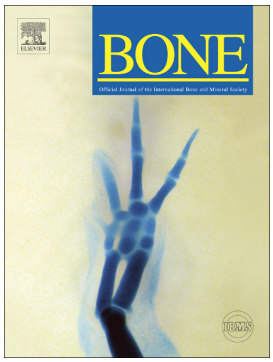

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Iron overload involved in the enhancement of unloading-induced bone loss by hypomagnetic field

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Abstract

During deep-space exploration missions, astronauts will be exposed to abnormal space environments including microgravity and hypomagnetic field (HyMF) that is 10,000 times weaker than geomagnetic field (GMF). It is well known that microgravity in space can induce bone loss; however, it is ill-defined whether HyMF involved in this process. Herein, we aimed to investigate the combined effects of HyMF and microgravity on bone loss. A mouse model of hindlimb suspension (HLU) was adopted to simulate microgravity-induced bone loss, that was exposed to a hypomagnetic field of < 300 nanotesla (nT) generated by a geomagnetic field-shielding chamber. Besides, a recent study showed that HLU induced bone loss was orchestrated by iron overload. Therefore, the changes of iron content in unloading-induced bone loss under HyMF condition were detected simultaneously. The results showed HyMF exacerbated the loss of bone mineral content (BMC), induced more detrimental effects on microstructure of cancellous bone but not cortical bone and yielded greater negative effects on biomechanical characteristics in mice femur under unloading status. Concomitantly, there was more iron accumulation in serum, liver, spleen and bone in the combined treatment group than in the separate unloading group or HyMF exposure group. These results showed that HyMF promoted additional bone loss in mice femur during mechanical unloading, and the potential mechanism may be involved in inducing iron overload of mice.

Key words:

hypomagnetic field, hindlimb unloading, iron overload, bone loss