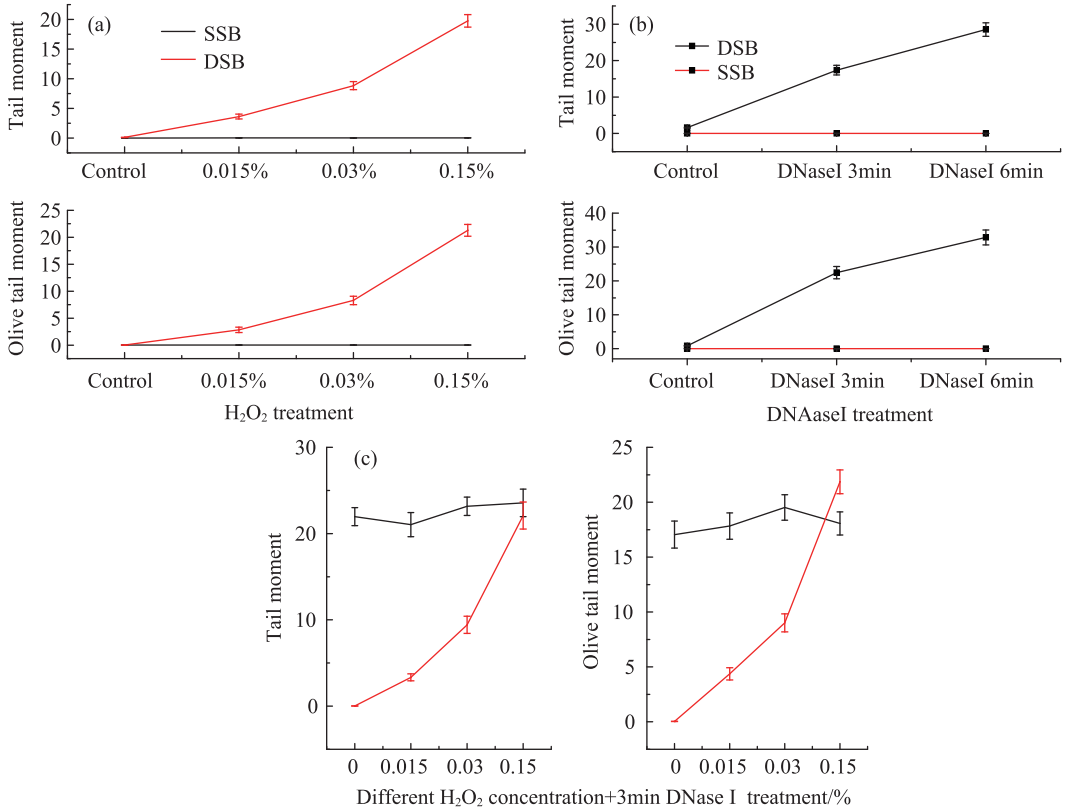

Fig. 2 DNA damage detection with two dimensional comet assay. (a) DNA damage induced by H_2O_2, (b) DNA damage induced by DNase I, (c) DNA damage induced by DNase I and H_2O_2.

4 - 38 DNA Damage in Bone Marrow Mononuclear Cells of Mice Following Total Body Irradiation with Carbon Ions

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Among the many special factors in the space environment, space radiation especially high energy heavy ion radiation is widely regarded as one of the crucial factors that hazard the health and safety of astronaut. It is well known that biological effects of radiation are dependent on the linear-energy-transfer (LET) of the emergent beam. Heavy ions have high LET and could induce complex and clustered DNA damage, which is more difficult to be repaired than individual lesions and is even irreparable. The biological effect of heavy ions is higher than conventional radiations such as low-LET γ- and X-rays. So it is important to focus on the radiation biological effects of heavy ions even if their proportion in space radiation is low.

Hematopoietic system is highly sensitive to radiation, and its damage can reduce astronaut's ability to work and radiation tolerance. Bone marrow involved in hematopoiesis primarily. The main purpose of this paper is to evaluate the high-LET irradiation, like carbon ions, caused DNA damage of bone marrow mononuclear cells (BMMNCs) in mice.

120 Female BALB/c mice were randomly divided into 5 groups (24 mice per group) and total body irradiated (TBI) with different doses of carbon ions (LET=31.6 keV/μm) at a dose rate of 1 Gy/min. Sham-irradiation mice were used as controls (0 Gy). On the first, third and eighth day after TBI, BMMNCs were harvested from mice femoral tissues (8 mice/group/time points) and the DNA damage of BMMNCs in mice was evaluated using the two dimensional comet assay.

DNA single strand breaks (SSBs) and double strand breaks (DSBs) results of two dimensional comet assay were analyzed separately and showed in Fig. 1. The results showed that DNA SSBs and DSBs induced by carbon ions irradiation were time and dose-dependent. The TM and OTM of DSBs (Fig. 1(c) and (d)) were much higher than those of SSBs (Fig. 1(a) and (b)). The percentages of DNA damaged cells were also time- and dose-dependent (Fig. 2), and the percentage of DNA DSBs cells at the 1^{st} day after carbon ion exposure (Fig. 2(b)) was much higher than that of SSBs damaged cells (Fig. 2(a)).

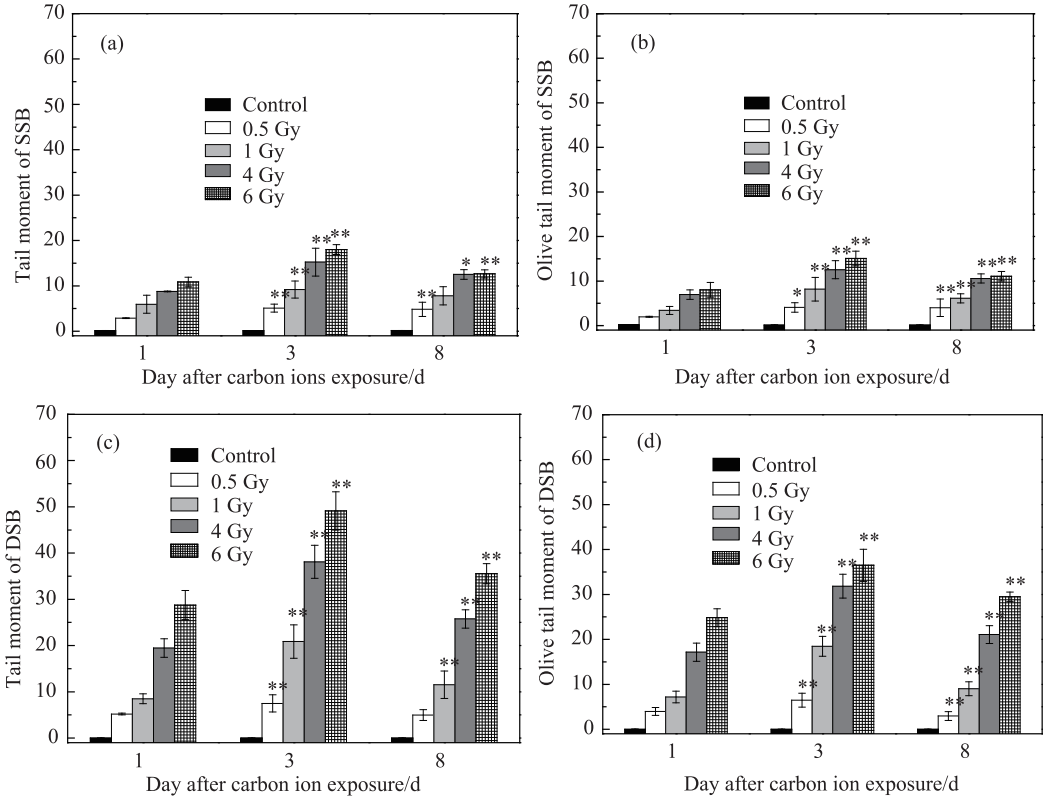

Fig. 1 DNA damage induced by carbon ions irradiation, n=8.

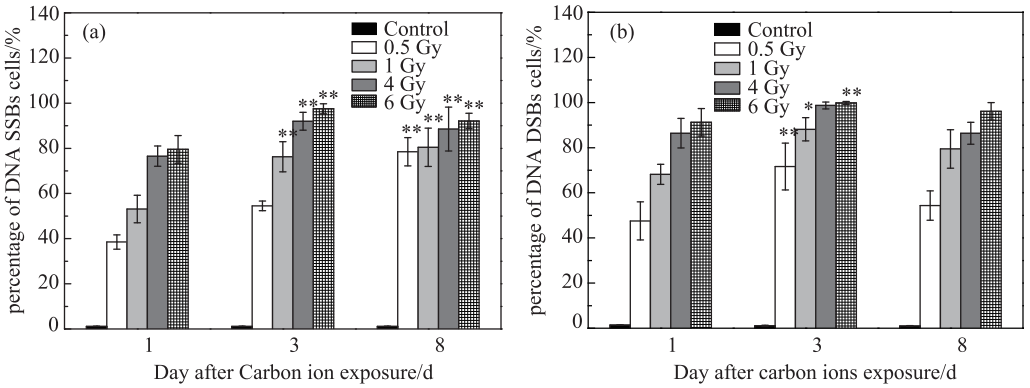

Fig. 2 Percentage of DNA damaged cells induced by carbon ions irradiation, n=8.

Our studies showed that carbon-ion irradiation caused serious BMMNCs DNA damage. Even after 8, 0.5 Gy induced-DNA damage was still very obviously.