Effects of copper, cobalt and iodine on some indices of lipid peroxidation in dairy cow's blood under the permanent low radiation dose influence

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Introduction

A vast territory of the Ukrainian agricultural land has been contaminated with radionuclides as the result. of the Chernobyl accident. At the same time, the release of a considerable amount of radioactive material into the ecosystem gave rise to a number of general biological problems. First of all, it concerns the effects of low radiation doses on the animal body. According to the present-day knowledge of the mechanism of low-dose influence on the animal cell (Anderson 1991, Armstrong *et al.* 1984) the main process here is generating free radicals, including organic ones (fat acid radicals, first of all).

One of the ways to reduce harmful effects of low doses on animals is the use of micronutrient additives.

Material and methods

The experiment was performed in the Narodichi district in 1993 - 1995. The activity concentration in the soils was 5 - 15 Ki·km^{-2}. Four groups of black-and-white cows were selected for the study (six cows in each). The resultant daily ^{137}Cs intake per animal ranged from 8,000 to 60,000 Bq·day^{-1}. An equivalent dose was 12 mk Sv.

The animals of group 1 (control) were offered an adequate diet with the exception J, Co and Cu, whose deficiency in the diet amounted to 21% - 40% of the normal mineral requirements. Group 2 was given the same diet with KJ, $CuSO_4$, $CoCl_2$ additives, which made up the deficiency in these microelements. The levels of J, Co, Cu in the diet of group 3 were 70%, 30% and 30% higher compared to those in group 2. The only difference between the diet of group 4 and that of group 3 lay in the cobalt content: it was 70% higher compared with group 3.

A lipid peroxidation level were evaluated by the lipid peroxide and malonic dialdehyde concentration.

Results and discussion

In July - October the LPO concentration in groups 2 and 3 was much lower than that in group1. However, this differences was only significant in July - September. The results of the experiment described in this paper show that supply-

ing dairy cows with these microelement additives caused a decline in the LPO concentration in animal blood. At the same time, animals fed rations higher Co doses (group 4) didn't reveal any decline in LPO. Moreover, there was a certain increase in the amounts of LPO in group 4 compared with group 1.

The data on malonic dialdehide were analogous to those on LPO.

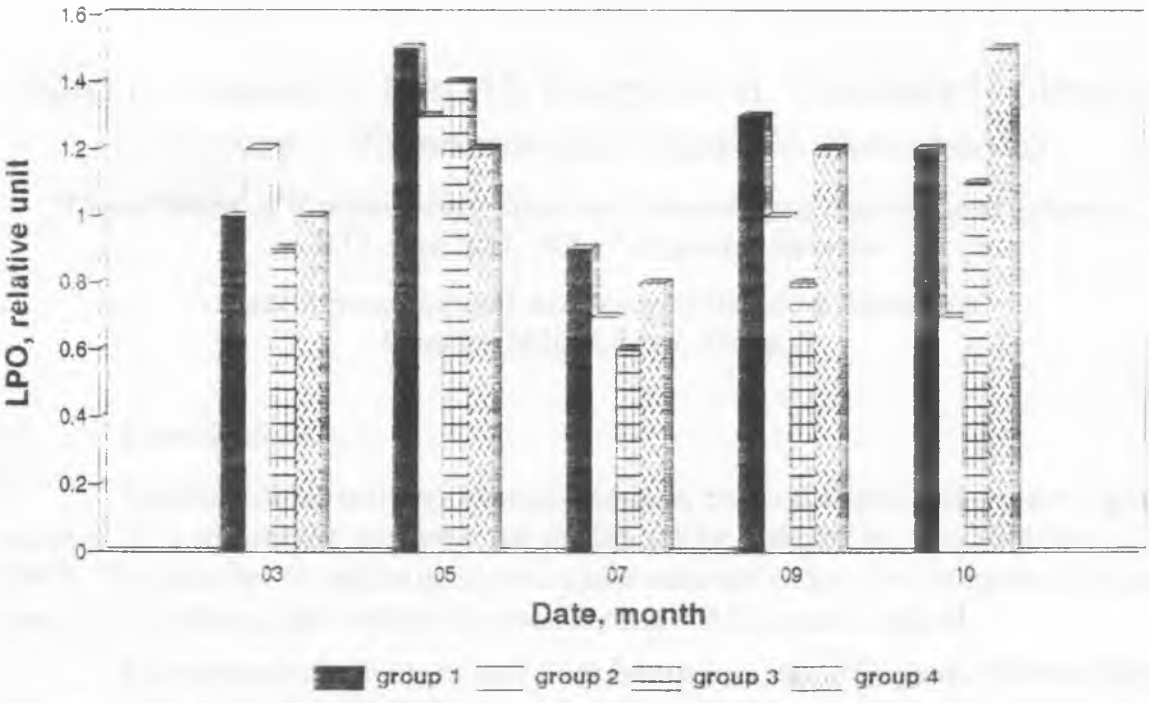

Figure. Concentration of blood hydroperoxides

The analysis of the results show that the micronutrient deficiency and the permanent influence of low doses cause a decompensation increase in the lipid peroxidation intensity and a decrease in antioxidation process activity. In our opinion, these changes take place due to the important biological role of microelements in providing the inactivation of lipid peroxidation products. Copper, for example, is the co-enzyme of one of the key enzymes of the antioxidant system - superoxiddismutase (SOD) (Davis *et al.* 1987).

References

Anderson M.S. Radiobiological mechanisms and the low dose problem. Radiat. Prot. Bull., 1991, 121: 3-4.

Armstrong D. et. al. Free radicals in molecular biology and disease. N.Y., Raven Press, 1984, 43.

Davis K.G., Mertz W. Copper. Trace, elements in human and animal nutritions.- Academic Press, 1987, Vol. 1, 301-364.

Matsubara S., Tajata Y.. Katasava M. Promotion of radioresistance by metallotioneine induction. Environ. R., 1987, 43(1): 66-74.