NEW ANTIOXIDANT FACTORS SECRETED BY THE GASTROINTESTINAL TRACT

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Physiological activity proceeds at a low level of free-radical lipid peroxidation (LPO) that is essential for normal functioning of several biochemical and physiological systems. However, in some pathological states LPO processes are intensified in the system of the cell membranes, and this leads to considerable changes in their phospholipid composition, disturbances of their functions, and depression of cellular activity [1-4, 7, 10].

The results of the writers' previous investigations into the action of LPO on deamination of amino acids and also into the level of energy metabolism of gastric tissue in the etiology and pathogenesis of gastric ulcer served as the basis for an analysis of the intensity of LPO in different tissues of normal animals and animals with experimental gastric ulcer.

EXPERIMENTAL METHOD

Experiments were carried out on male and female albino rats weighing 150-180 g (aged 2-3 months), kept on a mixed diet. The intensity of LPO in the mucosa of the normal stomach and of the stomach with experimental ulcer, and also in other organs of normal animals (small intestine, kidneys, liver, brain), was studied by the method in [5]. The tissues (slices weighing 100 mg) were incubated in Tris-HCl buffer (pH 7.4) for 60 min in an atmosphere of air at 37°C. Tissue slices 0.1-0.2 mm thick were cut manually, and homogenates of gastric and intestinal tissue were prepared in the above-mentioned buffer by means of a glass homogenizer with Teflon pestle. Homogenates of gastric and intestinal tissue were heated on a water bath at 96°C for 15 min. Homogenates of the gastric or intestinal mucosa were added to the incubated slices of liver, kidneys, and brain in an amount corresponding to 100 mg of fresh tissue. Experimental gastric ulcer was induced by the method in [6]. The intensity of LPO in the tissues was judged by accumulation of malonic dialdehyde (MDA), which was determined by the method in [5].

EXPERIMENTAL RESULTS

A fairly high intensity of LPO was recorded in renal, hepatic, and, in particular, brain tissue, but in the stomach wall it was much lower. It might be supposed that a certain substance possessing antioxidative activity, and causing inhibition of LPO in the organ, is synthesized in the stomach wall. To study this problem we examined the effect of a homogenate of gastric mucosa on the intensity of LPO in other tissues. We found that in the presence of homogenates of the stomach wall MDA formation was abruptly inhibited in all tissues studied. Slices and extracts of the stomach wall had a similar action. Incidentally, after heat treatment (at 96°C for 15 min) the gastric homogenate had the same inhibitory action on MDA formation in other tissues as the native homogenate.

These results suggested that the effect of intestinal tissues must be studied on LPO processes. Homogenate of the small intestine was found also to have a marked antioxidative action. However, after heat treatment there was some decrease in activity of the factor inhibiting LPO.

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The antioxidative activity of factors of the gastrointestinal tract is dependent on concentration. With a decrease in the amounts of homogenates added, the antioxidative effect appeared weaker. Incidentally, after addition even of 10 mg of the homogenate of the above tissues, marked inhibition of MDA formation was observed (by about 55-50%).

The investigations showed that all the tissues studied (liver, brain, kidney, heart muscle, stomach, intestine) only homogenates of gastric and intestinal tissues exhibited an antioxidative effect.

The experiments showed that activity of antioxidative factors of the stomach and small intestine is depressed in animals with experimental gastric ulcer.

It can be postulated on the basis of these results that certain substances with antioxidative properties are synthesized in the wall of the stomach and small intestine. These substances evidently differ, because the factor from the stomach wall is thermostable, whereas in the small intestine it loses part of its activity after heat treatment. We do not yet know whether these are the source of antioxidative factors contained in the blood serum, or what is their nature.

Several investigators [8, 9] have observed high levels of lipid peroxidation in the blood serum and erythrocytes in gastric and duodenal ulcer. It can be tentatively suggested that this is associated with reduced ability of the gastrointestinal tract to produce the antioxidative factors which were found in these organs.

The results of our previous investigations showed that under certain conditions (under the influence of radiation), leading to disturbance of activity of the gastrointestinal tract, the production of antioxidative factors by these organs is inhibited and the resistance of the experimental animals is sharply depressed. However, if the region of the kidneys or abdomen is screened, these disturbances assume a milder form. This is in agreement with the results of other studies showing inhibition of immunoreactivity in association with a marked decrease in activity of the antioxidative system.

The discovery of the ability of gastric and intestinal tissues to produce antioxidative factors substantially modifies our ideas on the activity of these organs and necessitates the development of new approaches to the study of the pathogenesis and treatment of their diseases.

LITERATURE CITED

1. E. B. Burlakova, A. V. Alekseenko, and E. M. Molochkina, Bioantioxidants in Radiation Damage and Malignant Growth [in Russian], Moscow (1975), p. 214.
2. E. B. Burlakova, M. I. Dzhalyabova, V. O. Gvakhariya, et al., Bioantioxidants and Regulation of Metabolism under Normal and Pathological Conditions [in Russian], Moscow (1981), pp. 156-179.
3. E. B. Burlakova, G. V. Arkhipova, A. N. Goloshchapov, et al., Bioantioxidants and Regulation of Metabolism under Normal and Pathological Conditions [in Russian], Moscow (1982), pp. 74-83.
4. E. B. Burlakova, M. I. Dzhalyabova, V. O. Gvakhariya, et al., Bioantioxidants and Regulation of Metabolism under Normal and Pathological Conditions [in Russian], Moscow (1982), pp. 113-140.
5. Yu. A. Vladimirov and A. I. Archakov, Lipid Peroxidation in Biological Membranes [in Russian], Moscow (1972).
6. Yu. A. Zavodskaya, Byull. Éksp. Biol. Med., **37**, No. 1, 26 (1954).
7. B. P. Kozlov, Free Radicals and Their Role in Normal and Pathological Processes [in Russian], Moscow (1973).
8. V. Yu. Kulikov, V. V. Ermolaeva, L. I. Kolesnikova, et al., Vopr. Med. Khimii, **25**, 289 (1979).
9. V. Yu. Kulikov, V. V. Ermolaeva, L. V. Mamontova, et al., Vopr. Med. Khimii, **27**, No. 4, 463 (1981).
10. I. P. Sadovnikova, Progress in Science and Technology. Series: General Problems in Biology [in Russian], Vol. 5, Moscow (1986), pp. 69-109.