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Review

Mobile phone and base stations radiation and its effects on human health and environment: A review

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ABSTRACT

A review of the impact of mobile phone and base station radiation on human health and the environment has been presented here. Cell phone is an important invention in human history that has revolutionized people's lifestyles. As mobile phones have become an integral part of human daily routine, the quality of life around the world has improved significantly. However, concerns about the exposure of people, flora and fauna to radio frequencies are not new. The satisfaction and convenience derived from the use of cellular phones is threatened by claims that the radiation emitted by the devices has unfavarable impacts on human health. The effects of radiation may be classified into non-thermal and thermal. Thermal effects are similar to those of cooking in a microwave oven. The non-thermal effects are not properly defined, but it is been learnt that the these effects are three to four times more hazardous than the thermal, which remains controversial. A brief picture of the Indian scenario of cell phone industry and the number of mobile towers in India was discussed. The effects of radiation emitted from cell phones and base stations on wildlife, humans and the environment were summarized with suitable examples and studies conducted by various voluntary organizations.

Introduction

Today is the age of wireless communication which gifted us with to cell phones. Mobile phones are the recent innovation and a popular mode to communicate nowadays. It is a long-range, portable, and wireless electronic communication device (Das, 2012). The telecommunication sector has exponential growth rate on a global scale and mobile phones are popular and necessary gadget in the modern culture and society which the society people to maintain constant and unlimited communication without limiting their freedom of movement. Since the of on set mobile phones 1980's, the total number of mobile phone subscribers and installed base stations have increased significantly. The report of Ericson mobile subscriptions outlook shows around 8.2 billion worldwide mobile subscribers and projected the figure will reach 9.1 billion by the end of 2027 (Ericson Mobile Subscribers Outlook Report, 2021).

Today's technologically advanced mobile phones can not only receive and make calls, take photos, store data, access email and the Internet, but the introduction of mobile phone applications has changed people's lifestyles across the board. According to one estimate, there were about 4.42 million apps in the Google and Apple stores combined. These devices and mobile apps have proved to be lifesavers when it comes to helping people in emergencies. For example, mobile apps such as 'm-health technologies' are used to prevent or treat childhood and adolescent obesity (Turner et al., 2015). However, individual mobile phones work by communicating with a fixed facility called as a base station or telecommunications structure. The use of mobile phones has increased probably and has been accompanied by a parallel raise in concern about the health hazards associated with exposure to the electromagnetic fields (EMF) generated by them at their installed stations. Mean while the mobile phone and its base station are two-way radios that generate radio frequencies (RF). Since the advent of mobile phones, concerns have been raised about the potential health risks of exposure to RF and microwave EMF (Dash & Mehta, 2011). RF radiation is non-ionising radiation with a

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wavelength of 3 kHz to 300 MHz, microwaves varies from 300 MHz to 300 GHz. The usual frequencies of cell phones and telecommunication networks limits from 900 MHz to 1.8 GHz and up to 8 GHz (2 G to 5 G networks) (Sanchez, 2006). In recent decades, the usage of mobile phones has increased rapidly worldwide and the impact on human health has attracted enormous attention. This impact has issues about societal exposure to radiation produced by cell phones and the possible interaction between RF, EMR and biological effects on human soft parts, especially the brain and human behaviour patterns are matters of concern (Aly et al., 2008; Rafiqi et al., 2016).

Mobile market industry in India

Mobile industry has revolutionised the telecommunication scenario in the world in general and in India in specific. Due to its many benefits and comfort, mobile phones have witnessed exponential growth in the last decade (Roy , 2018). Currently, India is one of the largest and fastest developing telecom industries in the world. In terms of total number of phone users, India's telecom network is the second largest in the world. As of April 2022, 1.2 billion people use mobile phones (TRAI Report GOI, 2022). The unparalled growth in phone density and a sharp reducyion in several packages in India's telecom sector have contributed significantly to the country's fast growing economy. Telecom not only contributes about 6% to India's GDP, but along with information technology (IT) has also crutialy propelled the growth of social and economic sectors (National Telecom Policy (NTP) Report, 2012). The gross revenue of the Indian telecom sector is about US$ 8.74 billion in the first quarter of FY22 (The Hindu, Chennai, India, 21 March 2011). The size of the Indian mobile device market is estimated at US$139 billion in 2021 and is expected to reach US$281 billion, according to Research and Markets, Dublin. (Research & Market, 2021).

With 150 manufacturers dealing in gadgets, the Indian mobile market is very aggressive. India is an important market for gadget manufacturers, accounting for about 12% of global sales. With more than 687.6 million internet users in 2020 (Research & Market, 2021), India has the second largest internet user base in the world. The widespread use of cell phones has inevitably raised the question of whether there are implications for human health. Is it safe to use mobile phones excessively? Is radiation from cell phones harmful? Scientists believe that any radiation is not good, especially at microwave frequencies such as those used for communication amongst mobile phones and base stations.

Case studies

Radiation levels in Hyderabad

The dangers posed by cell phones and radiation from cell towers are on the list of likely worrisome problems for developing countries. Several telecom operators and multinational companies are working to develop better quality services that are also environmentally safe for the environment and people (Roy, 2018). A survey conducted by the electronic media group TV9 explains that the radiation limits are many times higher than the range prescribed by the International Commission on Non-Ionising Radiation Protection (ICNIRP) (International Telecommunications Unit (ITU), 2011) in the capital of Telangana (HYDERABAD) and that attention must be paid to radiation limits and their impact on human health. The conclusion of investigation report is summarised below

The Media group was surveyed by using a broadband monopole antenna of gain = 2 dB and spectrum analyser to estimate the radiation ranges at a various location in front of the transmitting towers and at different angles from the tower (within and off the main beam lobe) and a distance ranging from 50 m to 150 m at different heights, outside and inside the buildings (Worldwide Cell Phone Safety Recommendations & Policies, 2011). Following the annual report of the Telecom Regulatory Authority of India (TRAI) 2022, in India there are about 727,000 mobile towers are established by the different telecom companies ((NTP report, 2012). There are nearly 24,961 towers present at only Hyderabad (NTP report, 2012).

Table 1.1
Classification of Radiation Levels.

Radiation ranges in mill watts/metre ^{2}	Type of Zones
0–600	Safe zone
600–1000	Little Bit Danger Zone
1000–4000	Danger zone
>4500	Most dangerous Zones

RF radiation is computed in the terms of milliwatts/meter^2. As per the survey of Worldwide Cell Phone Safety Recommendations and Policies conducted by World Health Organization (WHO) and ICNIRP, the ares/ zones that are having various levels (Table 1.1) and the Radiation ranges in different countries are listed as follows (Table 1.2)

TV9 reports reveal that most of the zones are having radiation levels within the level of 4000- 4500 milliwatts/ meter^2, areas like Toley chokey, Apollo Hospital (Punjagutta), Jublie hills (M.L.A Quarters), Care Hospital (Banjara Hills), and the Telangana State Secretariat falls in the most dangerous zones (>4500 milliwatts/meter^2) (Worldwide Cell Phone Safety Recommendations & Policies, 2011). Following the Environmental protection act 1986, the installation of cell towers and base Station Antennas should be at 300 m away from residential buildings and antennas should not directly face the building, and they may be avoided from schools and hospitals because children and patients are more susceptible to EMFs. (WWW.TV9/30minutes.com).

The most widely accepted finding in the survey was that all mobile companies violated the Environmental Protection Act of 1986 by placing base stations and antennas near sensitive areas such as schools, hospitals, and residential areas in the aforementioned areas (Fig. 1).

In the other major cities of A.P. (Vishakapatnam, Vijayawada and Tirupathi etc.), the same violations of rules are committed by the telecom operators (Worldwide Cell Phone Safety Recommendations & Policies, 2011).

Case studies affected by the installation of cell towers and mobile radiation

One of the builders in Riddhi Park, Thakurlee (West), had installed a cellular tower infront of the building. Ms Bhat, who had moved into the top floor flat, was diagnosed with a "brain tumour" after four months. She always felt tired and had white rashes all over her body. Her next-door neighbour delivered a baby with spinal cord cancer. Another neighbour had a child with "birth defects" and the baby died shortly after birth. Demolition of high-rise building is now being demanded by all residents of the building. Despite the residents' requests, the developer had installed another tower. Ms. Bhat has left her flat and is now residing at Goregaon, where she has expended about 10 lakh on treatment for a brain tumour. However, her health is improving now. Mr Bhagwant Deshpande from Solapur has reported 9 cancer deaths living within 91 metres of the couple of towers. Details of the deceased are presented below (Fig. 2):

Table 1.2
Permissible limits of Radiation levels in various countries.

Country Name	Radiation levels in milliwatts/meter^2
Swiss	42
Russia	100
China	100
America	3000
India	4500

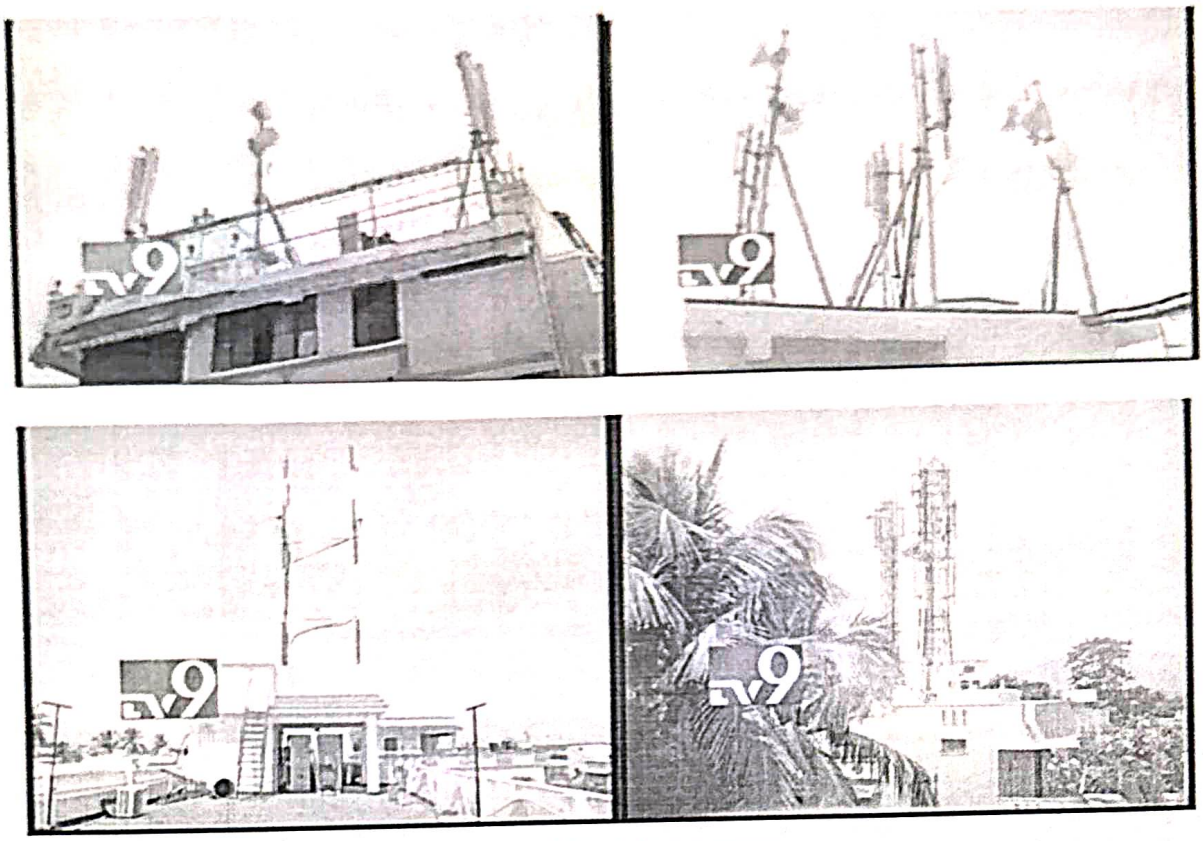

Fig. 1. Rules violation by telecom operators.

Another case study on Usha Kiran building, Mumbai

Swanky Usha Kiran building in Mumbai notices the four cancer patients they might be related to the cell towers installed on the Vijay Apartments opposite." The picture was taken from the Usha Kiran building and shows the various antennas installed on the 7th floor of the Vijay Apartments (Fig. 3). People living on the 6th, 7th and 8th floors of the opposite building maximum radiation as they are located on the main beam direction. The people residening on the other floors subjected to receive less radiation as the radiation maxima are probably minimized, as you may see from the vertical radiation pattern. In turn, in the horizontal direction, people staying in front of antenna receive more greater radiation than people residing on the back side of the antenna (Guidelines for Installation of the Mobile Towers, Ministry of Communications and Information Technology, GOI, New Delhi, 2019).

With recent directives in the public interest from the Government of India (GOI), the Ministry of Telecommunications issued a Government Order (G.O.) in September 2011 stating that the information SAR such as the IMEI (International Mobile Equipment Identity) number, which is used to identify the model, should be displayed on mobile phones (NTP Report, 2012). For cell phones, the specific absorption rate value (SAR) is now 1.6 W/kg averaged over one gramme of human tissue (NTP report, 2012). Previously, the SAR value for mobile phones was 2 W/kg measured over 10 gs of human tissue. "Every new mobile phone manufactured must comply with this standard (www.Midday.com/news)". In the US, the SAR limit for mobile phones is 1.6 W/Kg, which is generally for 6 min of use each day. There is a safety limit of 3 to 4, so that a person should not use the mobile phone for less than 30 min per day. This information is not widely known to public in India, so millions of people use cell phones for more than an hour a day without being aware of the health risks involved (Dash & Mehta, 2011).

Radiation effects on human health

All mobile phones emit a type of radiation known as electromagnetic field (EMF), which consists of waves of electrical and magnetic energy travelling together through atmosphere. Micro and radio waves emitted by transmitting antennas are a form of electromagnetic energy called radio frequency (RF) or radiation (www.mobileindian.com). The SAR is the unit of measure for the amount of RF energy absorbed by tissue in the human body while using mobiles. It is computed in terms watts/kilogramme (W/Kg) (www.ehhi.org). When the human body is exposed to EMR, it absorbs the radiation because the human body is made up of 70% liquid. The human body size is much larger than the wavelength of the transmitting frequencies of mobile phone towers, so there are multiple resonances in the body, which create local heating in the body (Batool et al., 2019). There is some research reporting possible adverse health effects from EMR and RF radiation emitted by cell phones and base stations.

Wireless phones can affect the brain, Swedish study

The study was conducted on animals, but the results can easily be applied to humans. Henrietta Nittby from Lund University in Sweden

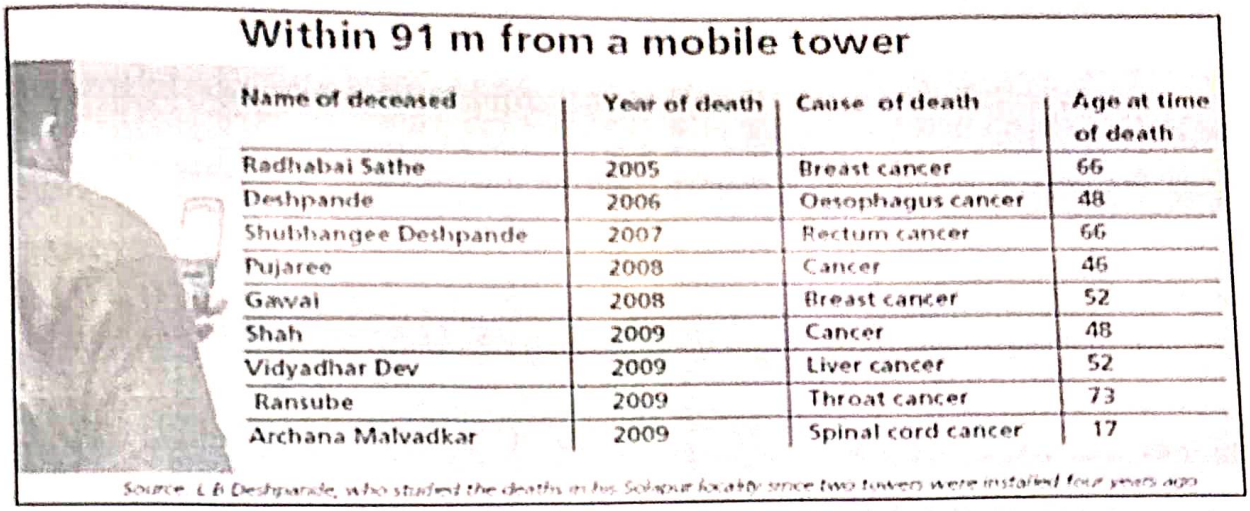

Fig. 2. Names of deceased persons year wise.

studied rats exposed to radiation of mobile phones. The investigators attached the mobiles to the sides of the rats' small cages using coaxial cables, allowing for intermittent direct exposure, and varied the intensity of the radiation in each treatment group to demonstrate the range of exposure a human mobile user might experience over the same period of time (Lalrinthara & Zaithanzauva, 2014). After 50 days, the 2 h exposure, the rats' brains showed considerable damaged neurons as well as blood vessel leakage. Higher the radiation exposure, greater the more damage. The control animals, on the other hand, showed little or no damage. If human brains are badly affected, it leads to long-term mental deficits (Lalrinthara & Zaithanzauva, 2014))

In addition, the team also found certain types of nerve damage and the cells in the cerebral cortex and hippocampus, the memory centre of the brain, observed after one to two months, showed changes in the activity of a huge number of gene groups that are functionally linked (www.ehhi.org) (Fig. 4).

Effect on male reproductive system

The Working Group of the Environment studies on 10 humans found a startling variety of concerns in sperm exposed to mobile phone radiation. The most striking finding was that men who carried their mobile phones in their pockets or on their belts were more likely to have lower sperm counts and/or more inactive or less mobile sperm (Grafström et al., 2008). These results were consistent with similar findings in laboratory animals. Overall, the study results suggest that exposure to mobile phone radiation can lead to a decrease in sperm motility, sperm count, and vitality, as well as increase the scope of sperm damage, DNA damage and changes in sperm morphology. Scientists have not yet found a mechanism by which mobile phone use could cause such effects (Baan et al., 2011; De Iuliis et al., 2009; Kesari et al., 2018; Makker et al., 2009) (Fig. 5).

Studies on the harmful effects of mobile phones on human sperm have been conducted in the Australia, Austria, Hungary, Poland, South Africa, Turkey and United States, using different protocals. Men who carried a mobile phone in their hip belt or on their pocket had 11% fewer mobile sperm than men who carried the phone elsewhere on their body (Sharma and Lamba, 2017). Men who carried a mobile phone on their belt and used it intensively during a five-day test period had a 19% decrease in high-mobility sperm (Kilgallon and Simmons, 2005). Men who talked on the phone for more than an hour a day had 17% fewer high-mobility sperm than men who talked on the phone for

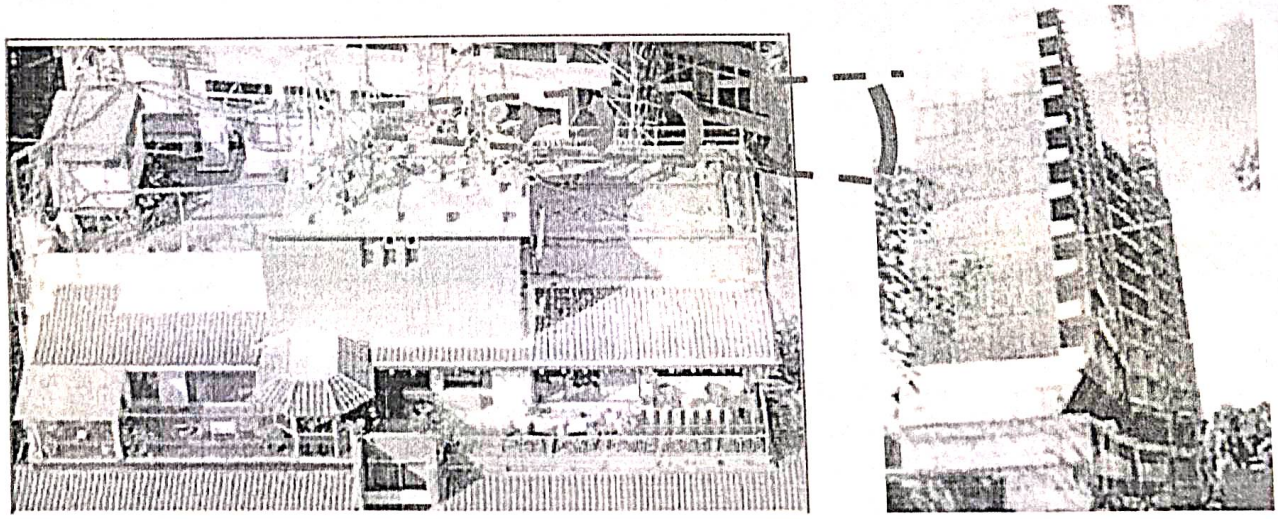

Fig. 3. Mobile towers installed on Vijay Apartments terrace at Carmichael Road, Mumbai.

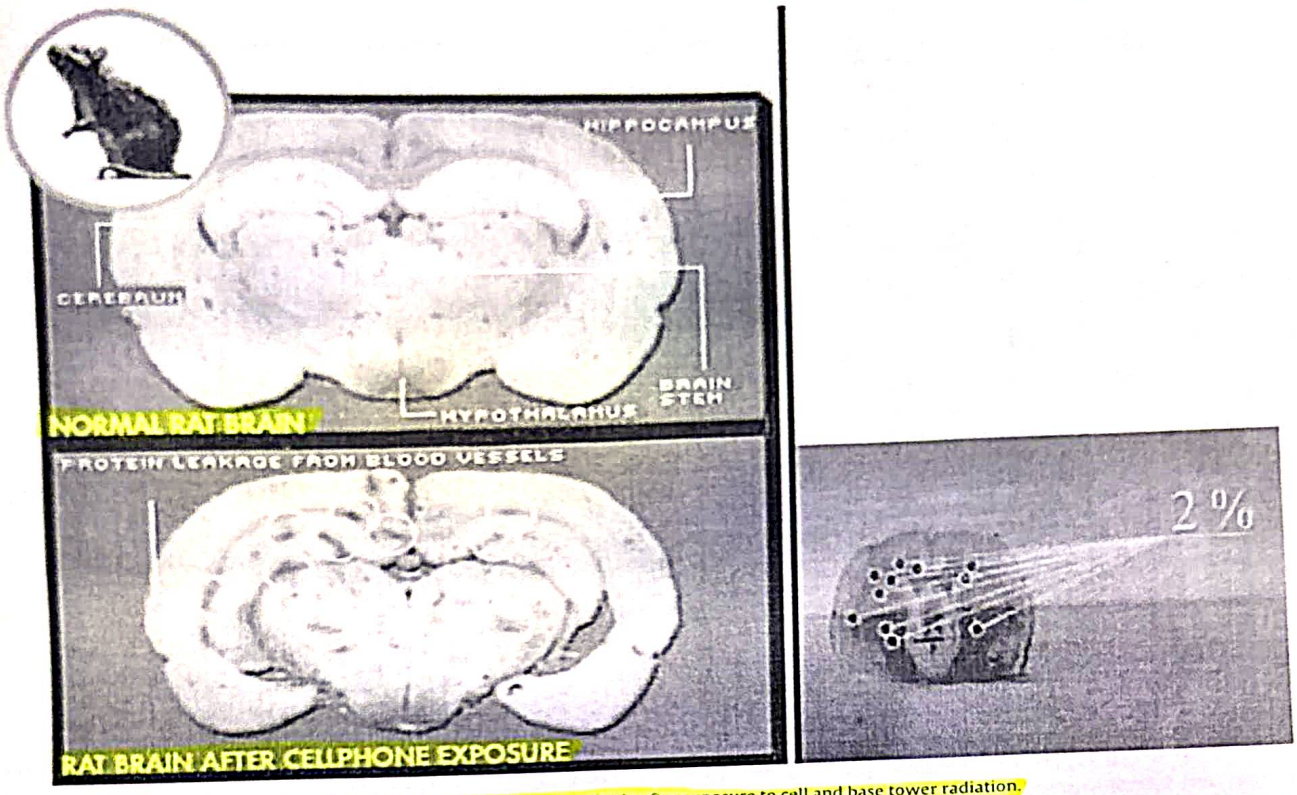

Fig. 4. Shows normal rat brain and rats brain after exposure to cell and base tower radiation.

less than 15 min a day (Surendran et al., 2020). Laboratory studies on the effects of mobile phone radiation on rabbits, rats and other animals have found parallel effects on reproductive health (Fejes et al., 2005; Kesari et al., 2011). All of these studies found a statistically significant association between mobile phone radiation and sperm health. However, opinions differ on the possible mechanism by which mobile phone radiation could cause these changes (Mailankot et al., 2009).

The other effects on human health from mobile phones and base station radiation are described in various studies as follows. Headaches, warmth in the ear and burning sensations on the skin of the face were reported (Falzone et al., 2011). Radiation from mobile phones and base stations can trigger Alzheimer's disease by decreasing acetylcholine levels, a chemical in the brain that is crucial for memory and learning (Lonns et al., 2005). Long-term exposure to base station radiation leads to the development of intraepithelial tumours, neurocognitive symptoms, nerve sheath tumours (including acoustic neuromas) and sleep disorders (Sharma & Lamba, 2017).

Mobile phone use before bedtime delays and reduces sleep, causes depression and confusion, and affects brain physiology. The recent findings are particularly leathai to the children and adolescents as they use mobiles at night and also hold the phone next to their head. This leads to personality and mood swings, depression, poor concentration and lack of academic performance (Sharma & Lamba, 2017).

Effects on infants and pregnant women

Children are more susceptible to mobile phone radiation because of their tiny head and brain, thinner skull bones, more elastic ears, thinner, skin, smaller volume of blood cells, and greater conductivity of nerve cells, they absorb more energy than adults and the energy penetrates deeper (Kumar, 2010). The absorption of EMR from a mobile phone (frequency - GSM 900 MHz) by an adult, a 10-year-old and a 5-year-old child is shown (Fig. 6) (www.mobileindian.com). When the radiation hits the head, it penetrates the skull. The yellow area at the bottom is where the cell phone is at the ear. The radiation penetrates the skull of an adult (25%), a 10-year-old (50%) and a 5-year-old (75%).

The younger the child, the deeper it penetrates because its skull is thinner and still developing. For these reasons, children under 16 should only use mobile phones for short, important calls, as the risk of getting a brain tumour is much greater for them. Brain tumours have now replaced leukaemia as the leading cause of death in infants (Kumar, 2010). For these reasons, countries such as France, Belgium, Finland, Germany, Israel, and Russia have publicly discouraged the use of mobile phones by children. Sweden reported that the likelihood of developing brain tumours is increased by 420% amongst mobile phone users who started using phones as teenagers or younger (ITU,2011). A pregnant woman and the foetus are both at risk because these RF radiations constantly react with the developing embryo and multiply cells. Microwave radiation can damage the placental barrier, the membrane that prevents the passage of some substances amongst maternal and foetal blood and protects the foetus, which means that pregnant women should avoid mobile phones or use them only in emergencies..

Effects on patients with pace makers

Close and prolonged exposure to EMR can have adverse effects on the heart: Pacemakers, implantable cardiovascular defibrillators (ICDs) and pulse generators can cause cardiac arrhythmias. Radiation emitted from mobile phones and transmission towers can interfere with implanted pacemakers and regularly interrupt the delivery of pulses or create a type of external control pulse that can lead to patient death (Sharma & Lamba 2017).

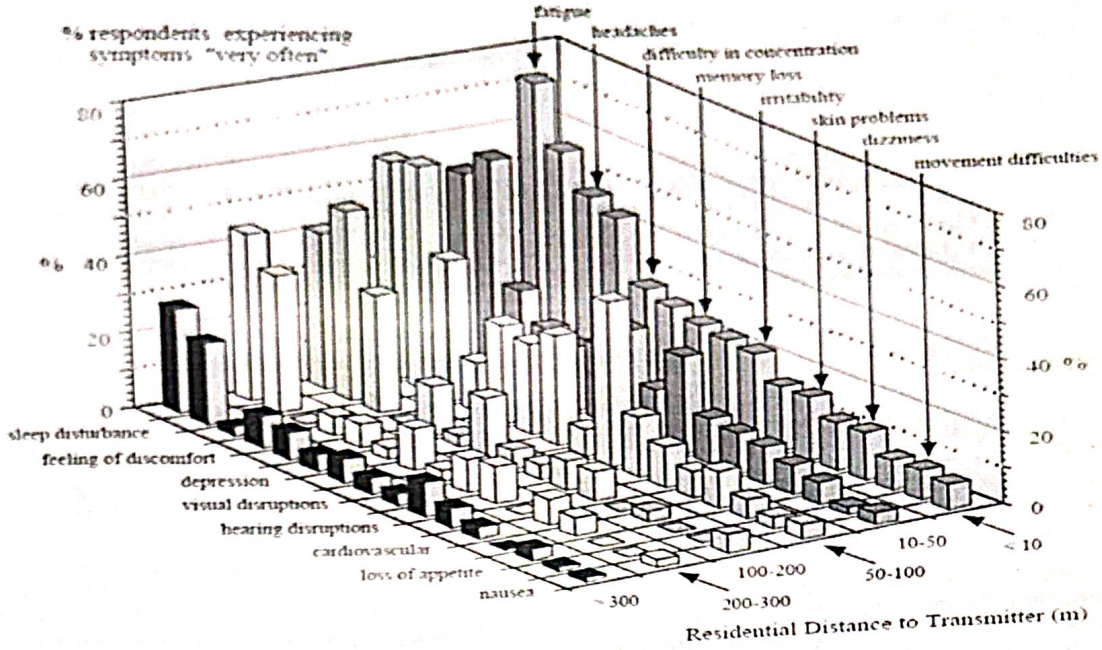

Fig. 5. The Response of residents near a mobile phone base station.

Radiation effects on flora and fauna

EMR from mobile phones and towers affects birds, animals, plants and the environment (Panagopoulos et al., 2007; Surendran et al., 2020). One would rarely see a pigeon, a sparrow, a bee, or any other bird staying and flying near a mobile phone mast. This is because the surface area of a bird is relatively larger than its weight compared to a human body. Therefore, it absorbs more radiation (power = power density x area). Since the fluid content is small due to its lighter weight, it heats up very quickly and the magnetic field also interferes with its navigation capabilities (Kumar et al., 2021).

On honey bee

A few years ago, an abrupt death of bees was observed, which was linked to increasing exposure to electrosmog. The bees are unable to locate their way back to the hive due to constant background electromagnetic noise, which seems to disrupt the intercellular communication of individual bees (Kumar, 2018; Taye et al., 2017). This is called Colony Collapse Disorder (CCD).

Recently, a sharp decline in the commercial bee population has also been noticed in Kerala, causing a serious danger to honey bees and affecting beekeeping (the breeding of bees on a commercial scale to produce honey). Several other studies show that the radiofrequency EMFs from cell phones can alter the resonance stimulus of living organisms and cause changes in specific areas of their brains (VanEngelsdorp et al., 2010). Changes in the brain structure of bees may be a cause of changes in the bees' ability not to return. It is not only honey bees that is lost if populations continue to decline. It is estimated that bees pollinate 90 crops worldwide (Kumar, 2018; Sharma & Neelima, 2010). The current death/disappearance of honeybees may have serious consequences on human health. Scientists believe that the gradual decline of bees and other pollinators could trigger pollution crises larger and more immediate than global warming (Johnson et al., 2009). Fortunately, the alarm bells have been rung and it is high time to develop strategic plans to protect not only honeey bees, but also human life and the environment from the negative impacts of such EMR.

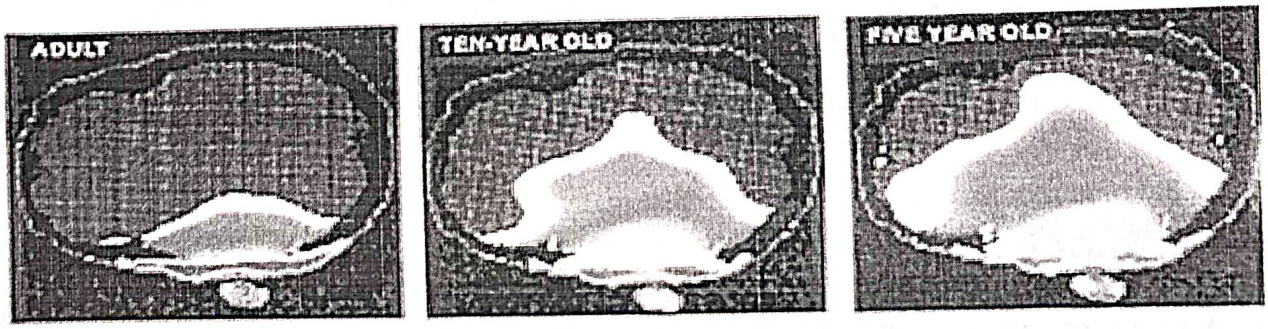

Fig. 6. Absorption of EMR from a mobile phone according to age (Frequency GSM 900 MHz).

...ects on birds

When birds are exposed to weak EMFs, they become disoriented and start flying at all directions, which explains why migratory birds undermine their navigational abilities. Many birds such as sparrows, pigeons, swans etc., get loose their way from the new "invisible enemy", namely cell phone towers. In India, the sparrow population has declined sharply, by 75% since 1994. Research indicates that the disappearance of the birds is owning to the GSM telephone masts correlate closely in time (Panagopoulos et al., 2007). The Bible prophesied this long ago "How long shall the land mourn, and the herbs of every field wither, for the wickedness of them that dwell therein? the beasts are consumed, and the birds; (Jer 12:4). The house sparrow is associated with human settlement; it is one of the preferred indicator species for urban ecosystems. A massive house sparrow population at the settlements is a safe indication of healthy environment in terms of water and air quality, vegetation and other habitat quality parameters. A fall in bird population, on the other hand, is a alarming signal that the healthy ecosystem is experiencing the alarming changes in the immediate future that are unsuitable for human health in future.

To monitor the breeding capacity of the White Stork population, Spain has hatched. 60 nests during May to June 2003. 30 nests were situated within 200 m of cell phone masts and the other 30 at a distance of more than 300 m from any transmitter. forty per cent of the nests near the antennas were without young, compared to 3.3% for nests further away (Everaert & Bauwens, 2007; Summers Smith, 2003). Behavioural changes were also observed in the birds near the telephone antennas. Young birds died for unknown reasons and pairs of birds frequently quarrelled while building their nests. Some nests were unfinished so the storks remained passive in front of the antennas (Summers Smith, 2003). Microwaves from telephone masts also affect the reproductive system of birds. In one experiment, 75% of chicken embryos exposed to radiation during the breeding season died, compared to 16% that were unexposed to radiation (Everaert & Bauwens, 2007). It was found that birds nesting in 27 towers abandoned their nests within a week. Eggs laid in nests near transmission towers did not hatch (Everaert & Bauwens, 2007).

Effect on mammals and amphibians

Studies carried out in Germany has shown that cattle grazing near mobile phone masts are more likely to have still births, spontaneous abortions, malformations, behavioural problems and a general deterioration in their health. Moving herds of cattle away from such poles has been reported to result in immediate improvements in health (Loshcer & Kas, 1998). Exposure of dairy cows to magnetic fields can also lead to a decrease in milk yield, altered milk composition and fertility problems. Not long ago, a considerable raise in micronuclei in erythrocytes was found in the blood of cows grazing in the vicinity of transmitter station. This is indicative of a genotoxic effect of exposure, i.e. the abnormal and unwanted change will pass on to next generations. Obviously, a weakened immune system in cattle, developmental and reproductive problems in cats and dogs, fear and alarm in rabbits and the frequent death of pets such as guinea pigs and hamsters placed in the vicinity of tower cell phone masts have been observed (Kumar, 2010). Electrosmog is also a possible cause of deformities and declines in some amphibian populations. In amphibians such as newts and frog tadpoles, morphological abnormalities, allergies, changes in blood count, increased heart rate, cardiac arrhythmias and increased mortality have been observed. Bat movement is considerably hampered in locations exposed to EMFs. In one study, the number of bats in a free-tailed bat colony decreased when several telephone poles were located 80 m away from the colony (Balmori, 2006).

Effect on plants

Apart from animals, Honey bees and birds, the EMR generated by mobile phone masts may also affect crops, vegetables and plants in their vicinity. Many investigations revels that mobile phones EMF can smother seeds and retard germination ability and root growth. Inaddition, affecting the overall crop growth and yield is minimized (Sharma et al., 2009; Tkalec et al., 2009). Declines in wheat and maize yields have also been reported in fields near high EMF (Soja et al., 2003). Progressive damage to trees near telephone poles has also been noticed. Trees planted within the main beam were dry, pale, have withered tops and show little growth and high vulneratibility to diseases and plagues (Alattar et al., 2017; Balodis et al., 1996).

Recommendations/suggestion to reduce the ill effects of cell phone tower radiation

- Only use a mobile phone if a conventional phone is not available.
- Always hold the phone to the left side of the ear when talking on the mobile phone so that the radiation does not directly affect the brain.
- Use a wired headset or leave the mobile phone in speaker mode for most calls
- Keep your mobile phone away from your body in a handbag, briefcase or carry bags etc., rather than in your trousers pocket where it is pressed against you. However, this is a common practice of many males across the world.
- Avoid long conversations and frequent phone calls as much as possible. Use a landlinefor longer phone calls.
- Find a strong signal and stick with it - If your mobile phone has a poor signal, it is difficult to transmit and receive, and that means higher radiation exposure.
- Wait until the call is established before holding the mobile phone to your left ear, this is another way of reducing exposure to the radiation.
- Use the toggle method - Since mobile phones emit much more radiation when sending than when receiving, one can reduce radiation exposure by holding the phone away from your ear when talking and close to your ear only when listening.
- Buy a mobile phone with a low SAR number. Avoid using a cell phone in metallic spaces such as lifts, where the radiation has nowhere to go but into the body.

Conclusion

This study reports and summarises some research done by different institutions and organisations. The work was motivated by the fact that the public is concerned about the threat posed by the use of mobile phones. The use of mobile phones is increasing tremendously day by day, but most people are not aware of the impact of mobile phones on human health. However, operators are competing with each other to attract more customers and are building mobile towers in every possible corner of the country to expand their own network coverage, even though the operators claim there are no health concerns. Some studies (Asl et al., 2019; Larik et al., 2016; Maregu, 2016; Singh et al., 2020;) report that there is a strong correlation between mobile phone radiation to the major health problems in people. However, some studies report that there is no impact on non-ionisation radiation exposure from mobile phones and base stations (Meena et al., 2016; Schoemaker et al., 2005; Schüz et al., 2006). On the other hand, some reports suggest that prolonged use of cell phones and exposure to mobile and base stations leads to abnormal mental disorders, sleep disturbances, concentration difficulties, headaches, irritability, dizziness and hypertension (Lönn et al., 2004).

Nevertheless, everyone has observed a sharp decline in the population of house sparrows (Passer domesticus), which can be attributed, amongst other things, to radiation from base stations. Therefore, it is high time to conduct multidisciplinary studies to decipher the effects of radiation from mobile phones and cell towers on humans and the environment. It is also imperative that policy makers and executive bodies enforce stringent radiation norms.

Declaration of Competing Interest

None.

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