

POTENTIAL AND RECOGNIZED EFFECT OF ELECTROMAGNETIC FIELD ON HUMAN NERVOUS SYSTEM AND CARCINOGENESIS

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Abstract. The main and potential effects of radiofrequency and intermediate electromagnetic fields on the human nervous system and the processes associated with the expression and repair of DNA are considered. Arguments to the harmfulness and safety of using EMF in everyday life are provided and explanations for contradictory hypotheses are provided. Safety measures are suggested when using electrical appliances and gadgets.

Keywords: electromagnetic field, radio frequencies, sleep, carcinogenesis, DNA, nervous system.

Анотація. Розглянуто основний та потенційний вплив радіочастотного та проміжного електромагнітного поля на нервову систему людини та процеси, пов'язані з експресією та репарацією ДНК. Наведено аргументи щодо шкідливості та безпечності використання ЕМП у побуті та надано пояснення щодо суперечливих гіпотез. Запропоновано заходи безпеки при користуванні електротехнікою та гаджетами.

Ключові слова: електромагнітне поле, радіочастоти, сон, канцерогенез, ДНК, нервова система.

Introduction. An electromagnetic field from a physical point of view is a state of space characterized by the electrodynamic nature of forces acting on electrically charged objects and consists of two independent components: electrical and magnetic. The extent of the effect of the field on the body is determined by the intensity of the field, the distance to the object, the frequency and specific power. It should be noted that the electromagnetic field can be natural and unnatural. Natural sources include cosmic bodies, Earth, lightning, and even living organisms, since they also have a flow of electrical impulses. The unnatural electromagnetic field was created over the last 100 years, but in 1995 the term "Global Electromagnetic Pollution" was introduced, and the level of the Earth's electromagnetic background exceeds the natural one by 200,000 times [1].

Analysis of the current status of the issue. In the last 30 years, about 25,000 papers have been published concerning the effects of electromagnetic fields on the human body and other organisms. It is supposed that the risks of EMF "can't not to exist", but there is very few specific evidence. The basic issues for the experiments are the effects on the nervous system, mutagenesis and carcinogenesis. Some researchers believe that public concern may be unfounded, given the insignificance or absence of influence of EMF in human everyday life ranges.

The objective of the article: o review and compare the results of experiments on the effects of EMF on the nervous system and carcinogenesis, to draw conclusions about the minimum necessary safety measures when using household appliances and

gadgets.

Research methods, materials and results.

EM radiation is divided by frequency range at the level of:

- static (0 Hz)
- very low frequency fields (0-300 Hz)
- intermediate (300 - 100000 Hz)
- radio frequencies (100 kHz-300 GHz)

Most people are exposed to radio frequencies, sources of which are household appliances, gadgets, etc. [1].

Of particular interest is the effect of EMF on the human nervous system, since CNS disorders are associated with many abnormalities in the body's functioning, as well as the likely carcinogenic effect of EMF.

According to studies in rats, EMFs from communication stations and cell phones do not actually exceed the standards approved by the Ministry of Health [2]. The specific absorption coefficient of electromagnetic energy (SAR) for a cell phones at operating frequencies of 0.5 - 1.0 W / kg, which is twice less than the safe level, but given the number of EMF sources, the absorption level is much higher than the standard limit and apoptosis is possible then. glial cells of the hippocampus and cortex [4].

However, there is still no reliable information on the cumulative effect of the combined effect of EMF [5].

EMF causes oxidative reactions and inflammatory processes that are precursors to diseases such as Alzheimer's disease and sclerosis [6]. Radiation from the phone can cause memory loss, and long-term Wi-Fi action, 2 hours a day for a month, can increase the risk of developing Alzheimer's. Studies have also been described indicating the possibility of cardiovascular disease, skin problems, irritability, hearing and vision problems, depressive states in people living near antennas [3]. One of the hypotheses for the occurrence of various neurological effects is the proximity of the cranial NA to the phone. Changes in sleep patterns and other disorders can be due to mechanisms such as heating, autophagy activation, ion channel changes, and membrane demyelination [7].

The impulse field or low-intensity field can also be used for targeted induction of apoptosis or membrane permeability for drugs, treatment of diseases of the supporting system and even tissue regeneration [5] and treatment of Parkinson's disease, schizophrenia, epilepsy [8].

There have been many studies of the effect of EMF on sleep, but they have yielded very controversial results that can only be explained by the multifactorial influence. There is even a suggestion that some people are more susceptible to EMF due to genetic background or health status. At the same time, most studies of radio frequency bands show that they affect the function of the circadian system, due to changes in the secretion of melatonin and cortisol - the main hormones of the circadian system. There is even a hypothesis for the association of impaired secretion of melatonin with carcinogenesis, but research findings should be considered rather negative [1].

Recent experiments on the effects of radio frequency on human sleep have shown that women are more exposed to GSM900 and TETRA, but this does not indicate that sleep disturbances from electromagnetic waves suggest that these mechanisms are related to skin thermoregulation [9].

A very debated issue is the effect on EMF carcinogenesis.

The International Agency for Research on Cancer attributes radio frequency EMF to group 2B (potential carcinogen). At the same time, there is a group of researchers who believe that the evidence of carcinogenic and mutagenic effects of EMF on DNA is still insufficient, since it is not possible to extrapolate in vitro or animal studies to humans [5].

It is known that under the influence of EMF free radicals are formed, which lead to DNA breaks and apoptosis of brain cells. However, the relatively short-lived effect of cellphone EMF does not lead to mutations in brain cell DNA. Positive results of the influence of EMF on mitochondrial function are available. Another factor of influence is the overheating of the body during the action of electromagnetic waves [4]. The absolute risk of leukemia among children is 0.0045% [8].

A separate risk group is people with cardiac electronic implants, who may also be exposed to EMF. In particular, safety systems and induction plates operating in the intermediate frequency range can create electromagnetic interference for such implants, but the level of exposure is also determined by other factors [10].

All experiments aimed at establishing a causal relationship between a particular factor and a health effect make it very easy to detect this relationship when it is obvious and the impact is really significant. Unfortunately, to distinguish a small effect from none at all is much more difficult, so if EMF at typical environmental levels would be strong carcinogens, then it would be easy to show. It is also very difficult to assess the background level of EMF, since a person in his or her life is surrounded by many devices that she actively uses. According to WHO recommendations, in order to reduce the effect of EMF on the body, it is necessary to simply keep a safe distance, so that the intensity of EMF falls sharply already at a distance of 30 cm from the ultra-high frequency radiation source. However, the guidelines of the International Commission on Non-Ionizing Radiation Protection provide that the maximum level of radio or microwave frequencies that a person may experience is at least 50 times lower than the threshold level [11].

Conclusions. The negative impact of EMF on the human body exists, which is confirmed by many experimental studies, but often this effect can be overestimated, which creates public concern about the use of household appliances and gadgets.

The article analyzes the degree of danger of EMF for humans, considering the proper use of electrical appliances and keeping a distance does not actually pose a health threat. It has been proven that the true impact of EMF cannot yet be unambiguous, and research findings may in many cases be misinterpreted.

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