American Journal of Biology and Natural Sciences
https://biojournals.us/index.php/AJBNS
ISSN: 2997-7185

The Effect of Mobile Phone Electromagnetic Waves on Fetal Health

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Received: 2024, 15, Apr
Accepted: 2025, 21, May
Published: 2025, 24, Jun

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Annotation: Many women use smartphones extensively during pregnancy for a variety of purposes, including learning how to care for their infant, talking to their doctor and other family members, browsing websites that sell baby supplies, and other things that force them to hold their phones for long hours. Today's mothers are constantly exposed to various sources of electromagnetic fields before and even during pregnancy. It has recently been proven that exposure to mobile phone radiation during pregnancy can have negative effects on fetal brain development and cause hyperactivity. Researchers have shown that behavioral problems in laboratory animals, similar to attention deficit hyperactivity disorder (ADHD), are caused by exposure to mobile phones in utero. A study conducted by a team of doctors at the Barcelona Institute for Global Health in Spain, which included more than 80,000 cases of mothers and their children in Denmark, Spain, Norway, the Netherlands, and Korea, revealed that children whose mothers used their phones during pregnancy suffered from hyperactivity and other behavioral problems, such as

inattention and lack of concentration.

Introduction

Today we live in a technological era whose expressions and names vary to describe it, including the era of the global technological revolution, and the era of information technology and the technological explosion. This revolution has contributed to the emergence of many achievements and inventions, including the mobile phone, which has undergone many developments until it became a smart phone [1].

In the era in which communication technology allows for the provision of services in various fields and the exchange of information, as it is considered one of the most important outlets for communication with others, which has led to the excessive use of communication means, and the use of social media as a modern social and cultural phenomenon results in a group of negative and positive effects in all educational, social, psychological and health fields. This is what was confirmed by the UNESCO report that the challenges of the twenty-first century impose on societies the necessity of adopting media education, considering that social media is one of the forms of new media in developing the child's personality so that he is at a level of awareness and sufficient understanding that enables him to avoid the negative effects resulting from the use of social media and increase the positive effects [2].

Many of the electronic equipment we commonly use in daily life, such as mobile phones, tablets, and wireless communication devices (Wi-Fi), create electromagnetic fields (EMF) at different levels [3].

While the lowest frequency of these electromagnetic fields is 3-30 Hz (50-60 Hz), which is what we encounter a lot in daily life, the frequency range of mobile phones, which is the most dangerous and most widely used for humans, is hundreds of megahertz (MHz)[4].

Mobile phones, which are part of the electromagnetic spectrum, are the most common sources of radio frequency fields [5].

Mobile communication services are a major concern for people as they are the fastest growing area in the telecommunications industry. It has been mentioned that mobile phones operate between 300 MHz and 3 GHz (GHz) within the global mobile communication system GSM [5].

3G mobile phones are known to operate in the frequency range from 1900 MHz to 2200 MHz[6].

Studies indicate that excessive use of mobile phones during pregnancy may negatively affect the health of the fetus. Research has shown that frequent exposure to the electromagnetic waves emitted by these devices can lead to behavioral problems in children later in life, such as hyperactivity, anxiety, and poor memory.

The negative effects of smartphones on humans

The professor, who invented mobile phone chips while working for an electronics company, said that mobile phone radiation hits brain cells approximately 215 times per second, resulting in a 4% higher cancer risk than normal. The German professor added that cancer in adults resulting from environmental hazards can only be detected more than ten years after initial exposure, making it imperative to conduct long-term studies and research.

A number of specialists in the fields of health, science and psychology have warned against children's excessive use of smart devices to the point of addiction, pointing out the great dangers resulting from this, especially its psychological, physical, health and social effects. The most prominent effects are the following [7]:

(1) It causes eye problems such as dry eye due to changes in brightness, patterns, shapes and colours.

Image 1: Dry eyes due to phone use

(2) Device separation phobia: Nearly two-thirds of teens and young adults check their phones every 15 minutes or less. The anxiety and stress of missing a text or Facebook update can negatively impact their health.

(3) Lifestyle diseases: Teenagers spend a lot of time on their devices, which affects digestion, breathing rate, heart rate, and sleep quality and time.

(4) Posture problems while standing and sitting due to staring at the phone for long periods with the neck bent and arms held in a fixed position cause pain, muscle spasms, insomnia, inflammation in the cervical vertebrae, and stiffness in the thumb, neck, and back.

(5) It negatively affects concentration. You don't own your phone, it owns you. Researchers in Finland found that people check their screen, news, email, and apps every moment.

(6) Affects cell growth When a group of ninth-grade students in Denmark had difficulty concentrating because they slept with their phones on.

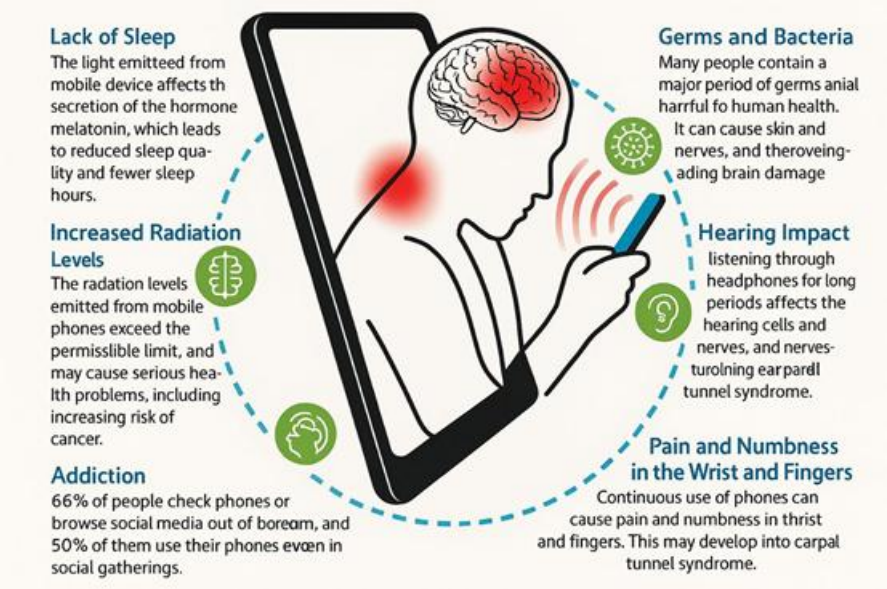


Image 2: The negative effects of mobile phones on humans

The effect of electromagnetic radiation on humans

In response to public concern, the World Health Organization (WHO) established the International Electric and Magnetic Fields (EMF) Project in 1996 to evaluate the scientific evidence on the potential health effects of electromagnetic fields in the frequency range 0–300 GHz. They stated that although extensive research has been conducted on the potential health effects of exposure to many parts of the frequency spectrum, all reviews conducted to date have indicated that as long as

exposures are below the limits recommended in the ICNIRP (1998) EMF guidelines, which cover the entire frequency range 0–300 GHz, such exposures produce no known adverse health effect [8].

In 2011, the International Agency for Research on Cancer (IARC), an agency of the World Health Organization, classified wireless radiation as Group B2 possibly carcinogenic. This means that it may have a risk of causing cancer.[9]

In 2018, the US National Toxicology Program (NTP) published the results of its ten-year, $30 million study on the effects of radiofrequency radiation on laboratory rodents, which found “clear evidence” of malignant heart tumors (endocardial cell tumors) and “some evidence” of malignant gliomas and adrenal gland tumors in male mice.[10]

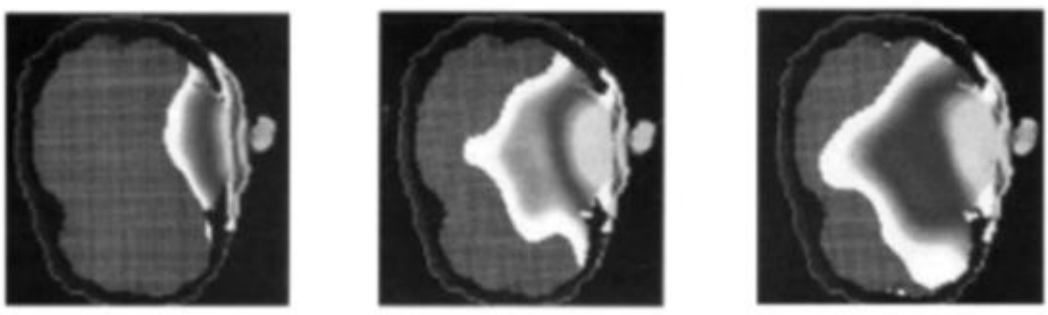
In 2019, scientists from the US National Toxicology Program (NTP) published an article stating that radiofrequency scientists had found evidence of "significant" DNA damage in the frontal cortex and hippocampus of the brains of male mice and in the blood cells of female mice. In 2018, the Ramazzini Cancer Institute's study on cell phone radiation and cancer published its findings, concluding that "the RI findings on far-field RF exposure are consistent with and reinforce the findings of the NTP study on near-field RF exposure, both of which reported increased incidences of brain and heart tumors in RF-exposed Sprague-Dawley rats. These tumors are similar to those observed in some epidemiological studies of cell phone users. These experimental studies provide sufficient evidence to warrant a re-evaluation of the International Agency for Research on Cancer (IARC) conclusions regarding the carcinogenic potential of RF in humans." [11]

International guidelines on exposure levels to microwave electromagnetic fields, such as the International Commission on Non-Ionizing Radiation Protection (ICNIRP), specify power levels for wireless devices, and it is rare for such devices to exceed these guidelines. These guidelines consider only thermal effects and do not take into account the published results of biological effects in studies from the NTP and the Ramazzini Institute. The official position of the UK Health Protection Agency (HPA) is that "there is no conclusive evidence yet that Wi-Fi and wireless local area networks adversely affect the health of the general population."[11]

Thermal effects generally occur when microwave exposure exceeds approximately 10 mW/cm . Research and studies on laboratory animals have shown that microwaves with frequencies ranging from 200 to 22,000 MHz are considered lethal if the product of the intensity of exposure to these rays and the exposure time is sufficient to raise the temperature of the tissue or organ above the equilibrium temperature with the surrounding organs by more than 5 degrees Celsius [12].

For example, mice exposed to microwaves at a frequency of 3000 MHz, with a power density of 300 mW/cm2, suffered from a temperature increase of 8 to 10 degrees Celsius, and all of them died after 15 minutes of exposure to a power density of 100 mW/cm2. The mice died after 25 minutes of exposure due to a temperature increase of 7.6 degrees [13].

Depth of thermal effects in the human head



Adult human Child aged 10 years Child aged 5 years

Figure 3: The effect of thermal depth on humans

The effect of electromagnetic radiation on the fetus

Research into the effects of electromagnetic fields on living organisms began in 1961. The biological effects of exposure to them have been discussed for years. It has been reported that mobile phone users may be affected by their nervous system as a result of exposure to them, especially in the head area [14].

Mothers are now constantly exposed to various sources of electromagnetic fields such as mobile phones, base stations, and Wi-Fi networks before and even during pregnancy.

Recent findings show that exposure to electromagnetic radiation in the radio frequency range (EMR-RF) emitted by mobile phones during pregnancy may have negative effects on brain development in offspring, causing hyperactivity[15].

Image 4: Mothers' use of the phone during pregnancy

Researchers have shown that behavioral problems in laboratory animals that appear similar to ADHD are caused by in-utero exposure to mobile phone radiation[15].

Over the past years, our laboratory has focused on studying the health effects of exposure of laboratory animals and humans to some common and/or occupational sources of electromagnetic fields such as mobile phones and their base stations [16], mobile phone jammers [17], laptop computers, radars [18], dental cavitrons, and MRIs [19].

The purpose of this study was to investigate whether maternal exposure to different sources of electromagnetic fields affects the rate and severity of speech problems in her children.

Another study reported differences in kidney, liver, and eye tissues in animals exposed to second-generation (G2) or third-generation (G3) mobile phone radiation [20].

In addition, abnormalities in synaptic transmission of pyramidal neurons in the prefrontal cortex have been reported in rats exposed to radiation from mobile phones during pregnancy.

Studies have shown that mice exposed to 900 MHz mobile phone radiation for an hour stimulated dental germ cells, causing them to erupt prematurely [21].\

Studies conducted on living organisms have indicated that studies conducted in vivo and in vivo in the frequency range 900-1800 MHz cause DNA damage [22].

A study also reported that vascular occlusion, changes in vascular smooth muscle, intima-media thickening, and inflammation in the outer layer occurred after radiation exposure [23].

Turidi et al. [24], examining the heart tissue of young male mice in the prenatal period exposed to 900 MHz radiation. Another study analyzed the heart tissue of mice exposed to 50 Hz radiation, and in both studies, it was reported that the electromagnetic field caused apoptosis in heart tissue.[25]

Comparing fetal development, a significant regression was observed in the experimental groups.

The growth disturbance was more pronounced in the group exposed to the magnetic field for a longer period (48 hours), while it was relatively less pronounced in the fetuses of the group exposed to the magnetic field for a shorter period.

Recommendations

1- Reduce phone usage time

2- Improve the environment around the holder and keep the phone away from the body when not in use.

3- Promoting health awareness and educating pregnant women about the importance of reducing exposure to electromagnetic waves.

4- Providing awareness programs in hospitals and clinics about the safe use of mobile phones.

5- Encourage ongoing scientific research and support long-term studies on the effects of electromagnetic radiation on pregnancy.

6- Developing new technologies that reduce radiation emitted by electronic devices.

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