

An action of superlow power extremely high-frequency radiation on some microbes *in vitro*, human erythrocytes, and the functional status of a person

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ABSTRACT

Aim: This paper is devoted to the analysis of advanced scientific research about the role of superlow intensity extremely high frequency (EHF) effects on biological objects, including people. **Materials and Methods:** In this investigation was utilized Gunn diode with the flow of electromagnetic radiation superlow intensity of 10 μW and frequency 40–43 GHz. **Results:** The estimation of the influence of the millimeter radiation on *Staphylococcus aureus*, *Escherichia coli*, and the native blood has been performed. It was shown that the death of *Staphylococcus* is associated with the frequency of modulation signals of the radiation. The EHF irradiation of bacterial suspension for 1 min leads to the short-term disorders of the motor function of *E. coli*. Exposure by EHF of the super weak intensity causes inhibition of red blood cell function, which manifests itself in a decrease in their ability to aggregate. **Conclusions:** Our experimental data also prove that the intake of water activated by means of EHF radiation modifies the functional status of patients.

KEY WORDS: Activated water, Circadian rhythms of the pulse, *Escherichia coli*, Entropy, Fractal dimension, Heart rate variability, Native blood, Redundancy, *Staphylococcus aureus*, Stochasticity, Superlow intensity millimeter radiation, Unpredictability

INTRODUCTION

In 1995 for the first time was patented, the biotechnical system of the millimeter therapy includes an avalanche transit-time diode and operates in the cyclical model of controlling by means of changing the duty ratio of signals. The control was implemented intact with the beats of the pulse and breathing of the patient.^[1]

In the 90 years of the 20th century were obtained principally new interaction mechanisms of biological objects with superlow doses of biologically active substances.^[2]

Besides that, in the last years of the XXI century in the study of the impacts on biological objects by means of short-term and superweak intensity extremely high frequency (EHF) radiation was detected similar result.^[3]

Also is noted the negative effect of EHF radiation on the growth of microbial flora and fungi (black mold).^[4,5] In experiments with bacteria, the technique of pouring Petri dishes known as the Koch method was used. In this case, the dilution of bacteria was adjusted to 1:10.000. The irradiation time in the experiment was 5 h, which was equivalent to a dose of 0.009 mJ/cm². In these experiments, it was shown that irradiation by means of millimeter waves does not exert any significant effect on the cells of Gram-negative bacteria and, at the same time, causes the death of at least 44% at titers colony forming units (CFU) of Gram-positive bacteria *Staphylococcus aureus*.^[4]

In the scientific literature of millimeter therapy debated question about the effectiveness of short-term and superweak radiation EHF at intensity of 10⁻¹⁶–10⁻²⁰ Wt/cm² Gunn diode. Since the 1995 year, the known also that the frequencies of millimeter range 64.6 и 65.7 GHz of superweak intensity $\leq 10 \mu\text{W}/\text{sm}^2$ can

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penetrate in aquatic environments with very low losses.^[6-8]

Hence, in 2013, Beckij *et al.* from the Institute of Radio Engineering and Electronics, Russian Academy of Sciences, had performed the studies of the Gunn diode with using highly sensitive radiometers.^[9] These investigations showed that the crystal of gallium arsenide of any passive or active states does not “memorizes” the spectrum of low-intensity electromagnetic oscillations in the millimeter frequency range. The question arises: Is not whether the associated positive results of the using method of the so-called background resonance radiation (BRR-therapy) with short-term exposure (60 s) of superlow intensive EHF radiation?

To answer this question was carried out this study.

Objectives of the Study

The aim of the research is to establish positive effects of the influence of electromagnetic radiation of the superlow intensity on biological objects and human systems.

Tasks of the Research

1. Study the influence EHF-radiation on the culture of *Staphylococcus* sown on nutrient medium in Petri dishes
2. Investigate the effect of EHF irradiation in a superlow intensive mode on *Staphylococcus* and *Escherichia coli*, which are in a liquid medium under the cover glass
3. Examine the influence of EHF impact of superlow intensity on native blood
4. Explore of the parameters of circadian rhythms pulse of the patient with hypertensive disease II with metabolic syndrome against the background of an acceptance of drinking-water activated by EHF impact and of medicines not acting on the heart rhythm.

MATERIALS AND METHODS

For studies was used the device for the processing of liquids and solutions of the everyday “Cem Activator,” certificate No. ROSS RU.AE88.B00235. The device is supplied by special the cap-activator for a plastic bottle, inside of which is situated one generator of EHF-radiation – Activator 1.

The device provides the impulse generation and emission of electromagnetic waves on a fixed frequency in the range of 40–43 GHz. There is the density of the current pulsed power 10 μ W, a modulated signal of 9 Hz.

The design included a realization of scientific researches in Russia and Italy and consisted of five series of experiments.

In the process of performing experiments, microbiological and microscopic methods were used. For seeding microbes, the optical density of the bacterial suspension with a concentration of 1.5×10^8 CFU/ml was taken into account, which visually corresponded to a turbidity standard of 0.5 McFarland. Directly from this concentration, microbial cultures were sown at 0.01 ml per Petri dish from a dilution of 1:100, which corresponds to a concentration of 10^{-2} . On presented micro photos, microbial cultures were seeded of 0.05 ml at dilution of 1:10000. In the process of experiment with a pure culture of *Staphylococcus* and *E. coli* were taken two Petri dishes with culture medium, on which was seeded microbial flora. After the appearance of colonies on one of the Petri dishes over them stretched food film, across which the impact by EHF was realized.

The influence of drinking water activated by means of device radiating EHF waves on the degree of activity of the autonomic nervous system was revealed. Activated water was prepared in advance. The water was accepted by the patient and further carried out the registration and enter in a computer 500 inter-pulse intervals by means of a sensor pulse with an interface through universal serial bus port of the computer. Registration of inter-pulse intervals implemented in every 4 h, starting at 7 am and lasted until 23 pm. Therefore, the daily analyzed 2500 inter-pulse intervals (5 record by 500 complexes), to identify the circadian rhythms of heart rate, reflecting the activity of the autonomic neural system. Cohort studies specifically were not conducted in connection with the fact that each person has their own individual variations of the rhythm, not comparable with deviations, which can be identified for the group as a whole. To assess the degree of activity of the autonomic nervous system, the method of heart rate variability was used. At the same time, information indicators of the heart rhythm were studied: total entropy ($H = -\sum P_i \log_2 P_i$); maximum entropy ($h = H/H_0$); unpredictability coefficient ($h = H/H_0$); redundancy ratio ($R = 1-h$); and coefficient of stochasticity ($S = H/H_0 - H$).

RESULTS AND DISCUSSION

The microphotos presented in the text are performed by us.

Figure 1 presents four photographs of microbiological preparations of pure culture *S. aureus* at a low magnification microscope. As can be seen from chains of *Staphylococcus* disappeared and the number of microbial bodies reliably decreased.

After 1 h and 23 min after exposure, single lysed microbial bodies were observed in the field of view.

Figure 2 is presented four blood smears in the period before exposure and after exposure of millimeter waves in the superlow intensity mode. From

Figure 2, it follows that in the first micrograph in the period before the exposure, the red blood cells were distorted, agglutinated together. At the second microphoto 10 min after the EHF impact, only the red cell deformation decreased. On the third microphoto, the number of agglutinated erythrocytes significantly decreased. Only in the fourth micrograph did normal red blood cells appear. It is necessary to note that the signal of modulation plays an important role. As it is well known, the synthesis of the protein is realized at such frequency in the ribosome (the process of protein chain lengthening – elongation). This provides the optimization of the patient's protein syntheses. That is why it occurs the trophic discrimination of frequencies of microbes, the period of the elongation protein of which is equal to 0.033 s (30 Hz).

By considering the results of experiments with the microbial flora, we came to the following conclusions, and namely: The EHF irradiation of bacterial suspension for 1 min leads to the short-term disorders of motor function of *E. coli* and the loss of the swaying movement oscillations (Brownian) of staphylococci. In the control experiments, these movements of the microbes are preserved. However, this phenomenon

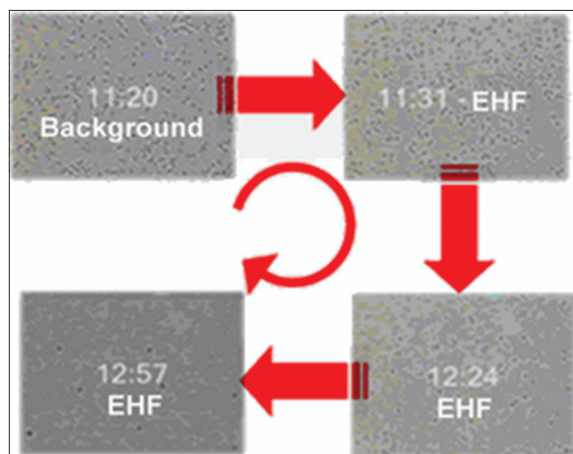


Figure 1: Impact of extremely high frequency on pure culture *Staphylococcus aureus*

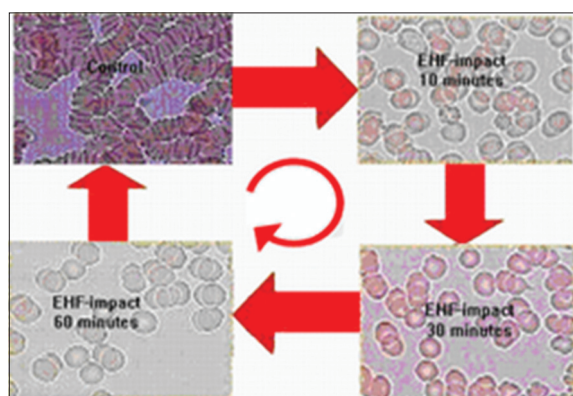


Figure 2: Impact of extremely high frequency on native blood

has no effect on the subsequent growth of microbial colonies.

Metabolic processes the persons are characterized by a cyclical nature, but not the harmonic nature, as this exists in the technical system. This is connected with those periods of the different cycle's person are constantly changed.

Moreover is known that in biological rhythms of the person besides the cyclical component exists and chaotic component, which connect with the presence of the transitional processes in the biological systems.

The plots of the distribution of the heart rhythm in a patient after drinking water on the background of drugs that do not affect the heart rate were studied.

The daily cyclicity of the heart rhythm of the patient is not changed because the temporal sequence is preserved:

From the reviewed above data, it follows that acceptance drinking water on the background of intake medicines not affect on the heart rhythm does not lead to any characteristic changes in the dynamics of circadian rhythms.

In this case, it indicates that changes in the degree of activity of the autonomic nervous system depend only from the natural cyclical fluctuations of the daily periodicity of the functions that control the heart rhythm.

Another picture is observed after acceptance of water activated by means of EHF impact. During 16 h of research, the plots of heart rate variability (HRV) are located in a narrow regulation zone with a moderate predominant sympathetic nervous system activity. At seven in the morning, the distribution plot was in the domain of moderate predominance of the sympathetic nervous system. The graph itself was high and narrow due to the reduced standard deviation. Herewith, after half an hour from the intake of activated water, reliable pulse acceleration was noted.

Only at seven in the evening distribution plot was in the domain of the harmonic interaction of the sympathetic and parasympathetic nervous system.

In addition, it should be noted that the standard deviation coefficient at this hour was increased in comparison with the morning hours.

Table 1 is presented parameters entropy HRV of the patient during the experiment with the reception of activated water by means of EHF impact.

The degree of activity of the autonomic nervous system during the eight subsequent hours of this study,

Table 1: Influence of activated water on circadian rhythms: Mean pulse (M±m) and entropy values

Indicators HRV	Day time				
	7.00	11.00	15.00	19.00	23.00
M	0.83	0.71	0.74	0.82	0.71
M	0.0011	0.0014	0.0012	0.0018	0.0014
H	1.07	1.64	1.16	1.82	1.34
h	0.22	0.33	0.24	0.37	0.27
R	0.78	0.67	0.76	0.63	0.73
S	0.28	0.50	0.31	0.59	0.37
Index	265 MP SNS	373 MP SNS	203 MP SNS	123 Norme	325 MP SNS

MP SNS: Moderate predominance sympathetic neural system, Norme: Harmonic interaction of cholinergic and adrenergic mechanisms of regulation.

HRV: Heart rate variability

according to the index of the tension of regulatory mechanisms, was in the zone of the moderate predominance of the sympathetic nervous system. Ten hours after accepting activated water, namely, at 19 am, the dynamics of the parameters of the heart rhythm testify about harmonic Interaction of Cholinergic and Adrenergic Mechanisms of Regulation.

This process is carried out with the help of an informational model directed to structural optimization of the HRV pattern. At the same time, harmonic relations of reproducibility ($R = H_0 - H/H_0$) and unpredictability ($h = H/H_0$) are established when the condition such as the presence of the numerical equality of the values of the reproducibility index and stochasticity ($S = H/H_0 - H$) is fulfilled. The results indicate that the structuring of the heart rhythm in the process of adaptation is carried out in strict accordance with the rule of the “golden proportion” when $\lim R/h \rightarrow 1.618$.

In our case, the ratio $R:h=1.7$ differs from the gold parameters (1.62) by only 4.9%.

Among the several parameters, we highlight the valuable diagnostic importance of fractal dimension (fD) in coronary microvessel motility nonlinear dynamics: A reduced fD is a symptom of pathology or tendency to disease, while a restored physiological value of fD is interpreted as a successful preventive treatment, expression of a higher h – coefficient of unpredictability.

Our experimental data also show that the short-term impact of EHF radiation modifies the parameters of the fD of the studied biological systems, improves hemodynamic parameters of microcirculation of the coronary vessels, and exerts a positive effect on the risk of coronary heart disease.

It is believed that the histone protein complex has a structure similar to that of a “diskette-resonator.” Hence, inside of the genetic construction, the fractally-organized electromagnetic field appears. Thus, DNA matrix transmits information modulated from outside the body toward the internal compartments

of the human organism. It is necessary to consider that electromagnetic radiation of low intensity of the sharp response of the human organism exists around the frequencies of 40 GHz that correspond with the resonance frequency of the tertiary structure DNA-helix.^[10,11]

Thus, our results and the results of earlier clinical observations of different authors on the basis of the so-called BRR-therapy can testify to their connection with the short-term impact superlow intensity millimeter waves on the person but not with the placebo effect. Analysis of the results indicates the need to conduct in-depth studies on the effect of superlow doses of EHF influence with the revision of the paradigm of interaction with biological objects of short-term and superlow intensity millimeter waves.

The following conclusions have been done on the basis of evidence and reasoning obtained in experimental studies.

CONCLUSIONS

1. Statistically significant changes in the *S. aureus* colonies were observed after their irradiation by means of a superweak electromagnetic EHF field. This leads to a reduction in the number of microbial bodies due to their lysis
2. In our opinion, the undoing of staphylococcus microbial bodies is associated with the frequency of modulation of electromagnetic radiation of an EHF of 10 Hz, which inhibits the synthesis of protein microbes with a frequency of 30 Hz
3. Results were obtained, indicating that the EHF irradiation of bacterial suspension for 1 min leads to the short-term disorders of motor function of *E. coli* and the loss of the swaying movement oscillations (Brownian) of staphylococci. In the control experiments, these movements of the microbes are preserved. However, this phenomenon does not influence the subsequent growth of colonies of microbes
4. The sludge and agglutinate erythrocytes were

- detected in patients with ischemic heart disease in the process of microscopy, in the study of the blood
5. Impact by BRR in the super weak intensity EHF band apparently is result in inhibition of red blood cells function, which is manifested in a decrease in their ability to aggregate, as well as a formation “coin columns”
 6. Acceptance of activated water leads to the optimization of the HRV pattern structure, including the equality of the values of the indicators of unpredictability ($h=0.382$), reproducibility ($R=0.618$), and stochasticity ($S=0.618$)
 7. Similar results indicate that the structuring of the heart rhythm in the process of adaptation in this situation is carried out in strict accordance with the rule of the “golden proportion,” when the relationship limit tends to the golden ratio, that is: $\lim R/h \rightarrow 1.618$
 8. An experimental data also show that short-term impact of EHF radiation modifies the parameters of the fD of the studied biological systems, improves hemodynamic parameters of microcirculation of the coronary vessels, and exerts a positive effect on the risk of coronary heart disease
 9. Index of fD allowed classifying the level of health of persons examined into five classes: (1) Explicit disease; (2) the presence of trend to disease; (3) the initial manifestation of disease; (4) the tendency to normalize; and (5) healthy persons
 10. It is particularly important to note that the revealed facts of influence superlow intensity millimeter radiation on human genetic apparatus may be used as non-pharmacological primary prophylaxis of coronary artery disease.

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