Radioprotective properties of *Helianthus tuberosus L. polysaccharide* in proton radiation

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Protecting the body from the harmful effects of ionizing radiation is an important medical task. This problem is especially relevant for patients undergoing radiotherapy, as well as for astronauts exposed to increased radiation levels. Currently available radioprotectors do not provide complete protection. It has been previously shown that some polysaccharides possess radioprotective properties [1, 2]. Therefore, the aim of this study was to investigate the effect of Helianthus tuberosus L. polysaccharide on mouse survival after irradiation, as well as to assess the degree of DNA damage in animal cells.

Materials and methods: The study used 5-month-old male SHK mice weighing 30-35 g. The HTLP polysaccharide was isolated from Helianthus tuberosus as described in previous studies [1-3]. HTLP was administered intravenously into the tail vein at a dose of 100 μg per animal 15 minutes before irradiation. The irradiation was performed on the Prometheus proton therapy facility [4] PTC PHIAN, Protvino, Moscow region) at doses of 1.5 Gy and 6.5 Gy. The control group received the same dose of X-ray radiation on the RUT device [IBCh RAS]. 50 mice were used, divided into 5 groups: 1) proton irradiation control; 2) HTLP + protons; 3) X-ray control; 4) HTLP + X-rays; 5) HTLP without irradiation. Survival was assessed in a 30-day Kaplan-Meier test. Statistical processing was performed in R using the survival and survminer packages.

Results: To assess the radioprotective properties of HTLP, the frequency of cytogenetic damage in bone marrow cells was analyzed using the micronucleus test. Micronuclei are a relevant biomarker of radiation-induced genetic damage to cells [5]. In animals treated with HTLP before irradiation, the number of micronuclei in bone marrow cells was 5 times lower compared to the irradiated control group. In the group of animals which received HTLP without subsequent irradiation, the micronuclei frequency did not differ from the control group, indicating that the drug is not genotoxic.

With 6.5 Gy irradiation, the pre-administration of HTLP polysaccharide 15 minutes before irradiation increased the median life expectancy of mice by 48% compared to the control groups that received irradiation without prior protection. The effect was observed for both X-ray and proton irradiation. The control group of animals receiving HTLP without subsequent irradiation showed 100% survival. The obtained data demonstrate that HTLP polysaccharide possesses radioprotective properties comparable to applied chemical drugs. Further research on the mechanisms of this effect seems promising.

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