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TECHNICAL ARTICLE

Mobile Phone Radiations and Its Impact on Birds, Animals and Human Beings

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Abstract

Mobile phone technology has revolutionized the telecommunication system of present times. Mobile phone networking has spun the world altogether and our ecosystem is constantly under the effect of radio frequency radiations from base stations and mobile antennas. The hazardous effects are electro pollution is no less than any other form of environmental pollution. Radio frequency radiations directly affect the bio molecules like DNA and produce genetic and genotoxic defects. Apart from neuronal damage, behavioral changes have been reported in insects, birds and animals. Locomotory defects have been observed in birds which result in inability of birds to fly. Electromagnetic radiation can influence the reproductive capacity of birds, animals and even humans and thus is a serious cause of concern in present era.

Keywords: Electropollution, Ecosystem, Electromagnetic radiation, Neurological defects, Telecommunication.

1. Introduction

Graham bell would have never imagined that his invention would enslave the mankind to such an extent that even toddlers will handle smart phones quite well. The familiarization and dependency on mobile phones is growing at an alarming pace. The advent of wireless technology gave an impetus to mobile phone industry which led to the era of G's (3G/4G) and world shrunk into a small village. Recent advancement in mobile communications has also drawn attention to their biological effects, thereby raising some serious concerns about possible health effects of radiofrequency emissions. The entire civilization, both biosphere and mankind are exposed to exponentially increasing radio frequency (RF) radiation from base stations and satellite antennas. The result of such increased exposure to radio frequency can have thermal and non thermal effects on health. Thermal effects are mainly due to extended conversations over a long period of time by holding mobile phones close to body. Secondly, there could be possibly non thermal effects from both phones and base stations, the effects being cumulative. People living in the vicinity of mobile phone base stations or dwelling in houses where mobile phone antennas are erected on roof tops are most threatened among entire population. Health endpoints reported to be associated with RF include childhood leukemia, brain tumors, genotoxic effects, neurological effects and neurodegenerative diseases, immune system deregulation, allergic and inflammatory responses, infertility and some cardiovascular effects.

2. Impact on Humans

In a cross sectional case control study conducted to study genetic damage in individuals living in vicinity of mobile base stations, it was found that power density in the area within 300 m from the base station exceeded the permissive limits and was significantly higher compared to the area from where control samples were collected. Genetic damage parameters of DNA migration length, damage frequency (DF) and damage index were significantly elevated in the sample group compared to respective values in healthy controls. 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. The increased reactive oxygen species (ROS) play an important role by enhancing the effect of microwave radiations which may cause neurodegenerative diseases. Disturbance of the nervous system leads to behavioral changes and may serve as an early indicator of disturbances in regulatory functions of many systems. Exposure of the neural tissue to RFR can cause electrophysiological changes in the nervous system such as efflux of calcium ions from brain tissue. The non systematic and sudden calcium efflux can manifest in many irregularities of

neuronal control as calcium ion plays an important role in the functions of the nervous system such as the release of neurotransmitters. Moreover, RFR activates endogenous opioids in the brain, which in turn causes a decrease in cholinergic activity leading to short-term memory deficit. The stress hormone ‘‘corticotropin releasing factor’’ is also involved. The inhabitants around mobile base station antennas significantly complain or develop headache, memory changes, tremors, dizziness, and depressive symptoms and sleep disturbance than controls.

3. Adverse Effects on Animals

Living organisms are exposed to variable levels of radiofrequency electromagnetic fields depending upon the distance from phone masts, presence of metallic structures which are able to reflect or obstruct the waves (buildings or other obstacles), and number of phone masts, orientation and position. In recent years, animals have been chronically exposed to microwaves and RFR (Radiofrequency radiation) signals from various sources, including GSM and UMTS/3G wireless phones and base stations, WLAN (Wireless Local Area Networks), WPAN (Wireless Personal Area Networks such as Bluetooth), and DECT (Digital Enhanced (former European) Cordless Telecommunications) that are erected indiscriminately without undertaking studies on environmental impact. As in humans radiofrequencies induce biological effects on biomolecules that include changes in intracellular ionic concentration, cellular proliferation, interferences with immune system, effects on animal’s reproductive capacity, effects on stress hormones in intrauterine development, genotoxic effects, effects on the nervous and circulatory system, and a decline in the number of births. Numerous studies have pinpointed cellphone towers as a potential cause in the decline of animal populations. Animals exposed to electromagnetic fields can suffer a deterioration of health and changes in behavior. Frequent deaths in domestic animals; such as, hamsters and guinea pigs, living near mobile telecommunication base stations have been witnessed. Electromagnetic radiation can exert an aversive behavioral response in bats. Bat activity is significantly reduced in habitats exposed to electromagnetic field strength greater than 2 V/m. It has been reported in a study that the number of free-tailed bats (*Tadarida teniotis*) decreased in a bat colony, when several phone masts were placed 80m from the colony. Experimental studies on rats have revealed mobile phone exposure has detrimental effects on sperm motility leading to decreased fertility in males and dystrophic changes in reproductive organs in female rats. Not only terrestrial species, amphibians have equally bore the brunt of indiscriminate mushrooming of cellphone towers. Amphibians are important components of the ecosystem and reliable bio-indicators; their moist skin, free of flakes, hair or feathers, is highly permeable to water chemicals (particularly larvae) and air pollutants (especially adults). These characteristics make amphibians especially sensitive to environmental conditions, changes of temperature, precipitation or ultraviolet (UV) radiation and reliable monitors of local conditions. Radiation emitted by phone masts affects the development of tadpoles leading to increased mortality. Disappearance of amphibians and other organisms is part of the global biodiversity crisis which can have serious implications on the ecological balance.

4. Adverse Effects of Radiation on Birds

The extensive use of mobile phones has been accompanied by public debate about possible adverse effects on human health. However, little is known about the effects of long-term exposure that is experienced by birds and other helpless creatures inhabiting near mobile phone base stations. Ornithologists assert that one would never see a sparrow, pigeon, or any bird flying or staying near the cell tower, the reason being increased absorption of radiation owing to large surface area of bird in comparison to human body (power = power density x area). Since fluid content is small due to less weight, it gets heated up very fast and also the magnetic field disturbs their navigational skills. When birds are exposed to weak electromagnetic fields, they disorient and begin to fly in all directions, which explain migratory birds undermining navigational abilities. Millions of migratory birds die each year from collisions with telecommunication masts. Birds are believed to be using earth's magnetic field for navigation, and get severely disoriented by the microwave radiation from telecommunication masts.

During recent decades there has been a marked decline of the house sparrow population. London has witnessed a steep fall in its sparrow population; a 75 percent fall since 1994. There have been dramatic declines, almost to the point of extinction in Glasgow, Hamburg, Dublin, Belgium, etc. Behavioral changes have also been observed among birds close to the phone antennae. Frequent fighting, youngone mortality and abandoned nests have been witnessed in vicinity of phone antennas. In an experiment, 75% of chicken embryos that were exposed to a GSM mobile phone during incubation died compared to 16%, who were not exposed to any radiation. The eggs laid in nests near towers fail to hatch. A general disappearance of birds like Kestrel, White Stork, Rock Dove, pigeons, Magpie has been observed near mobile telecommunication base

stations. Locomotive problems, breeding problems, and tendency to stay long in lower parts of the trees and on the ground have been observed. House sparrow is associated with human habitation. Being very sensitive to changes in the environment, it is one of the most preferred indicator species of urban ecosystems. A stable house sparrow population indicates a healthy ecosystem for human beings in terms of air and water quality, vegetation and other parameters of habitat quality. There has been an enigmatic decrease in population of house sparrows which in itself is hinting that the urban ecosystem is experiencing some environmental changes unsuitable for human health in the immediate future.

5. Effects on Insects

Insects are the key species of ecosystem and they are very sensitive to electromagnetic radiation or even minute changes in the environment. A study in South Africa has revealed a strong correlation between decrease in ant and beetle diversity with the electromagnetic radiation exposure. A decrease of insects and arachnids near base stations has been detected and corroborated by engineers and antenna's maintenance staff. In houses near the antennas, an absence of flies, even in summer, has been noticed. The radiation affects the gonadal development of insects in a non thermal way. The disappearance of insects could have an influence on bird's weakening caused by lack of food, especially at the first stages in a young bird's life. In another study, it was revealed that exposing fruit flies (*Drosophila melanogaster*) to mobile phone radiation, elevated stress protein levels (Hsp70) which usually means that cells are exposed to adverse environmental conditions (non-thermal shock). Albert Einstein had said, ''If the bee disappears from the surface of the earth, man would have no more than four years to live." Electromagnetic pollution has lead to what is called in bees as Colony Collapse Disorder (CCD) where bees cannot find their way back to the hive as a result of consistent electromagnetic back ground noise that seems to disrupt intercellular communication within individual bees. In England, the bee population has fallen by 54 percent between 1985 and 2005 compared to an average of 20 per cent across Europe. Recently, a sharp decline has also been noticed in commercial bee population in Kerala posing a serious threat to honey bees, hitting apiculture. The state has the highest density of mobile towers. Similar cases have been observed in Bihar, Punjab, Nepal and other parts of India and have been attributed to increasing electro pollution in the environment. When honey bee colonies were exposed with radiation, the honeycomb weight and area were reduced and returning time of honey bees increased compared to similar non-exposed colonies. Several other studies show that the high-frequency electromagnetic fields of mobile phones alter the resonant stimulus of living organisms and can cause modifications in certain areas of their brain. Changes in the brain structure of bees can be a cause of alterations of the returning capabilities of bees. Bees are estimated to pollinate 90 commercial crops worldwide. Scientists warn that the steady decline in bees and other pollinators could trigger crises bigger and more immediate than global warming. Apart from the controversy over the possible health effects electromagnetic fields, the electromagnetic interaction of radio waves with biological system needs to be quantitatively evaluated. While a lot of efforts have gone into resolving the issue, a clear picture has yet to emerge. In the light of current knowledge there is enough evidence of serious effects from this technology to biosphere. The World Health Organization has classified radiofrequency electromagnetic radiation as a potential carcinogen (class 2B), the same classification used for lead, chloroform, and emissions from automobiles. Total cell phone subscriptions amounted to more than 6 billion in 2013, corresponding to a global penetration rate of 93.1% per 100 inhabitants. Pondering over these grave statistics one can easily conclude that virtually every part of biosphere is exposed to continuously increasing RF radiations and in near future electro pollution will engulf whole universe. For this reason precautionary measures should be developed, alongside environmental impact assessments prior to installation, and a blanket ban on installation of phone masts in protected natural areas and in places where endangered species are present.

6. Conclusion

Apart from the controversy over the possible health effects electromagnetic fields, the electromagnetic interaction of radio waves with biological system needs to be quantitatively evaluated. While a lot of efforts have gone into resolving the issue, a clear picture has yet to emerge. In the light of current knowledge there is enough evidence of serious effects from this technology to biosphere. The World Health Organization has classified radiofrequency electromagnetic radiation as a potential carcinogen (class 2B), the same classification used for lead, chloroform, and emissions from automobiles. Total cell phone subscriptions amounted to more than 6 billion in 2013, corresponding to a global penetration rate of 93.1% per 100 inhabitants. Pondering over these grave statistics one can easily conclude that virtually every part of biosphere is exposed to continuously increasing RF radiations and in near future electro pollution will engulf whole universe. For this reason precautionary

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