

Short report on the national activities on EMF

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➤ **General research activities in India related to EMF health –**

- i. **Balakrishnan K, Murali V, Rathika C, Manikandan T, Malini RP, Kumar RA, Krishnan M (2014). Hsp70 is an independent stress marker among frequent users of mobile phones. J Environ Pathol Toxicol Oncol. 2014;33(4):339-47**

The aim of this study was to measure the serum concentrations of heat shock protein (HSP) 70 and C-reactive protein (CRP) and the expression levels of the *hsp70* gene among frequent users of mobile phones (FUMPs). We enrolled 120 employees of information technology (IT)/IT enabled service companies (FUMPs; IT professionals) and 102 infrequent users of mobile phones (IFUMPs; people from non-IT professions) as controls. The serum concentrations of HSP70 and CRP were measured by enzyme-linked immunosorbant assay and *hsp70* gene expression by reverse transcription polymerase chain reaction. Significantly higher concentrations of serum HSP70 ($P < 0.00012$) and CRP ($P < 0.04$) were observed among FUMPs than IFUMPs. A higher level of *hsp70* gene expression (fold induction) was observed among FUMPs than IFUMPs ($P < 7.06 \times 10^{-13}$). In contrast to the duration of exposure-dependent increase of serum concentration of CRP, the serum HSP70 concentration was found to be independent of the duration of exposure to mobile phones. Thus, the study convincingly demonstrated the role of serum HSP and CRP as systemic inflammatory biomarkers for mobile phone-induced radiation

- ii. **Gandhi and Komal. Residential proximity to mobile phone base stations and non-specific health symptoms – A cause for concern? Current Trends in Technology and Science, 3: 337-342; 2014.**

A recently published study funded by ICMR reported increase in various kinds of health symptoms (i.e. headaches, blurred vision, skin and cardiovascular problems, dizziness, depression, nausea, memory loss, tinnitus, loss of appetite, feeling of discomfort and bowel disturbance) in people residing within 200 meters of cell phone towers in comparison to control group. A significant increase in case of headache was observed in female in comparison to male residing near the cell phone tower

- iii. **Mahajan N., Bhat A. and Gandhi G. Genetic damage biomarkers in buccal epithelial cells of healthy individuals staying near three mobile phone base stations. Molecular cytogenetics 2014 7 (suppl 1): P49.**

The author also analysed the genetic damage in some individual residing within 150 meters of cell phone towers. The genetic damage in term of micronuclei and nuclear buds was significantly higher in people residing within 150 meters of cell phone towers. Simultaneously the condensed chromatin and karyolitic cells also showed significant increase in the people residing near the cell phone towers (Mahajan et. al. 2014)

- iv. **Gandhi G., Kaur G. and Nisar U. A cross sectional case control study on genetic damage in individuals residing in the vicinity of a mobile phone base station. *Electromagnetic Biology and Medicine*. 2014, Jul 9:1-11.**

A cross-sectional case control study also reported significant increase in DNA damage with reference to DNA migration length, Damage Frequency (DF) and Damage Index (DI) in people residing within 300 meters of cell phone towers in comparison to people residing more than 300 meters away from the cell phone towers. The study also reported that the females had significantly elevated DNA damage frequency than the male residents.

- v. **Shahin S, Mishra V, Singh SP, Chaturvedi CM. 2.45-GHz microwave irradiation adversely affects reproductive function in male mouse, *Mus musculus* by inducing oxidative and nitrosative stress. *Free Radic Res*. 2014; 48(5):511-25.**

The study reported that MW irradiation induced a significant decrease in sperm count and sperm viability along with the decrease in seminiferous tubule diameter and degeneration of seminiferous tubules. Reduction in testicular 3β HSD activity and plasma testosterone levels was also noted in the exposed group of mice. Increased expression of testicular i-NOS was observed in the MW-irradiated group of mice. Further, these adverse reproductive effects suggest that chronic exposure to nonionizing MW radiation may lead to infertility via free radical species-mediated pathway.

- vi. **Kesari KK, Meena R, Nirala J, Kumar J, Verma HN. Effect of 3G cell phone exposure with computer controlled 2-D stepper motor on non-thermal activation of the hsp27/p38MAPK stress pathway in rat brain. *Cell Biochem Biophys*. 2014; 68(2):347-58.**

The data indicated that microwave radiation emitted from 3G mobile phone significantly induced DNA strand breaks in brain. Meanwhile a significant increase in micronuclei, caspase 3 and apoptosis were also observed in exposed group ($P < 0.05$). Western blotting result shows that 3G mobile phone exposure causes a transient increase in phosphorylation of hsp27, hsp70, and p38 mitogen-activated protein kinase (p38MAPK), which leads to mitochondrial dysfunction-mediated cytochrome c release and subsequent activation of caspases, involved in the process of radiation-induced apoptotic cell death. Study shows that the oxidative stress is the main factor which activates a variety of cellular signal transduction pathways, among them the hsp27/p38MAPK is the pathway of principle stress response. Results conclude that 3G mobile phone radiations affect the brain function and cause several neurological disorders.

- vii. **Meena R, Kumari K, Kumar J, Rajamani P, Verma HN, Kesari KK. Therapeutic approaches of melatonin in microwave radiations-induced oxidative stress-mediated toxicity on male fertility pattern of Wistar rats. *Electromagn Biol Med*. 2014; 33(2):81-91.**

The present study reported that melatonin prevent oxidative damage biochemically by significant increase ($p < 0.001$) in the levels of testicular LDH-X, decreased ($p < 0.001$) levels of MDA and ROS in testis ($p < 0.01$). Meanwhile, it reversed the effects of MWs on XO, protein carbonyl content, sperm count, testosterone level and DNA fragmentation in testicular cells. These results concluded that the melatonin has strong antioxidative potential against MW induced oxidative stress mediated DNA damage in testicular cells.

- viii. Behari J, Nirala JP. Specific absorption rate variation in a brain phantom due to exposure by a 3G mobile phone: problems in dosimetry. *Indian J Exp Biol.* 2013; 51(12):1079-85.

The authors concluded that SAR values are sensitive to the angular position of the moving platform and are well below the safety criteria prescribed for human exposure. The data are suggestive of having a fresh look to understand the mode of electromagnetic field -bio interaction.

- ix. Kesari KK, Siddiqui MH, Meena R, Verma HN, Kumar S. Cell phone radiation exposure on brain and associated biological systems. *Indian J Exp Biol.* 2013; 51(3):187-200.

The present study summarizes the public issue based on mobile phone radiation exposure and their biological effects. This review concludes that the regular and long term use of microwave devices (mobile phone, microwave oven) at domestic level can have negative impact upon biological system especially on brain. It also suggests that increased reactive oxygen species (ROS) play an important role by enhancing the effect of microwave radiations which may cause neurodegenerative diseases.

- x. Indian Council of Medical Research (ICMR) is conducting a multi-disciplinary prospective cohort study to find out adverse effects of Radio Frequency Radiation (RFR), emitted from cell phone on adult Indian population. Under this study efforts are going on to examine whether use of cell phone is associated with reproductive dysfunctions, infertility, neurological disorders (cognitive behavior, sleep related disorders, depression etc.), cardiovascular disorders, Otorhinolaryngology (ENT) disorders and promote cancer. Under this study efforts are also going on to survey the health status of the people residing near the cell phone tower. In addition to the above the ICMR is also funding few more studies in different institutions of the country to address this issue.

➤ **New policies and legislations regarding EMF exposure**

Under the direction of the honorable Prime Minister of India, an Experts Committee has been established at the Department of Science and Technology (DST), Ministry of Science and Technology, Govt. of India to identify the researchable areas to study the effect of electromagnetic radiations emitted from Cell Phones and Cell Phone Towers on human health, animals, environment, plants, agriculture etc.. The Committee invited proposals in the above mentioned areas from various Institutions in the country. Numbers of proposals were received which have been evaluated and around 16 proposals have been approved to conduct research in this discipline.

➤ **Areas of public concern and National response**

Both electronic and print media are regularly raising the concern of the people who are living near the cell phone towers. Even few Court Cases have been filed under various High Courts of the country in relation to installation of cell phone towers and their adverse effect on the health of the people. Various residential welfare associations and number of independent activist have raised the various types of health hazards being faced by the people living near the cell

phone towers. In few cases it has been published in the news paper indicating that the incidence of cancer has increased among the people residing near the cell phone towers.

➤ **New public information activities**

Numbers of public debates are being organized to obtain the views of the people and to educate them regarding the adverse effects of Radio Frequency Radiations emitted from cell phones and cell phone towers.