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Safety of hypomagnetic field and its effects on the skeletal system

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All organisms survive and multiply under the geomagnetic magnetic field (GMF) [1]. With the launch of the Moon and Mars space program, during long-distance space mission, astronauts will inevitably be exposed to an environment with a hypomagnetic field (HyMF), which several thousand times weaker than GMF[2]. Spatial hypomagnetic field exists on the surface of the moon or in the deep space of the solar system, and its magnetic intensity is less than 5 μT[3]. At present, the research on the effects of HyMF on the health of astronauts is mainly focused on the conditions of ground simulation experiments, including the central nervous system, blood system and brain cognition [4,5]. However, relevant safety of the skeletal system studies about HyMF are deficient. Our recent research indicated that the effects of HyMF on bone cannot be overlooked. In vivo, our study found that HyMF aggravated bone loss induced by hindlimb unloading (HLU) in rats and mice, which related to the changes in iron metabolism[6,7]. In addition, HyMF also inhibited the recovery of simulated microgravity-induced osteoporosis of mice, probably by restraining elevated iron return to normal levels[8]. Meanwhile, we found that HyMF can inhibit osteoblast differentiation and mineralization[9], promote osteoclast formation and bone resorption in vitro[10]. The research results have significant academic values in the field of magneto-biology and the potential application values in space activities for the manned moon landing exploration.

Key words:

Hypomagnetic field, geomagnetic field, safety management, iron storage.

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