

CHANGES IN CONTENT OF AMINO ACIDS IN INTERNAL ORGANS OF RABBITS DURING EXPOSURE TO HIGH-FREQUENCY ELECTROMAGNETIC AND ULTRASONIC WAVES

K. G. Vibe, E. P. Miroedova,
S. P. Kulachenko, and V. R. Faitel'berg-Blank

UDC 612.015.348:547.965]
.014.426.014.45

Exposure to a high-frequency electromagnetic field and to ultrasound changes the total content of free amino acids in the internal organs. Short exposures to uhf and microwave fields cause an increase in the concentration of free amino acids, whereas large doses have the opposite effect and reduce their content. Ultrasound caused the greatest changes when applied in a dose of 3 W/cm² for 5 min.

Data indicating the effects of microwaves on functions of individual organs [3, 4, 8, 10, 11] and on nuclear and mineral metabolism [1, 2, 11] provided the basis for this study of the effect of high-frequency electromagnetic and ultrasonic waves on protein metabolism in internal organs.

EXPERIMENTAL METHOD AND RESULTS

The effects of electromagnetic centimeter (shf) and meter (uhf) waves and of ultrasound on the total concentration of amino acids in the liver, stomach, small intestine, lungs, spleen, and kidneys was studied in experiments on 87 rabbits. The concentration of free amino acids was determined by the method of

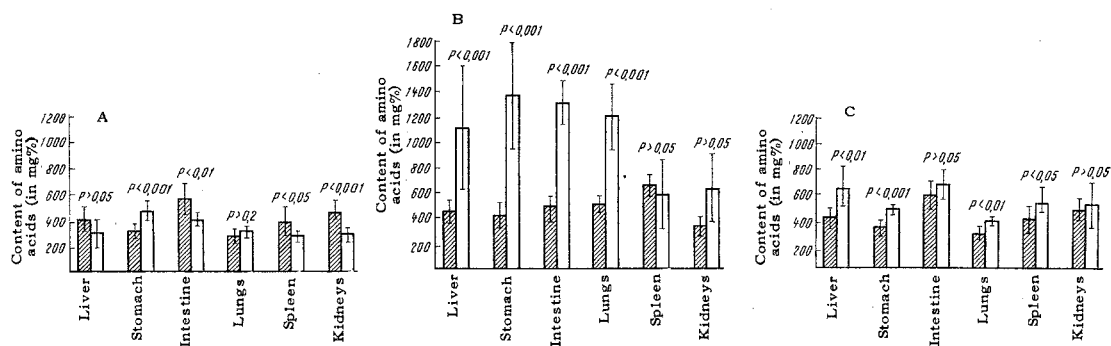


Fig. 1. Effect of shf and uhf fields and of ultrasound on amino acid content in internal organs of rabbit: A) shf field with power 75 W; B) uhf field with power of 80 W; C) ultrasound with intensity of 3 W/cm². Unshaded columns represent experiment, shaded columns control.

Department of Physiology of Animals, Tselinograd Agricultural Institute. Department of Pathophysiology, Tselinograd Medical Institute. (Presented by Academician of the Academy of Medical Sciences of the USSR S. E. Severin.) Translated from *Byulleten' Éksperimental'noi Biologii i Meditsiny*, Vol. 70, No. 10, pp. 47-48, October, 1970. Original article submitted December 14, 1967.

© 1971 Consultants Bureau, a division of Plenum Publishing Corporation, 227 West 17th Street, New York, N. Y. 10011. All rights reserved. This article cannot be reproduced for any purpose whatsoever without permission of the publisher. A copy of this article is available from the publisher for \$15.00.

Harding and McLean. Microwaves were generated by a type "Luch-58" apparatus, uhf currents by a UVCh-4m or UVCh-300 generator, and ultrasound by a type UTP apparatus. The epigastric region was irradiated in all cases.

The experiments showed that exposure for 10 min to an shf field of strengths of 30 and 50 W causes no regular changes in the total content of amino acids in the investigated organs. Under the influence of an shf field with a strength of 75 W, and with the same duration of exposure, the content of amino acids in the stomach tissues increased, but in the intestine, spleen, and kidneys it decreased (Fig. 1A). If the duration of exposure to an shf field of the same strength was increased to 20 min, the level of free amino acids in the liver showed an increase to 669.9 mg% (normal 403.3 mg%), while in the stomach it rose to 501.7 mg% (normal 325.3 mg%), and in the lungs to 381.8 mg% (normal 267.6 mg%), but their level in the intestine fell.

Exposure to a uhf electric field with a strength of 40 W for 10 min caused an increase in the content of free amino acids in the liver to 662 mg%, in the spleen to 482 mg%, and in the kidneys to 616.6 mg%, while an increase in the strength of the field to 80 W led to a considerable increase in the content of free amino acids in the liver, stomach, intestine, and lungs (Fig. 1B).

Exposure to a uhf field with a strength of 300 W for 10 min and to a field of 40 W for 20 min also caused an increase in the content of free amino acids, but it was less marked.

After exposure to ultrasound (0.5 W/cm^2) for 5 min, the content of free amino acids was increased in the liver, lungs, and spleen. The maximal increase in the content of amino acids in the gastro-intestinal tract and liver was observed after exposure to ultrasound with a strength of 3 W/cm^2 (Fig. 1C). A weak dose of ultrasound (0.3 W/cm^2) was less effective, even after a longer exposure, than a strong dose (3 W/cm^2) with a shorter duration of exposure (5 min).

The results of these experiments showed that the content of free amino acids in the investigated internal organs was changed after exposure to high-frequency electromagnetic fields and ultrasound, in a manner depending on the intensity of irradiation. These results are in agreement with observations by other workers [5-7, 9] who found that high-frequency physical agents modify physiological processes in the body in a manner depending on the strength of the field and the duration of its action on the body.

LITERATURE CITED

1. K. G. Vibe and V. R. Faitel'berg-Blank, *Fiziol. Zh. (Ukr.)*, No. 2, 234 (1967).
2. K. G. Vibe and V. R. Faitel'berg-Blank, in: *Treatment at Carpathian Health Resorts* [in Russian], Uzhgorod (1967), p. 184.
3. S. Kh. Nikolov, *Abstracts of Proceedings of a Scientific Session of the Kuban Medical Institute* [in Russian], Krasnodar (1962), p. 45.
4. A. I. Rapoport, in: *Collected Scientific Transactions of Leningrad Pharmaceutical Institute* [in Russian], Vol. 1, Leningrad (1947), p. 235.
5. E. L. Revutskii, *Abstracts of Proceedings of a Scientific Session on Chronic Gastritis* [in Russian], Leningrad (1963), p. 44.
6. M. K. Smirnov, *Vopr. Kurortol.*, No. 6, 512 (1958).
7. A. P. Speranskii and I. L. Martveladze, *Byull. Éksperim. Biol. i Med.*, No. 5, 101 (1961).
8. V. R. Faitel'berg-Blank, *Investigation of the Physiological Mechanisms of Action of High-Frequency Physical Agents on Processes of Absorption in the Gastro-Intestinal Tract*, Doctoral Dissertation, Odessa (1964).
9. V. R. Faitel'berg-Blank, *Pat. Fiziol.*, No. 4, 92 (1965).
10. Ya. S. Tsimmerman, in: *The Physiology and Pathology of Digestion and Problems in Balneology and Physiotherapy* [in Russian], Tbilisi (1963), p. 186.
11. W. F. Esan, *Arch. Phys. Ther. (Omaha)*, 17, 86 (1937).
12. D. Fiandesio and C. Quaglia, *Minerva Med.*, 1, 190 (1955).