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Mobile phone radiation induces reactive oxygen species production and DNA damage in human spermatozoa in vitro.

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Source

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Erratum in

. PLoS One. 2013;8(3). doi:10.1371/annotation/9a8a0172-3850-4059-b852-72c330769c1b.

Abstract

BACKGROUND:

In recent times there has been some controversy over the impact of electromagnetic radiation on human health. The significance of mobile phone radiation on male reproduction is a key element of this debate since several studies have suggested a relationship between mobile phone use and semen quality. The potential mechanisms involved have not been established, however, human spermatozoa are known to be particularly vulnerable to oxidative stress by virtue of the abundant availability of substrates for free radical attack and the lack of cytoplasmic space to accommodate antioxidant enzymes. Moreover, the induction of oxidative stress in these cells not only perturbs their capacity for fertilization but also contributes to sperm DNA damage. The latter has, in turn, been linked with poor fertility, an increased incidence of miscarriage and morbidity in the offspring, including childhood cancer. In light of these associations, we have analyzed the influence of RF-EMR on the cell biology of human spermatozoa in vitro.

PRINCIPAL FINDINGS:

Purified human spermatozoa were exposed to radio-frequency electromagnetic radiation (RF-EMR) tuned to 1.8 GHz and covering a range of specific absorption rates (SAR) from 0.4 W/kg to 27.5 W/kg. In step with increasing SAR, motility and vitality were significantly reduced after RF-EMR exposure, while the mitochondrial generation of reactive oxygen species and DNA fragmentation were significantly elevated ($P<0.001$). Furthermore, we also observed highly significant relationships between SAR, the oxidative DNA damage bio-marker, 8-OH-dG, and DNA

fragmentation after RF-EMR exposure.

CONCLUSIONS:
RF-EMR in both the power density and frequency range of mobile phones enhances mitochondrial reactive oxygen species generation by human spermatozoa, decreasing the motility and vitality of these cells while stimulating DNA base adduct formation and, ultimately DNA fragmentation. These findings have clear implications for the safety of extensive mobile phone use by males of reproductive age, potentially affecting both their fertility and the health and wellbeing of their offspring.

Study of electromagnetic radiation pollution in an Indian city.

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Source

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Abstract
Electromagnetic radiation emitted by cell phone towers is a form of environmental pollution and is a new health hazard, especially to children and patients. The present studies were 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 bel

Environmental hazards: evidence for effects on child health.

Wigle DT, Arbuckle TE, Walker M, Wade MG, Liu S, Krewski D.

Source

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Abstract

The human fetus, child, and adult may experience adverse health outcomes from parental or childhood exposures to environmental toxicants. The fetus and infant are especially vulnerable to toxicants that disrupt developmental processes during relatively narrow time windows. This review summarizes knowledge of associations between child health and development outcomes and environmental exposures, including lead, methylmercury, polychlorinated biphenyls (PCBs), dioxins and related polyhalogenated aromatic hydrocarbons (PHAHs), certain pesticides, environmental tobacco smoke (ETS), aeroallergens, ambient air toxicants (especially particulate matter [PM] and ozone), chlorination disinfection by-products (DBPs), sunlight, power-frequency magnetic fields, radiofrequency (RF) radiation, residential proximity to hazardous waste disposal sites, and solvents. The adverse health effects linked to such exposures include fetal death, birth defects, being small for gestational age (SGA), preterm birth, clinically overt cognitive, neurologic, and behavioral abnormalities, subtle neuropsychologic deficits, childhood cancer, asthma, other respiratory diseases, and acute poisoning. Some environmental toxicants, notably lead, ionizing radiation, ETS, and certain ambient air toxicants, produce adverse health effects at relatively low exposure levels during fetal or child developmental time windows. For the many associations supported by limited or inadequate epidemiologic evidence, major sources of uncertainty include the limited number of studies conducted on specific exposure-outcome relationships and methodologic limitations. The latter include (1) crude exposure indices, (2) limited range of exposure levels, (3) small sample sizes, and (4) limited knowledge and control of potential confounders. Important knowledge gaps include the role of preconceptual paternal exposures, a topic much less studied than maternal or childhood exposures. Large longitudinal studies beginning before or during early pregnancy are urgently needed to accurately measure and assess the relative importance of parental and childhood exposures and evaluate relatively subtle health outcomes such as neuropsychologic and other functional deficits. Large case-control studies are also needed to assess the role of environmental exposures and their

interactions with genetic factors in relatively uncommon outcomes such as specific types of birth defects and childhood cancers. There is also an urgent need to accelerate development and use of biomarkers of exposure and genetic susceptibility in epidemiologic studies. This review supports the priority assigned by international agencies to relationships between child health and air quality (indoor and outdoor), lead, pesticides, water contaminants, and ETS. To adequately address such priorities, governments and agencies must strengthen environmental health research capacities and adopt policies to reduce parental and childhood exposures to proven and emerging environmental threats.ow the ICNIRP limit, but much above the biological limit.

Wei Sheng Yan Jiu. 2002 Oct;31(5):402-4.

[Hazards of radio frequency magnetic field and their prevention and control].

[Article in Chinese]

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Source

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Abstract

The paper briefs the sources of radio frequency (RF) electromagnetic field, their hazards to human health and the hygienic standards of RF electro-magnetic field for occupational exposure and for general population exposure. Based on the physical properties of RF electromagnetic field, the author put forward the comprehensive measures for controlling the electromagnetic radiation to meet the hygienic standards. These measures are improvement of the technology to lower the intensity of RF electromagnetic radiation, shielding the RF radiation sources to reduce the radio frequency levels in accessible areas, increasing the distance between the sources and human, and using personal RF protecting devices in area of high radio frequency levels, etc.. In protecting the general population from exposing to RF radiation, measures keeping a safe distance between the sources and the public play very important role, in which good city planning and the effective control of new and existing RF sources are very important. Referring to the RF electromagnetic

problems by using electrical devices in the household, different measures based on the above principles for controlling RF hazards are also cited.

Bioelectromagnetics. 1999;Suppl 4:52-63.

Thermal models for microwave hazards and their role in standards development.

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Source

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Abstract

We consider the thermal response of the body to radiofrequency (RF) energy, with emphasis on partial-body exposure, to assess potential thermal hazards. The thermal analysis is based on Pennes' bioheat equation. In this model, the thermal response is governed by two time constants. One (tau1) pertains to heat convection by blood flow and is (for physiologically normal perfusion rates) on the order of 3 min. The second (tau2) characterizes heat conduction, and varies as the square of a distance that characterizes the spatial extent of the heating. We examine three idealized cases. The first is a region of tissue with an insulated surface, subject to irradiation with an exponentially decreasing SAR, which models a large surface area of tissue exposed to microwaves. The second is a region of tissue in contact with a hemispherical electrode that passes current into it, which models exposure from contact with a conductor. The third is a region of tissue with an insulated surface, subject to heating from a dipole located close to it. In all three cases, we estimate the maximum steady-state temperature increase as a function of the relevant electrical and thermal parameters and the thresholds for thermal hazard. We conclude that thermal models are a potentially fruitful but underutilized means of analyzing thermal hazards from RF fields. A quantitative analysis of such hazards enables the development of data-based uncertainty factors, which can replace arbitrary "safety factors" in developing exposure limits. Finally, we comment on the need to marry quantitative modeling of data and risk assessment, and to incorporate contemporary approaches to risk assessment into RF standards development.