



RESEARCH ARTICLE

HEALTH HAZARDS FROM MOBILE PHONE TRANSMISSION TOWERS

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ABSTRACT

Now a days mobile phones form an integral part of our daily life. We have billions of users worldwide and this number is ever increasing. Many researchers have proved that radiation of mobile phone is harmful for the health of human beings, animal and plants. Effect of the radiation of mobile phone 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 the radiations of mobile phones 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.

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INTRODUCTION

In recently, the use of mobile phone radiation is wide spread in our society. Today more than 1.5 billion people are using mobile phones world wide in which high frequency waves are used and this number is ever increasing. Because mobile phone technology emits low energy electromagnetic fields, concerns have been raised as to whether exposure to non-ionizing electromagnetic radiation in this radio frequency range can modify biological material, leading to possible adverse health effects. 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/m². The range of exposure of the general population due to GSM signals is typically between some few hundred mW/m². 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. 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, 2006).

High frequency EMW is known to affect the human health directly. According to Fact Sheet no. 201, July 1998 of World Health Organization (WHO), EMW's may cause spontaneous abortion (miscarriage) or birth of deformed children. Also it is observed that the people living near the transmitting towers of mobile phone situated near the thickly populated areas are exposed to varying intensities of EMW emitted by tower. The WHO, based upon the consensus view of the scientific and medical communities, states that cancer is unlikely to be caused by cellular phones or their base stations and that reviews have found no convincing evidence for other health effects (Foster, 1996, Kesari *et al.*, 2011). Some National Radiation Advisory Authorities (Guideline ICNIRP 1998, Kaune, 1998, Pathak *et al.*, 2003) have recommended measures to minimize exposure to their citizens.

Mobile phone radiation and health concerns have been raised, especially following the enormous increase in the use of wireless mobile telephony throughout the world, there were more than 2 billions users worldwide. Mobile phones use electromagnetic radiation in the microwave range, and some researcher (Mason *et al.*, 2000, Osepchuk *et al.*, 2008) believe this may be harmful to human health. These concerns have induced a large body of research (both epidemiological and experimental, in non-human animals and in humans). Concerns about effects on health have also been raised

regarding other digital wireless systems, such as data communication networks (Nielsen *et al.*, 2010, Polk, 1996).

REVIEW OF LITERATURE

Some epidemiology studies have reported associations between childhood cancer and the configurations of electric power wiring located near subjects' homes (Gajsek, 2001, Walters *et al.*, 2000). The most frequent interpretation of these results is that they reflect on underlying associations between childhood cancer and exposure to power frequency magnetic field (Gajsek, 2001, Stuckly and Stuckly, 1996). In addition to the extensive use of microwave energy for diathermic heating of body tissues (Adair, 2002) and as an adjunct to cancer treatment (Maker, 2003) techniques have been developed that use EMW energy for rearming body (Kumar *et al.*, 2008, Prasad, 1996) or individual body parts (Salford *et al.*, 2003, SSI report 2008). Radio frequency coils energized at frequencies of (13-30) MHz, heat deep tissues more rapidly and efficiently than warm water immersion, insulated socks, or nichrome wire coils energized by DC skin areas remote from the radio frequency coil are warmed convectively by heated blood while no adverse thermal effects have been observed. EMW have been studied in animals, including primates. The earliest signs of an adverse health consequence, found in animals as the level of EMW increased, include reduced endurance, aversion of the field and decreased ability to perform mental tasks. These studies also suggests adverse effects may occur in human subjected to whole body or localized exposure to EMW sufficient to increase tissue temperatures by greater than 10C. Possible effects include the induction of eye characters, and various physiological and thermo regulatory responses as body temperature increases. These effects are well established and form scientific basis for restricting occupational and public exposure to EMW (Gandhi *et al.*, 1996, Rhattoy *et al.*, 2007).

Further the studies conducted in Sweden and Germany have established that radiation from a mobile phones are harmful for biological material of living beings and the effects are more on the cells on the cells of brain of children as reported by NRPB 2000. The penetration of electromagnetic wave depends upon the frequency of wave. Higher is the frequency of waves smaller is the distance of penetration because absorption is higher at higher frequency (Agarwal *et al.*, 2006, Wood, 1998, Blackman, 1982). They are associated with large-scale induced currents in the body. Many experimental studies have been conducted for biological effects of EMW. The electric field produced around the transmission tower of EMW, penetrates inside the human body and includes the field at different parts of the body. This electric field produces a potential difference across the cells and tissues of the body and due to this potential difference, cells absorb the power and a growth in temperature is occurred. The growth of temperature produces heating effects and the heating effects lead to change in reaction rates and of current flows (Kumar *et al.*, 2010, Rodrigues *et al.*, 2007).

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 and Singh 1997a, Altamura, 1997 and Black, 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, 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. To regulate the balance between heat production and heat loss, the temperature regulation in humans has evolved with the development of autonomic and behavioral mechanisms but the thermoregulatory mechanism of the human being compensates the effect and reduces the risk at some extent.

Table 1. International Exposure limits for RF fields, 1800MHz

Name of country	Exposure limit in W/m ²
ICNIRP and EU recommendation 1998 – Adopted in India	9.2 W/m ²
Exposure limit in Canada (Safety Code 6, 1997)	3 W/m ²
Exposure limit in Australia	2 W/m ²
Belgium (ex Wallonia)	1.2 W/m ²
Exposure Limit in Auckland, New Zealand	0.5 W/m ²
Exposure limit in CSSR, Belgium, Luxembourg	0.24 W/m ²
Exposure limit in Poland, China, Italy , Paris	0.1 W/m ²
Exposure limit in Switzerland, Italy in areas with duration > 4hours	0.095 W/m ²
ECOLOG 1998 (Germany) <i>Precaution recommendation only</i>	0.09 W/m ²
Exposure limit in Italy in sensitive areas	0.025 W/m ²
Exposure limit in Russia (since 1970), Bulgaria, Hungary	0.02 W/m ²
"Precautionary limit" in Austria, Salzburg City only	0.001 W/m ²
<i>BUND 1997 (Germany) Precaution recommendation only</i>	0.0009 W/m ²
New South Wales, Australia	0.00001 W/m ²

Table 2. Manufacturer Model, SAR Output (W/Kg)

Mobile hand set with model number	SAR (W/kg)
Motorola V195	1.6
Motorola Rival	1.59
Sony Ericsson Satio (Idou)	1.56
BlackBerry Curve 8330	1.54
Nokia E71x & X6	1.53
LG Rumor	1.51
BlackBerry Bold	1.51
Samsung S3650 Corby	0.75
Samsung SGH-G800	0.23
Samsung Blue Earth	0.196

<http://www.icnirp.de/documents/emfgdl.pdf>

SPECIFIC ABSORPTION RATE

The specific absorption rate is defined as the time derivative of the incremental energy (dW) absorbed by or dissipated in an incremental mass (dm) contained in a volume element (dV) of a given density (ρ). It can be defined as

$$SAR = \frac{d}{dt} \left(\frac{dW}{dm} \right) \text{-----} (4)$$

$$SAR = \frac{d}{dt} \left(\frac{dW}{\rho dV} \right)$$

By using Poynting vector theorem for sinusoid ally varying electromagnetic fields. We get

$$SAR = \frac{\sigma E_z^2}{\rho} \text{-----} (5)$$

Where σ the conductivity of the material and E_z be the field inside that material.

This relation represents the rate at which the electromagnetic energy is converted into heat through well-established interaction mechanisms. It provides a valid quantitative measure of all interaction mechanisms that are dependent on the intensity of the internal electric field (Kumar *et al.*, 2010). The amount of heating produced in a living organism depends primarily on the intensity of the radiation once it has penetrated inside the body. Specific absorption rate (SAR) is the most appropriate metric for determining such exposure near the fields of such radiation sources. This SAR also varies with the dimension of tissues (Abdal *et al.*, 2006, Sirav, 2009). The absorbed microwave energy produces molecular vibration and converts the energy into heat. If the organism cannot dissipate this heat is produced, the internal temperature of the body will rise. This heat may damage these biological tissues permanently. Microwave frequency for which the wavelength are of the same magnitude as the dimensions of the human body produce close coupling between the body and microwave field. A large number of heats can be generated to cause severe damage in the body. Such effect of microwave is termed as 'thermal effect'.

The scientific literature reported these thermal effect and SAR distribution in biological objects due to these radiations from different sources (Stang, 2001, Harbell, 2007). Exposure from TV and radio transmitters has been previously studied (Santini, 2002, Rothman, 2009). In present scenario mobile phone has become the basic necessity of human to communicate the distant ones. Hence, to provide a better networking large amount mobile phone towers have been installed depending on the area of coverage and location of site. Nielsen *et al.* (2004) illustrate the perceived risk from mobile phones and mobile masts in residential areas. The rate of temperature change in tissues is assessed by taking the TV transmitters of high frequency radiation as a point source. This work is an extension of our previous research for computing the induced electric field inside the different tissues, specific absorption rate and continuously the rate of change in temperature of the tissues at different depths (Lascher, 1998).

The core temperature (i.e. rectal, colonic, brain) is tightly regulated in the face of marked variations in ambient heat and cold stress, depending on the species. The skin and mucosal surfaces of the body and tissues under the surfaces whose temperature may deviate from the core owing to heat exchange with the environment. Though the human body could compensate for and handle the extra energy load through the thermoregulatory mechanisms without obvious increase in temperature, stress could still develop (Balmori, 2009, Kesari, 2010).

The influence of electromagnetic waves on the human body mainly contributes to heating effect, which is generated by the absorption of energy above 100 kHz (31). It is generally accepted that The SAR is the most appropriate metric for determining electromagnetic exposure, i.e. the mass averaged rate of energy absorption in tissue, is related to the induced electric field E_i (V/m)
 EError! Bookmark not defined.; can be determined at any point from the relation (Adair, 2002, 2003, 2005, 2008)

$$SAR = \frac{\sigma E_i^2}{\rho},$$

where σ is the conductivity of the tissues for which the calculation is made and ρ is their mass density.

The absorption of electromagnetic waves produces temperature change, when a human body of specific heat C , otherwise in thermal equilibrium with environment, is exposed for a duration Δt seconds to these waves, then the local heating to be given by equation (Ahma, 2010, Akimoto, 2009)

$$C \Delta T = SAR(\Delta t).$$

Some standard values of SAR: SAR is expressed in Watts per Kilogram

Current UK Standard = 1.0W/Kg
 Current US Standard = 1.6W/Kg

San Francisco Govt. has made it mandatory for the industry to display SAR value for each phone. (USA Today 14 July, 2010). India adopts ICNIRP guideline for Power density (P_d) = Frequency (MHz) / 200.

For GSM900 (935-960 MHz), $P_d = 4.7W/m^2$ and
 GSM1800 (1810-1880 MHz), $P_d = 9.2W/m^2$.

ICNIRP has considered only thermal effects of radiation and has given following disclosure:

ICNIRP is only intended to protect the public against short term gross heating effects and NOT against 'biological' effects such as cancer and genetic damage from long term low level microwave exposure from mobile phones, masts and many other wireless devices. (Bachmann, 2007, Black, 2006)

Health Effects

Power Absorbed by Human Body: The most common complaints due to the power absorption are given below

1. Cognitive functions -Concentration, memory, behavior, etc
2. Epidemiological studies - Sleep disruption, Headache, Depression, discomfort, irritability, nausea, dizziness, appetite loss, muscle spasms, numbness, tingling, altered reflexes, Subjects reported buzzing in the head, palpitations of the heart, light-headedness, heat, visual disorders, cardiovascular problems, respiratory problems, nervousness, agitation.
3. More severe reactions include seizures, paralysis, psychosis and stroke.

4. Damage the delicate workings of the inner ear. Patients, 18-25 yrs of age - damaged hair cells by radio frequency radiation (RFR) from phones. Hearing problems occur because these cells do not regenerate. All these are related to changes in the electrical activity of the brain.
5. Tinnitus and Ear Damage- Tinnitus or "Ringxiety"-sensation of cell phone ring – in millions of cell phone users. People with severe tinnitus may have trouble hearing, working or even sleeping.
6. Increase in Cancer risk - Cell phone use also increases risk of glioma, acoustic neuroma, salivary gland tumors, uveal melanoma, non-Hodgkin lymphoma, facial nerve tumors, skin, blood, testicular and breast cancer.
7. Children and teenagers, before age of 20 - Five times more likely to get brain cancer if they use cell phones.
8. Mobile phone use >10 years doubles risk of brain cancer. Risk is highest for ipsilateral (on the same side of the head where the instrument is held) exposure (Dein, 2010, Gabriel, 1996, Gabriel, 1996a, 1996b).

Effect on Environment

9. Farm animals - Dairy cows – Decreased milk production, spontaneous abortions, reproductive and developmental problems, and general declines in overall health. •Sheep, dogs, cats, rabbits living near base stations affected.
10. Birds – Interfere with navigation, reproduction, thin shells.
 - i. London - 75% fall sparrow population.
 - ii. Sparrow - 'Red List' of endangered avian species.
 - iii. Fall in Pigeons, swans, white stork, rock dove
_Biological indicators to detect alterations in our ecosystem.
 - iv. Abrupt disappearance of bees in US
 - v. 1/4th (about 2.4 million colonies) lost to CCD.
 - vi. Loss projected to \$8-12 billion on US agricultural economy.
 - vii. US now regularly imports bees from Australia and China.
 - viii. Bees are vital pollinators for agriculture. With vanishing of bees, a major food crisis could ensue.
 - ix. Colony Collapse Disorder (CCD):

- Abrupt disappearance of bees.
- Cannot find their way back to hive due disruption in intercellular communication.

Honey Bees- CCD has hit – US (up to 70 %), England (54% fall), Germany, Spain, Italy, Switzerland, Greece, Scotland, Wales, Kerala etc. (Gandhi, 2008, Habash, 2008 and Herate, 2008)

SUGGESTIONS

When we use mobile phone for communication, try to talk with minimum time and when it is not in use, it should keep

away from our body. The transmission towers are also radiated the electromagnetic energy, thus the people who are living around the towers should keep away from the towers. When we use any model of cell phone, check SAR Values of the set, it is given on Internet, SAR mobile phone Until now, man has been absorbing the harmful, unseen EM radiations without even being aware of it, but now, with rapid advent in technology this RF radiation pollution has started having ill effects on human health and health of animals. Hence, there is an urgent need to take precautionary steps. Example, when a glass is filled with water, it holds up to a certain level, but once it reaches the rim, it starts spilling. Similarly, our bodies can also absorb radiation up to a certain limit.

CONCLUSION

The aim of this manuscript is not to discourage about the use of new technologies like mobile phone, wireless phone, Wi-Fi technology, work on computer etc. But we want to aware the public about the harmful effects of these technologies so that they use some precautions. In addition to continuous radiation from cell towers, there is radiation from cell phones, computers, laptops, TV & FM towers, microwave ovens, etc. additive in nature. Stricter radiation norms must be enforced in India. This does not mean that we have to stop living near these towers. We all know that automobiles create air pollution. Hence came up with unleaded petrol, CNG driven vehicle, hybrid vehicles, etc. Similarly, the solution to avoid excess radiation is to use radiation shields. Mobile companies should not be in the denial mode and accept that radiation causes serious health problems. Only then people all over the world will carry out research to come out with solutions.

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