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A STUDY OF THE ACTION OF ELECTROMAGNETIC WAVES AT VARIOUS REGIONS OF THE RADIO BAND ON SOME FUNCTIONAL INDICES IN WORKERS

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[Text] Contemporary scientific and technological ~~level~~ offers wide possibilities for the utilization of the energy of radiofrequency electromagnetic waves in various domains of the national economy. At the same time, we encounter new professional dangers from constant and variable electric fields which may affect very unfavorably the organism of workers. Being that radiowaves represent an intensive physical factor of the working medium, it affects all organs and systems of the human organism: central nervous system (6, 8, 14, 21), cardiovascular system (2, 15, 17), hemopoesis (1, 3, 22, 26, 27), thermoregulation (13, 19, 20), analyzers (9, 23, 24, 25), exchange processes (11, 12, 18) and others.

Our studies aimed at the determination of the influence of electromagnetic waves from the various segments of the radio-range on certain functional indexes characterizing the state of the organism of workers exposed to radiofrequency irradiation. We studied the servicing personnel at various working posts (Table 1).

Table 1

Working post	Generator frequency	Generator power
Highfrequency generators for welding and melting of metals	60-300 kHz	10-125 kW
Coastal radio station of the Bulgarian Maritime Fleet (BMF)	2-20 MHz	5-20 kW
Radio-Relay Station, Varna (RRS)	2900 MHz 3600-4000 MHz 194-200 MHz	40 W (pulse) 7 W 150-600 W

We studied on three occasions over a period of one month, 83 workers divided as follows: Group I - generators of technical high frequency (THF) -- 45 persons; Group II -- BMF -- 18 persons; and Group III -- RRS -- 20 persons of average age of 34 years, with 6 years of average continuous employment. The control group consisted of 12 employees working under analogous conditions but without electromagnetic field interaction.

We determined the following indexes: arterial blood pressure, pulse frequency, vegetative kerdo index, skin temperature of the wrist, cholinesterase activity in the blood serum, hemoglobine, erythrocytes, differencial blood picture, attention span, speed and accuracy of information processing. The investigation was carried out using standard classical methods.

Table 2

Physiological State of Workers Exposed to Electromagnetic Waves (MHm)

Group	n	Blood pressure mm Hg systolic	Blood pressure mm Hg diastolic	Pulse frequency in p/min	Vegetative Kerdo index in %	Temperature of wrists in °C right	Temperature of wrists in °C left
I -- THF							
II -- BHF							
III -- RRS							
Control							

The basic results of the investigation are presented in Table 2. It is seen that the systolic blood pressure in workers of each group is within normal bounds. A reduction in diastolic pressure is found only in Group I. The pulse rate of all three observed groups is higher when compared with the rate of the control group and the difference may reach 11.0 pulses per minute. Analogous data are quoted also by G. L. Khazan (20), Yu. A. Csipov (13), and others. One should note that the oscillations are within the limits of the physiological norm, which agrees with the results obtained by V. M. Malishev, F. A. Kolesnik (10), N. V. Tyagin (19), and others. The positive vegetative Kerdo index is found in Group I and II, which indicates a predominant activity of the sympathicus, which is most strongly pronounced in Group I -- +18.0%.

The skin temperature of the wrists of workers exposed to the electromagnetic waves is insignificantly increased as compared with those of the control group. This indicates an absence of

thermoregulation stresses probably because of the weak intensity of the electromagnetic field in the working quarters.

According to data in the literature (4, 5, and others), a prolonged stay within intense HF and SHF fields causes a redistribution of the forming elements of the blood and a reaction by the blood-producing system. Our investigations show that in the workers of Group I (HF field) one finds lymphopenia (Table 3) and in Groups II and III -- monocytosis. Normochromic anemia was found in the observed as well as in the control group. A tendency towards leukopenia is found only in the workers exposed to the SHF field (Group III). Our data fully agree with those of A. A. Kevorkyan (7), V. V. Sokolov and M. I. Ariyevich (16), Ye. I. Smurova et al. (15), and others.

Cholinesterase activity found in the blood serum of the workers in the control group was 3.10±0.10 E, in Group I -- 2.80±0.09, in Group II -- 2.21±0.08, and in Group III -- 2.24±0.08 E. The decrease in CEA is in the opinion of S. V. Nikogosyan (12) due to the increased content of acetylcholine in the organism. One deals probably with quite complicated neuro-endocrine changes caused by the influence of the electromagnetic field.

The results determining the ~~length and concentration of~~ attention span ~~comprehension~~ (Schulte-Platonov test) and the speed and accuracy of visual information processing do not show an essential difference between the investigated and the control groups. Most probably, changes of the functional state of the nervous system in workers exposed to radio frequency waves generate mostly vegetative changes without significantly influencing the psychic activity.

ble 3

Changes in the Peripheral Blood of Workers Exposed to Electromagnetic Waves

roup	n	Hemoglobine in %	Erythrocytes (millions)	Leucocytes (thousands)	Stabs	Segment.	Lymphocytes	Monocytes	Eosinophils
I -- THF									
II -- EMF									
III -- RRS									
Control									

Conclusions

1. The observed changes in arterial blood pressure and pulse rate under the influence of electromagnetic waves of the radio-frequency range are within the limits of the physiological norm.

1. Weak intensities of electromagnetic fields (under the permissible limit) do not show a significant influence on thermoregulation.

3. In personnel servicing the THF generators one observes lymphopenia, while in the pheripheral blood in workers servicing the coastal radiostation and the Radio-Relay Station one finds monocytosis.

4. In workers exposed to electromagnetic radiations one notices a tendency towards a reduction in the cholinesterase activity determined in blood serum.

5. The width and concentration of perception and the processing of information do not show a significant variation in observed workers.

The established data confirm the opinion (10, 13) that the changes in particular indexes depend not so much on the characteristic and frequency of the electromagnetic field but rather on its intensity, i.e. on the distance between the generators and the workers.

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