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Side-Effects of Harmful Radiation from Mobile Phones and Towers

The Indian Council of Medical Research (ICMR) has informed that in a number of studies it has been reported that exposure to radiation from mobile phones causes adverse health effects. But there is no conclusive data available so far on this issue, however the growing body of scientific evidences indicates some bio-effects and possible adverse health effects of Radio Frequency Radiation (RFR) which merit further investigations. Even the World Health Organization (WHO) (2011) after reviewing the studies published from year 2000 to 31st May 2011 classified the radio frequency electromagnetic radiations/field emitted from wireless phone under group 2 B-carcinogen category. Due to this fact numbers of countries have developed health based precautionary guidelines for exposure of EMF from cell phone towers including India.

The ICMR has further informed that there is no scientific confirmed evidence that use of mobile phones causes mental and physical diseases. There is no proven scientific evidence yet to suggest that electromagnetic radiations emitted from mobile phone may lead to cancer, tumour, mental imbalance, dementia, headache and even it can damage DNA of a person.

The ICMR is conducting a multi-disciplinary cohort study in Delhi & National Capital Region (NCR) to find out adverse effects of Radio Frequency Radiation (RFR), if any, emitted from cell phone on adult Indian population. Under this study specific absorption rate, power density, wave length and frequency of RFR emitted from various types of cell phones used by the enrolled subjects as well as from cell phone towers installed at various places in Delhi are measured. The physical characteristics of RFR emitted from various cell phones will be correlated with the clinical & laboratory findings to examine whether use of cell phone is associated with reproductive dysfunctions, male infertility, neurological disorders (cognitive behavior, sleep related disorders, depression etc.), cardiovascular disorders, Otorhinolaryngology (ENT) disorders and promote cancer if any, in Human Volunteers.

In addition to the above, the ICMR has also funded few studies on limited basis in India to address this issue. The summary of the finding of the studies conducted in India in this area given below:-

Studies are being conducted in India on the issues related to Health effects of Radiations emitted from mobile Phone & mobile Phone Tower

1. Department of Human Genetics, Guru Nanak Dev University, Amritsar has conducted number ca studies in this area both on animals and human volunteers. Study reported cytogenetic damage in tissues of some individuals using cell phones over a period of time. The data revealed increaser number of micro nucleated buccal cells and cytological abnormalities in cultured lymphocytes indicating the genotoxic response from mobile phone use. As exposure to radiofrequency radiations has been reported to affect physiological, neurological, cognitive and behavioural changes and to induce, initiate and promote carcinogenesis; threat to human health has been suggested for mobile phone users (Gandhi et al. 2005).

2. In one of the study a correlation between mobile phone use (exposure to radio frequency radiations) and DNA and chromosomal damage in lymphocytes of individuals using mobile phones was observed which may have long-term consequences in terms of neoplasia and/or age-related changes (Gandhi & Anita, 2007).

3. The Indian Council of Medical Research (ICMR) supported an animal study (2005-08) to find out the effect of RFR on male reproduction at Jawaharlal Nehru University (JNU) New Delhi. The results indicated significant reduction in testicular size, weight and in sperm counts. The data also indicated that the chronic exposure to Radio Frequency Radiation (RFR) imitated from cell phone causes a significant decrease in protein kinase C and total sperm count along with increase apoptosis in male rat. The study suggested that decrease in sperm count and increase in apoptosis may be a causative factor due to mobile radiation exposure leading to infertility (Kesari & Behari, 2008).

4. National Institute of Technology (NIT), Calicut, Kerala, has reported headache, dizziness, numbness in the thigh, and heaviness in the chest among mobile phone users. The results indicated an increase in the both parameters when mobile phone is kept close to chest and a decrease when kept close to the head. Mobile phone has caused changes in Heart Rate Variability indices and the change varied with its position. But these observations were not significant in comparison to without mobile condition (Ahmed et al, 2008).

5. PGIMER, Chandigarh, has conducted a study (Panda et al. 2010) and reported tong term and intensive mobile phone use may cause inner ear damage and based on their observations they have recommended following criteria's for the release of harmful rays from mobile phones.

a) Mobile phones should not be used continuously for more than one hour in a day.
b) Hands free technology to be used where excessive use of the mobile phone is unavoidable. This includes use of microphones and Bluetooth so that the handset remains away from the ear and thus avoids the direct impact of harmful electromagnetic radiations on the ear and the brain.

c) People to avoid long talks and discussions on mobile phones as far as possible.

6. In another study a significant increase in peak heart rate, serum total cholesterol, VLDL cholesterol and triglycerides concentration were noticed in acute RFR exposed male students in comparison to control students (Parkar et. al., 2010).

7. Author examined biological effects of 2.45 GHz microwave radiation in Parker strain mice, Locomotor activity was recorded on running wheel for 12 days prior to microwave exposure (pre-exposure), 7 days during the first week of exposure (short-term exposure) and another 7-day split during the last week of the 30-day exposure period (long-term exposure). Microwave radiations caused an increase in erythrocyte and leukocyte counts, a significant DNA strand break in brain cells and the loss of spatial memory in mice. This report for the first time provides experimental evidence that continuous exposure to low intensity microwave radiation may have an adverse effect on the brain function by altering circadian system and rate of DNA damage (C. M. Chaturvedi et al. 2011).

8. Another study concluded that Electromagnetic fields are recognized as hazards that affect testicular function by generating reactive oxygen species ad reduce the bioavailability of androgen to maturing spermatozoa. Thus, microwave exposure adversely affects male fertility (Sanjay Kumar et. al. 2011).

9. The study was taken to estimate the microwave/RF pollution by measuring radiation power densities near schools and hospitals of Chandigarh city in India. The cell phone radiations were measured using a handheld portable power density meter TES 593 and specific absorption rates were estimated from the measured values. These values of electromagnetic radiation in the environment were compared with the levels at which biological system of humans and animals starts getting affected. The values were also compared with the international exposure limits set by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). The highest measured power density was 11.48 mW/m (2) which is 1,148% of the biological limit. The results indicated that the exposure levels in the city were below the ICNIRP limit, but much above the biological limit (Dhami 2011).

10. To study the pathophysiology of microwave radiations and its effect on rat brain, a study was conducted at Jawaharlal Nehru University, New Delhi. The study indicated that a reduction in melatonin or an increase in caspase-3, creatine kinase, and calcium ion may cause significant damage in brain due to chronic exposure of these radiations. These biomarkers clearly indicate possible health implications of such exposures (Kesari et. al. 2012).

11. 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 (Kesari et al., 2013).

12. A specific absorption rate (SAR) measurements system has been developed for compliance testing of personal mobile phone in a brain phantom material contained in a Perspex box. The volume of the box has been chosen corresponding to the volume of a small rat and illuminated by a 3G mobile phone frequency (1718.5 MHz), and the emitted radiation directed toward brain phantom. The induced fields in the phantom material are measured. Set up to lift the plane carrying the mobile phone is run by a pulley whose motion is controlled by a stepper motor. The platform is made to move at a pre-determined rate of 2 degrees per min limited up to 20 degrees. The measured date for induced fields in various locations are used to compute corresponding SAR values and inter-comparison obtained. These data are also compared with those when the mobile phone is placed horizontally with respect to the position of the animal. The SAR data is also experimentally obtained by measuring a rise in temperature due to this mobile exposures and data compared with those obtained in the previous set. To seek a comparison with the safety criteria same set of measurements are performed in 10 g phantom material contained in a cubical box. These results are higher than those obtained with the knowledge of induced field measurements. It is conclude that SAR values are sensitive to the angular position of the moving platform and are well below the safety criteria prescribed tor human exposure. The data are suggestive of having a fresh look to understand the mode of electromagnetic field -bio interaction (Behari et al 2013)

13. Electromagnetic radiations are reported to produce long-term and short-term biological-effects, which are of great concern to human health due to increasing use of devices emitting EMIR especially microwave (MW) radiation in our daily life. In view of the unavoidable use of MW emitting devices (microwaves oven, mobile phones, Wi-Fi, etc.) and their harmful effects on biological system, it was thought worthwhile to investigate the long-term effects of low-level MW irradiation on the reproductive function of male Swiss strain mice and its mechanism of action. Twelve-week-old mice were exposed to non-thermal low-level 2.45- GHz MW radiation (CW for 2 h/day for 30 days, power density = 0.029812 mW/cm (2) and SAR = 0.018 W/Kg). Sperm count and sperm viability test were done as well as vital organs were processed to study different stress parameters. Plasma was used for testosterone and testis for 3β HSD assay_ Immunohistochemistry of 3β HSD and nitric oxide synthase (i-NOS) was also performed in testis, We observed 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 (Shahin et al. 2014).

14. Cell phone radiation exposure and its biological interaction is the present concern of debate. Present study aimed to investigate the effect of 3G cell phone exposure with computer controlled 2-D stepper motor on 45-day-old male Wistar rat brain. Animals were exposed for 2 h a day for 60 days by using mobile phone with angular movement up to zero to 30°. The variation of the motor is restricted to 90° with respect to the horizontal plane, moving at a pre-determined rate of 2° per minute. Immediately after 60 days of exposure, animals were scarified and numbers of parameters (DNA double-strand break, micronuclei, caspase 3, apoptosis, DNA fragmentation, expression of Stress-responsive genes) were performed. Result shows 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 (Kesari et. al. 2014).

15. Present study aimed to investigate the protective effects of melatonin (is well known antioxidant that protects DNA, lipids and proteins from free radical damage) against oxidative stress-mediated testicular impairment due to long-term exposure of MWs. For this, 70-day-old male Wistar rats were divided into four groups (n = 6/group), Sham exposed, Mel atonin (Mel) treated (2 mg/kg), 2.45 GHz MWs exposed and MWs + Mel treated. Exposure took place in Plexiglas cages for 2 h a day for 45 days where, power density (0.21 mW/cm(2)) and specific absorption rate (SAR 0.14 W/Kg) were estimated. After the completion of exposure period, rats were sacrificed and various stress related parameters, that is LDH-X (lactate dehydrogenase isoenzyme) activity, xanthine oxidase (XO), RCS (reactive oxygen species), protein carbonyl content, DNA damage and MDA (malondialdehyde) were performed. Result shows 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 (Meena et. al., 2014).

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The MoS, Ministry of Health and Family welfare, Shri Shripad Yesso Naik stated this in a written reply in the Rajya Sabha here yesterday.

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