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THE EFFECT OF SAFFRON EXTRACT ON CATALASE ACTIVITIES IN BRAIN STRUCTURES UNDER EXPOSURE TO X-RAY IRRADIATION DOSE

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Abstract

Under exposure to X-ray irradiation at 4 Gy dose in various brain structures it is observed a decrease in catalase activity. Tendency towards decreasing is more developed on the 3th day of irradiation. Insertion of saffron extract to experimental animals (for 21 days before irradiation) contributes to prevention of decreasing of catalase activity and exerts an effective influence.

Key-Words: *X-ray irradiation, catalase, glutathione peroxidase, saffron extract, brain structures, lethal dose*

1 Introduction

Effect of ionizing radiation on living organism is accompanied by interaction of free radicals (FR) with molecules of proteins, nucleic acids and lipids. FR in its turn appears in the result of excitation and ionization of molecules. Besides all this, ionizing radiation becomes the reason of accumulation in organism tissues of toxic products (radio-toxins) that enhance radiation effect [1, 2].

Unlike a lethal dose, within the irradiation at 4 Gy dose life is possible, but thus in all physiological systems the abnormal changes develop. The intensity of these changes correlates with the comparative radiosensitivity of tissues. The nervous system is not an exception. Nerve cells have a relatively higher radiosensitivity. At higher radiation doses it is observed significant structural changes and loss of nerve cells [3]. The changes in physical and chemical properties of biological membranes, which are detected soon after the irradiation at small doses, play on the whole an important role in radiation damage of cells. It is supposed that just these abnormalities, leading to more profound changes in the membrane structure, become the reason of the penetrability increase, exit of various cofactors and enzymes from the cell [4]. Within the irradiation of biological objects the nature of changes in the activity of enzyme systems in a cell or tissue has an exceptionally important value. The numerous facts testify to essential radiation effect on the activity of many enzymes, as well as metal-containing biological catalysts. Under the radiation influence the high-molecular components of cell, as well as catalase molecules and glutathioneperoxidase (GPO) are exposed to conformational changes. Catalase (EC 1.11.1.6) is one of the high-molecular antioxidant enzymes, providing a complex protection of biopolymers from the active forms of oxygen. The main role of the catalase in a living organism is that it destroys toxic hydrogen peroxide for cells. Catalase molecule consists of four identical subunits, each of which contains iron atom. The catalase is directly involved in the processes of conjugate oxidative phosphorylation and is a radiosensitive enzyme [5]. The data obtained within the enzyme irradiation, testify that in addition to the common damaging effects of penetrating radiation, there was also the selective effect on

iron atom, part of the active site of the enzyme. The researches show that the observed decrease of catalase activity in hepatic tissue of the irradiated animals is bound to the separation of hemoglobin under radiation influence [5, 6].

At the same time the accumulation of H_2O_2 and other peroxide compounds in organism causes the inactivation of catalase [7]. Activity increase of haemocontaining-chromoprotein is observed in kidneys of exposed guinea pigs. This is probably due to the fact that in kidneys there is no accumulation of peroxidates [8].

2 Materials and methods

Experiments were carried out on white rats of 180 ± 20 gr. weight. Various structures of brain (medulla oblongata, cerebellum, visual and sensorimotor cortex) were studied according to the following scheme: I group- control, II group- x-ray irradiation, III group- x-ray irradiation + saffron extract. Within 21 days before irradiation, saffron extract was injected into the organism of animals per 120 mg/kg dose. At irradiation the indicators were recorded after an hour, 3 and 6 days. In accordance with the International Convention, decapitation of experimental animals was performed using urethane anesthesia (total dose of anesthesia was 0.08-0.1 gr. hexanol per 1 kg of body weight) and various brain structures were allocated for identifying indicators.

Saffron extract was obtained by the following scheme: dried stigmas of saffron were subjected to alcohol extraction with solution of 75% ethyl alcohol, which were kept on cold within 2 days. During this time they were constantly stirred. The solution obtained by this way, was filtered and the residue was washed with 75% alcohol. Thereafter, the alcohol was distilled off, and the obtained extract was concentrated to dryness. 0.5% solution of saffron extract was prepared on physiological solution.

The irradiation process was carried out on X-ray apparatus «PYM-17» under the following conditions: pressure 180 kVt, current strength 15 mA, filters 0,5 mm Cu and 1,0 mm Al, coefficient of focal distance 30 mm without tube, dose rate 0,86 Gy/sec, irradiation dose 4 Gy. In the result of the conducted researches it is revealed certain dynamics of change in antioxidant enzyme activity in various brain structures of white rats within the X-ray irradiation at 4 Gy dose and joint influence of X-ray radiation and saffron extract. In Tab.1, and in Fig.1 it is shown the change dynamics of catalase activity in various brain structures under the influence of saffron extract against a background of X-ray irradiation at medium doses. As it is seen from Tab.1, the catalase activity in medulla in an hour after X-ray radiation of the animals is reduced by 22%, and after 3 days - 23%, in 6 days after the irradiation by 14%, when compared with the indicators in the control group (intact animals).

3 Results and discussion

In the result of the conducted researches it is revealed certain dynamics of change in antioxidant enzyme activity in various brain structures of white rats within the X-ray irradiation at 4 Gy dose and joint influence of X-ray radiation and saffron extract. In the result of the conducted researches it is revealed certain dynamics of change in antioxidant enzyme activity in various brain structures of white rats within the X-ray irradiation at 4 Gy dose and joint influence of X-ray radiation and saffron extract.

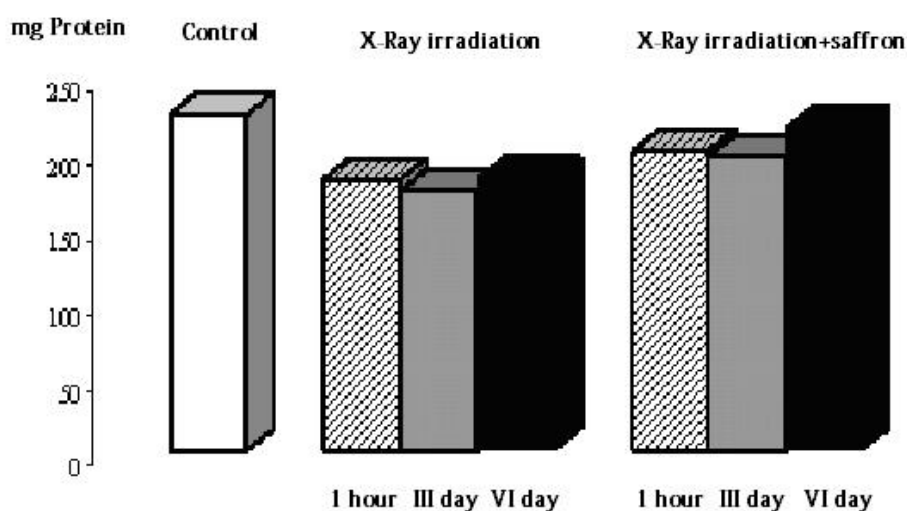


Fig.1. Change of catalase activity in sensorimotor cortex within the X-Ray irradiation at 4Gy dose and saffron extract

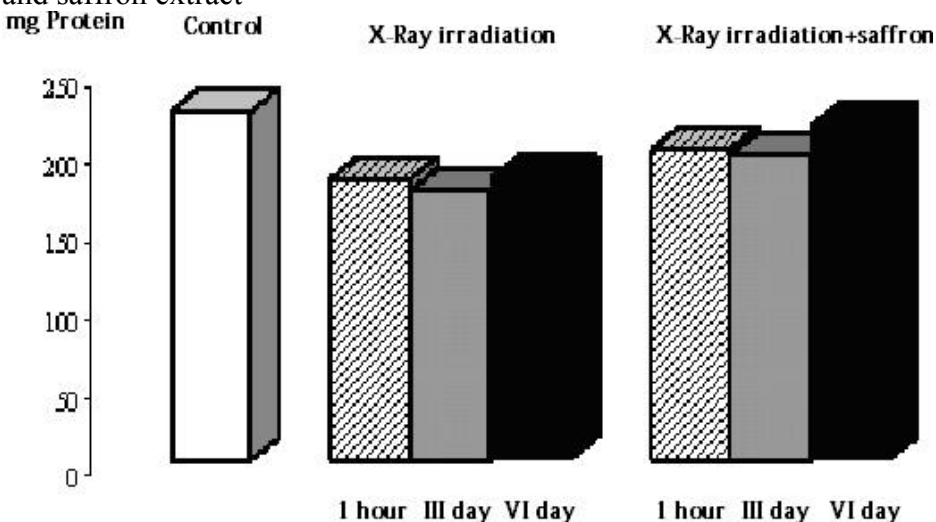


Fig.2. Change of catalase activity in visual cortex within the X-Ray irradiation at 4 Gy dose and saffron extract

At sequential influence of saffron extract and x-ray irradiation, the activity of catalase in visual and sensorimotor cortex after an hour irradiation was close to the indicator in control group (intact animals) (Fig. 1 and Fig. 2).

Preliminary injection of saffron extract into the organism of animals before their irradiation, leads to grading of POL processes' intensification in all cells that is reflected also in antioxidant defense system. Our studies revealed that injection of saffron extract facilitates minor changes in the activity of AOS enzymes, in particular catalase and glutathione peroxidase, in all studied brain structures, contributes to the activity of endogenous defense system that plays significant role in maintaining stationary level of endogenous antioxidants.

Thus, bio oxidants is of great importance in processes' balancing, taking place in cells and tissues under the influence of extreme factors. System of antioxidant defense of organism realizes permanent protection of organism from toxic radicals, and contributes to stable level of free radicals. During the free radical, enzyme, oxidant processes taking place in organism, bio antioxidants are directed to the side of enzyme oxidation, and create optimum state for cell metabolism and contributes to normal growth of tissues. Thus, preliminary injection of saffron extract into organisms of animals before irradiation leads to leveling of intensification of POL processes in all

tissues, which is reflected in AO defense system as well. Our studies revealed that the injection of saffron extract contributes to minor changes in the enzyme activity of AO system, in particular

4. Conclusion

Thus, preliminary injection of saffron extract into organisms of animals before irradiation leads to leveling of intensification of POL processes in all tissues, which is reflected in AO defense system as well. Our studies revealed that the injection of saffron extract contributes to minor changes in the enzyme activity of AO system, in particular catalase in all studied structure of brain, favors activation of endogen defense system, which plays an important role in maintaining stationary level of endogen antioxidants.

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