EFFECT OF AN ULTRAHIGH-FREQUENCY ELECTROMAGNETIC FIELD ON RATS COMBINED WITH CHANGES IN INTENSITY OF OXIDATIVE PROCESSES

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The resistance of rats to a uhf electromagnetic field depends on the redox potential of the tissues.

The uhf electromagnetic field induces functional and morphological changes in the tissues of living organisms [3]. Since the integrity of a living system is maintained through antidestructive processes [7], relying mainly on oxidative reactions for their energy, the resistance of an organism to the action of a uhf electromagnetic field can be expected to depend on the level of its oxidation-reduction processes.

In the investigation described below the rate of survival of animals in a uhf electromagnetic field was studied after interference with their oxidation-reduction processes through changes in the concentration of oxygen in the inspired air and administration of substances affecting oxidative metabolism.

EXPERIMENTAL METHOD

Two series of experiments were carried out on 70 male albino rats weighing 180-200 g.

In series I, the animals were exposed to a uhf electromagnetic field [2] with an intensity of 150 mW/cm^2, using the "Luch-2" generator (λ = 12.6 cm). The rats of group 1 were irradiated under normal conditions (control), and the animals of groups 2 and 3 were irradiated 10 min after being placed in atmospheres of 40% oxygen + 60% nitrogen and 10% oxygen + 90% nitrogen respectively. The rats of group 4 received an intraperitoneal injection of cystamine in a dose of 130 mg/kg 10 min before irradiation, while the animals of group 5 received a corresponding injection of S-β-aminoethylisothiuronium (AET) in a dose of 200 mg/kg. These substances possess a marked action on oxidative metabolism [4, 6]. The animals were irradiated until death.

In the experiments of series II, different groups of animals were exposed to the same gas mixtures and received the same compounds. The magnitude and direction of the deviation of the redox potential (ΔEh) of the triceps surae muscle from its stationary values were determined in vivo 10 min after the beginning of exposure [5].

EXPERIMENTAL RESULTS

The experimental results are given in Table 1.

During uhf irradiation of rats kept in an atmosphere with a raised oxygen concentration, their life span was increased by 1.3 times compared with the control, while if placed in an atmosphere with reduced oxygen concentration it was shortened by 1.4 times. Inhalation of a gas mixture saturated with oxygen caused an increase in Eh of the tissue. This index fell with a decrease in the oxygen concentration in the inspired air.

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TABLE 1. Life Span of Rats during uhf Irradiation 10 Min after Being Placed in Atmosphere with Different Oxygen Concentrations and Injection of Chemical Compounds, and Change in Redox Potential (ΔEh) under Their Influence

Conditions of irradiation	Life span during uhf irradiation (min)	ΔE_h in mV
Control	40,1±1,62 (6)	0
40% oxygen + 60% nitrogen	54,8±1,12 (8) $P<0,001$	+41,0±3,82 (6)
10% oxygen + 90% nitrogen	28,4±0,68 (8) $P<0,001$	—46,4±2,54 (6)
AET 200 mg/kg	19,5±0,67 (8) $P<0,001$	—126,4±5,18 (10)
Cystamine, 130 mg/kg	17,3±0,56 (8) $P<0,001$	—158,0±7,84 (10)

Note. Number of animals in parentheses.

An increase in Eh indicates an increase in the reserve of free chemical energy, while a decrease indicates a deficiency [8]. Hence, if the conditions favor an increase in the production of chemical energy in the tissues, the chance of survival of animals in a uhf electromagnetic field increases. It decreases during uhf irradiation under conditions producing an energy deficit.

The intensity of the observed effect depends on the degree of inhibition of oxidation-reduction processes. For instance, injection of cystamine and AET causes a much greater decrease in Eh. The life span of the rats during uhf irradiation after injection of these substances was shortened by more than half.

The results described show that the resistance of the living organism to the harmful action of a uhf electromagnetic field is largely determined by the intensity of exergonic oxidative processes in its tissues.

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