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The Effect of Modulated Microwaves on the Central Nervous System

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Abstract

An overview of the work on the effects of microwaves on the central nervous system is given. The effect of microwaves on the human brain was studied in order to repeat the results of Alan Frey, who discovered the so-called sound effect. The experiment gave a negative result. However, it was found that as the frequency increases, the modulated electromagnetic field affects the reticular formation, which causes a decrease in tone. The study was conducted using the Anfimov tables. The cumulative effect of exposure to microwaves was also found.

Keywords: Brain; DNA; Non-Thermal Effect; Eddy Currents

Abbreviations: EMF: Electromagnetic Field; EHF: Extremely High Frequencies; SanPiN: Sanitary Rules And Regulations.

Introduction

The effect of the electromagnetic field on living systems was studied in Presman AS, et al. [1-4]. Microwave high-density power flow causes, among other things, oncological diseases. The electromagnetic field of the radio frequency range, according to the International Agency for Research on Cancer, belongs to the group of factors 2B-this is "possible carcinogenicity for humans." According to official statistics, young soldiers serving in the radio engineering forces have cancer 4 times more often than the local population over the age of 60. The EMF of EHF, i.e. the millimeter range, penetrates the human body by a maximum of 5 mm, since the higher the frequency, the greater the skin effect and the stronger the absorption.

Extra high frequency fields of the centimeter range penetrate at a depth of 10-15 cm, they are used in phthisiology. If the density of the microwave EMF power flux is small, does not cause a thermal effect, the EMF passes freely through the human body. In Russia, sanitary rules and regulations (SanPiN) 2.2.4.1191-03 "Electromagnetic fields in production conditions", as well as a number of other regulatory documents, in particular: SanPiN 2.1.8/2.2.4.1383-03 "Hygienic requirements for the placement and operation of transmitting radio engineering facilities", SanPiN 2.2.4.1329-03 "Requirements for the protection of personnel from the effects of pulsed electromagnetic fields", SanPiN 2.5.2/2.2.4.1989-06 "Electromagnetic fields on swimming facilities and marine structures. Hygienic safety requirements". In Ukraine, the hygienic standards of the GDR (MPD) 5803-91 "Maximum permissible levels (MPD) of exposure to electromagnetic fields (EMF) in the frequency range 10 kHz -60 kHz.

SanPiN standards have been adopted regarding the power flux density of electromagnetic radiation in the radio frequency range 10 kHz-300 GHz: in the Russian Federation (the same as in the USSR), Belarus, Kazakhstan, Poland-10 mcW/cm^2 . In Ukraine: 100 MW/cm^2, in the USA, Europe (excluding some countries), in Japan, South Korea: 200-1000 mcW/cm^2, in Canada: 130-2000 mcW/cm^2, in China: 10 (40)-2000 mcW/cm^2. In Russia and Belarus, the maximum speed limit is exceeded everywhere, but according to the norms of the USA, China or Canada, it is ten times less than the accepted maximum speed limit.

However, microwave EMF at a non-thermal level can nevertheless affect the human body. For example, if the frequency of electromagnetic radiation coincides with the natural frequency of torsional vibrations of human DNA spirals, this leads to a decrease in the ability of DNA to self–repair, therefore, sharply increases the number of single-strand breaks in the DNA chain, which leads to cell death. Secondly, this effect prevents DNA replication, which also leads to cell death. The ranges of some American cellular communication frequencies, as well as Wi-fi, overlap with the natural frequency range of torsional vibrations of human DNA spirals, thus they can be dangerous [5].

Some radio frequencies, on the contrary, are stimulating for the human body, for example, for the hypothalamus, see Kholodov Y [6]. It turned out that exposure to radiation on the hypothalamus of rats leads to an increase in their life expectancy.

If you try to rid a person of the weakly alternating electric and magnetic fields of the Earth, this will affect his health, which is especially important in cosmic space.

The effect of EMF on the central nervous system and, in particular, the brain has also been studied in some detail [7-11]. For example, Sudakov KV [10] discusses experimental data indicating the effect of modulated electromagnetic fields 30-120 V/m with a carrier frequency of 30 MHz, modulated sinusoidally at frequencies 2-50 Hz, on emotional reactions accompanying various stages of the systemic organization of behavior in rats. The fundamental studies of the effects of EMF on the brain are described by Sudakov KV, Kholodov YA [6,12].

The Purpose of the Work

Allan HF, Frey A [13,14], it was found that the effect of microwave modulated by megahertz is felt as a sound, an angle with a needle, and even as a blow to the head with a stick-at a distance of 10 m. It was assumed that the cause of the reactions is the thermoelastic expansion of the areas of the hearing aid, and the generally accepted mechanism is the rapid (but insignificant, within 10^{-5} ° C) heating of the brain with each pulse, as a result of which a pressure wave passes through the skull to the cochlea. Which is also refuted by the fact that the deaf had a sense of sound. NASA research in the 1970s showed that this is caused by thermal expansion of parts of the inner ear. However, the problem is that not every complex of radiation parameters has this effect, and its manifestations also depend on the complex of parameters. Therefore. the thermal effect has nothing to do with it.

Materials and Methods

During the work, an Agilent Technologies E82570 1 microwave generator with an amplifier of the same brand was used. Appropriate adapters and antennas were used to obtain the necessary frequencies. The effect of microwave EMF with low-frequency modulation on the brain was studied. Using the Anfimov tables, 744 Perm state university applicants were examined. In the tables with rows of letters, the subjects had to cross out all the letters “i” first, and then, after turning on the generator, all the letters “k”. The control group was not exposed to radiation. Frey’s tests used a repetition rate of 50 Hz with a pulse duration of 10 to 70 microseconds. It has been found that perceived loudness is related to peak power density rather than average power density. At a frequency of 1.245 GHz, the peak power density for perception was below 80mW/cm^2. The induced sounds have been described as buzzing, clicking, hissing, or knocking, depending on several parameters of the transmitter: pulse duration and pulse repetition rate. By changing the parameters of the transmitter, it was possible to feel a strong blow to the head without such obvious vestibular symptoms as dizziness or nausea. Other parameters of the transmitter caused a tingling sensation. Frey experimented with subjects suffering from nervous deafness. It was assumed that the detection mechanism in humans is located in the cochlea, but the sound was felt, including by the deaf.

Auditory reactions to transmitted frequencies from about 200 MHz to 3 GHz were studied by Kholodov YA [15]. In our experiment, the power flux density at a distance of 1 cm from the hairline of the subject’s head was 50MW, it was at this distance that the radiating antenna moved closer to the subject’s head. During the experiment, 59 applicants were exposed to EMF radiation with a frequency of 1.245 GHz with a modulation of 50 Hz, while no effect was observed in comparison with non-irradiated subjects. 626 applicants were examined for exposure to EMF with a frequency of 4 GHz modulated by 10 MHz, 113 people were exposed to radiation, and 113 more were not exposed. The total number of characters in the Anfimov table is 2116 randomly selected letters of the alphabet. The number of letters “i” randomly scattered among them is 264, the number of letters “k” is 264. The speed of filling in the tables by the subjects depended

on their intellectual level and ranged from 10 to 17 minutes. Since the work completion rate for each applicant practically did not change, there was no need to calculate the mental performance index using the formula

$$A = P \times V,$$

where P = (n – a)/N, n is the number of correctly crossed out characters, a is the number of missing characters, N is the total number of one type of characters (accuracy of work), V = M/t, the total number of characters divided by time is the speed of work (or according to Will's formula: A = (L – r)/(L + a), where r is the number of incorrectly crossed out letters, L is the total number of crossed out letters), [16,17].

The results were processed using a different method. The performance indicator was calculated as follows:

$$A = (N – a) \times 100\% / N$$

It was found that non-irradiated applicants crossed out both 100% of the letters "i" and 100% of the letters "k". The applicants of the second group crossed out 100% of the letters "i", but after irradiation, on average, only 77% of the letters "k", 23% of the letters "k" were skipped. The spread was calculated using a standard method with a Student coefficient, it is small, total. This meant a dispersion of attention, which was most likely due to a decrease in tone. This, in turn, is most likely due to the effect of microwave EMF on the reticular formation stretching along the brainstem to the nuclei of the thalamus. The reticular formation consists of reticular nuclei and a large network of neurons with branched dendrites and axons. This complex activates the cortex and controls the reflex activity of the spinal cord. The reticular formation participates in the processes of memorization, has a facilitating or inhibitory effect on physical motor activity, ensures the course of internal inhibition and phases of fast and slow sleep, participates in the processes of initiation, maintenance and change of wakefulness, attention, orientation reflexes. 43 applicants agreed to continue the experiment and undergo secondary radiation. They were irradiated for 5 (13 people), 10 (13 people) and 15 days (17 people) for 15 minutes daily. Result: the last group had a sleep disorder, insomnia that lasted two weeks. The same phenomenon was observed in 4 laboratory assistants serving the experiment. There were no deviations in two groups of 13 people.

The accumulation effect was also noted in Kholodov Yu [6]. Thus, it was also found that the effects of microwave EMF accumulate with an increase in the number of exposures. This reinforces the assumption about the effect of the field on the reticular formation.

Results

Thus, Frey's results were not confirmed, but the effect of microwave EM on the reticular formation of the human brain was discovered. Accordingly, the question arises, which formation in the brain tissue is able to perceive microwaves. The human body is transparent to microwave EMF, because blood behaves like a dielectric at high frequencies. Accordingly, microwave waves can be detected by the dendrites of pyramidal neurons in the cerebral cortex. And vice versa: the electromagnetic brain radiation was detected in the range of ultrahigh and ultrahigh frequencies from 1.5 to 4.5 GHz in accordance with the minimum size of the studied areas of the head.

Brain radiation is associated not with the activity of the cerebral cortex, but with the activity of electromagnetic waves in the area of the intervertebral liquor space between the cortex and the inner surface of the cranial box of the human head. It is also known that when an electromagnetic field acts on biological objects, eddy currents are formed in the interstitial fluid. It is possible that microwave EMF directly affects neurons. For example, in Lukyanova SN [18], the effects of microwave EMF on the brain in the range of 1-10 GHz with a non-thermal intensity of < 500mcW/cm^2 and a short exposure of 1 min with a number of effects of about 60-100 were studied. A predominant decrease in background frequency was found in neurons of the visual region of the cerebral cortex and in neurons of the sensorimotor region of the cerebral cortex, as well as a predominant inhibition of neurons of the parieto-occipital and antero-central regions of the cerebral cortex. At the same time, the pulsed mode caused greater changes than the continuous one, which indicates the possibility of resonance. It was noted that the nature of modulation in the form of a smooth frequency change in the range of alpha rhythms of the EEG can provoke its amplification. In there is also an indication of the work of A. Frey, in which the pulsed effect of microwave EMF on the rat brain was more effective than continuous Kholodov Yu [6], it was also suggested that the field affects both neurons and glial cells.

Conclusion

In the case of a reticular formation, the electromagnetic field could be perceived by clusters of its neurons. Similarly, the receivers in the case of the Frey effect can be spatial clusters of neurons of the temporal lobes (sound) and the insular lobe (blow with a stick, stake with a needle, etc.). The specific effect may depend on the ratio of the wavelength of the EMF and the size of the clusters of neurons.

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