%), iris (1%) and unknown parts of the uveal tract (1%). Computational modeling and experiments with several laboratory animals show that microwave radiation similar to mobile phone frequencies (900, 1800 MHz and 2450 MHz) can induce chromosomal breaks in the corneal epithelial cells and increase the intraocular temperature of the eye with prolonged exposure.[14] . Increase in temperature close to the eye lens (as low as 3oC) can result in lens opacities and increase the risk of developing cataracts in humans, a condition characterized by clouding in the natural lens of the eye and lens opacities. When Bovine eye lenses were exposed to microwave radiation, it caused macroscopic damage and affected the optical function of the lens. The damage increased as the irradiation continued and reached a maximum level after a number of days. When the exposure stopped the optical damage began to heal gradually. A similar maximum level was observed when the irradiation intensity was reduced to one-half the original, except that it took twice the time.[15] A lens of good optical quality is able to focus the laser beam from the various locations (green lines in the left frame of Fig. 2. When the lens is damaged due to exposure to microwave radiation, its ability to focus the laser beam at the various locations is altered, as clearly revealed in the right frame. The blue line connects the points of the back vertex distance for each ray passing through the lens. The pink line shows the relative intensity of each beam, that is, the transmitted intensity normalized to the incident one. Prolonged exposure to microwave radiation similar to that used by cellular phones can lead to both macroscopic and microscopic damage to the lens and part of this damage seems to accumulate over time and does not heal. [16]

Cell phone emission weaken bones

Researchers have measured bone density at the upper rims of the pelvis (iliac wings) in men who were mobile users and carried their phones on their belts. The iliac wings are widely used source of bone for bone grafting, so any reduction in bone density may be of special importance to reconstructive surgery. The results showed reduction in iliac wing bone density on the side where men carried their phones. In general, it is better to keep mobile phones as far as possible from our body during our daily lives.[17]

Sleep Disorders

Electromagnetic fields have been shown to affect the brain physiology. Use of mobile phones disturbs 4 stage sleep, the stage important for full recuperation of brain and body. Use of the handsets before bed, delays and reduces sleep, and causes headaches, confusion and depression.[18] The findings are especially alarming for children and teenagers as they use cell phones at night and also keep the phone next to their head; which may lead to mood and personality changes, depression, lack of concentration and poor academic performance.[19]

Neurodegenerative Diseases

Exposure to electromagnetic fields has shown to be in connection with Alzheimer's disease, motor neuron disease and Parkinson's disease. All these diseases are involved with the death of specific neurons and are classified as neurodegenerative diseases.[21] People living near mobile phone base stations are also at risk for developing neuropsychiatric problems as headache, memory loss, nausea, dizziness, tremors, muscle spasms, numbness, tingling, altered reflexes, muscle and joint paint, leg/foot pain, depression, and sleep disturbance. More severe reactions include seizures, paralysis, psychosis and stroke.[20]

Increase in Cancer risk

Heavy use of mobile phones can cause cancer. Use of mobile phones for >10 years give a consistent pattern of increased risk for brain cancer - glioma (cancer of the glial cells that support the central nervous system) and acoustic neuroma (a benign tumor in the brain on a nerve related to hearing). The risk is highest for ipsilateral (on the same side of the head where the instrument is held) exposure. Children and teenagers, before the age of 20 are

five times more likely to get brain cancer, as their brain is not fully developed and radiation penetration is much deeper. It is possible that today's young people may suffer an "epidemic" of the disease in later life. Besides increase in brain tumour and acoustic neuroma, there is an increased risk of several other types of cancers following prolonged exposure to mobile phone/ tower radiation, such as, salivary gland tumors, uveal melanoma, lymphoma, facial nerve tumors, skin, blood, testicular and breast cancer. Interphone study has also found a 'significantly increased risk' of some brain tumors for heavy users of mobile phones (> 20 minutes per day) for a period of 10 years or more. It is suggested that children should be discouraged from using mobile phones and restrict use to emergency while adults should "keep calls short".[22]

CONCLUSION

The seriousness of the health hazards due to radiation from the cell phones and cell towers has not been realized among the common man. Cell operators continue to claim that there are no health issues. Even organizations like WHO, ICNIRP, FCC, etc. have not recommended stricter safe radiation guidelines, whereas several countries have adopted radiation norms, which are 1/100th to 1/1000th of these values based on their studies. Cell phone industry is becoming another cigarette industry, which kept claiming that smoking is not harmful and now there are millions of people around the world who have suffered from smoking. In fact, cell phone/tower radiation is worse than smoking; as one cannot see it or smell it, and its effect on health is noted after a long period of exposure. Therefore, majority of people tend to have casualness towards personal protection. Unfortunately, ignorance and non-awareness adds to this misery and all of us are absorbing this slow poison unknowingly. Even if people are aware of the radiation hazard, they may not have the choice to move away from it if the tower is installed near their office or residential building. In addition to the continuous radiation from cell towers, there is radiation from cell phones, wireless phones, computers, laptops, TV towers, FM towers, AM towers, microwave ovens, etc. We are exposed to all these radiations which are additive in nature. Hence, it is imperative that stricter radiation norms must be enforced by the policy makers. This does not mean that we have to stop living near these towers. We all know that automobiles create air pollution – have we stopped using them? Instead, solutions were found such as unleaded petrol, catalytic converters to reduce emission, CNG driven vehicles, hybrid vehicles, etc. If people in the mobile companies think there is no health hazard, then let them stand in front of their own transmitting tower at 1m distance in the main beam for 6 hours – are they willing to take the risk? Similar effect will be there at 10m distance in about 600 hours (25 days). If mobile companies accept that radiation causes serious health problems, will people stop using cell phones? Not really, because the cell technology has its several advantages. However, then researchers/technocrats/entrepreneurs will come out with possible solutions, which may be expensive but that cannot be greater than the health risk faced by humans, birds, animals and environment.

References

1. Levitt B, Lai H, Biological effects from exposure to electromagnetic radiation emitted by cell tower base stations and other antenna arrays, Environ. Rev. 18:369–395,
2. N. Kumar and G. Kumar, "Biological effects of cell tower radiation on human body", ISMOT, Delhi, India, pp. 678-679, Dec. 2009.
3. Independent Expert Group on Mobile Phones, Report of the Group (The Stewart Report), Mobile Phones and Health, First issued 11 May 2000 –
4. Gandhi et al., IEEE Transactions on Microwave Theory and Techniques, 1996.Foliart DE, Pollock BH, Mezei G, Iriye R, Silva JM, Epi KL, Kheifets L, Link MP, Kavet R, Magnetic field exposure and long-term survival among children with leukemia, British Journal of Cancer, 94, 161-164, 2006 –
5. Divan HA, Kheifets L, Obel CJ, Olsen, J, Prenatal and Postnatal Exposure to CellPhone Use and Behavioral Problems in Children, Epidemiology, 2008 – http://www.scribd.com/doc/10927149/Cell-phones-carry-damage-risk-during-pregnancy.
6. Allan H. Frey, Evolution and Results of Biological Research with Low-Intensity Nonionizing Radiation, Modern Bioelectricity, 785–837, 1988 Geoffrey Lean Warning: Using a mobile phone while pregnant can seriously damage your baby,18 May 2008.
7. Feychting M., Non-cancer EMF effects related to children. Bioelectromagnetics Supplement 7:S69-S74 (2005)http://onlinelibrary.wiley.com/doi/10.1002/bem.20153/pdf.
8. Karinen A, Heinävaara S, Nylund R, Leszczynski D, Mobile phone radiation migh alter protein expression in humanSkin,*BMCGenomics*,Finland,2008,**9:**77 http://www.biomedcentral.com/content/pdf/1471-2164-9-77.pdf
9. Pacini S, Ruggiero M, Sardi I, Aterini S, Gulisano F, Gulisano M., Exposure to global system for mobile communication (GSM) cellular phone radiofrequency alters gene expression, proliferation, and morphology of human skin fibroblasts.Oncol Res. 2002;13(1):19-24,
10. Johansson O, Disturbance of the immune system by electromagnetic fields—A Potentially underlying cause for cellular damage and tissue repair reduction which could lead to disease and impairment , Pathophysiology. 2009;16(2-3), 157-77, 2009
11. Meo SA, Al-Drees AM, Mobile phone related-hazards and subjective hearing and vision symptoms in the Saudi population, Int J Occup Med Environ Health. 18(1):537,2005http://www.ncbi.nlm.nih.gov/pubmed/16 05289
12. Hutter HP, Moshammer H, Wallner P, Cartellieri M, Denk-Linnert DM, Katzinger M, Ehrenberger K, Kundi M, Tinnitus and mobile phone use, Occup Environ Med. 2010http://oem.bmj.com/content/early/2010/06/23/oem.2009.048116.abstract
13. Foster. K. R, Finch. E.D, Microwave hearing: Evidence for Thermoacoustic Auditory Stimulation by Pulsed Microwaves, IEEE Press, Biological effects of Electromagnetic Radiation; Edited by Johm M. Osepchuk,1974http://www.sciencemag.org/cgi/content/abstract/185/4147/256
14. Stang A, Anastassiou G, Ahrens W, Bromen K, Bornfeld N, Jöckel K-H: The possible role of radio frequency radiation in the development of uveal melanoma. Epidemiology 2001 , 12(1):7-12.-http://www.jstor.org/stable/3703672

15. Wainwright PR., Computational modelling of temperature rises in the eye in the near field of radiofrequency sources at 380, 900 and 1800 MHz, Phys MedBiol.2007Jun21;52(12):333550http://www.ncbi.nlm .nih.gov/pubmedhttp://ieeexplore.ieee.org/stamp/stamp.j sp?tp=&arnumber=1189664
16. Hirsch F. G. and Parker J. T. "Bilateral Lenticular Opacities Occurring in a Technician Operating a Microwave Generator,"A M A Arch Ind Hyg Occup Med., 1952, 6(6):512-7. Dovrat A. , Berenson R., Bormusov E., Lahav A., Lustman T., Sharon N., Schächter L. , Localized effects of microwave radiation on the intacteye lens in culture conditions, Bioelectromagnetics 26:398^405 (2005)
17. Atay T, Aksoy BA, Aydogan NH, Baydar ML, Yildiz M, Ozdemir R., Effect of Electromagnetic Field Induced by Radio Frequency Waves at 900 to 1800 MHz on Bone Mineral Density of Iliac Bone Wings, The Journal of Craniofacial Surgery, 20(5):1556-60, 2009.
18. Mann K, Röschke J., Effects of pulsed high-frequency electromagneticfieldsonhumansleep,Neuropsychobiolog y. 1996;33(1):41-47.-
19. Hutter HP, Moshammer H, Wallner P, Kundi M , Subjective symptoms, sleeping problems, and cognitive performance in subjects living near mobile phone base stations, Occup Environ Med. 2006 May;63(5):307-13.
20. Westerman R, Hocking B,Diseases of modern living: neurological changes associated with mobile phones and radiofrequency radiation in humans, Neurosci Lett. 2004May6;361(1-3):13-6, http://www.ncbi.nlm.nih.gov/pubmed/15135881
21. Lönn S, Ahlbom A, Hall P, Feychting M, Mobile phone use and the risk of acoustic neuroma, Epidemiology. 2004Nov;15(6):6539.http://www.ncbi.nlm.nih.gov/pub med/15475713

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