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Introduction. Long-term spaceflight induces hypokinesia and hypodynamia, which, together with microgravity per se, result in a number of physical alterations, such as muscle atrophy, force reduction, balance and coordination impairment, and aerobic fitness decrease. Each of these adaptations could turn to serious health deterioration during the long-term spaceflight needed for planetary exploration or when returning on earth. Currently, numerous countermeasures have been tested (resveratrol, leucine, exercise, etc.), but none showed a total efficiency. Beta-hydroxy-beta-methylbutyrate (HMB), a leucine metabolite, has been described in normal condition to increase aerobic fitness and prevents muscle atrophy during cancer. We hypothesized that HMB could be used as a nutritional countermeasure to prevent physical deconditioning in hindlimb unloaded mice.
Methods. Mature (14 weeks) C56Black6J male mice were hindlimb-unloaded (HU) or kept ambulatory for 14 days. Mice were provided either HMB (250mg/kg body mass per day) or deionized distilled water by oral gavage for 21 days (7 days prior to and during the 14 days of HU). Aerobic fitness was evaluated by a treadmill incremental test, and a multiple static rod test assessed coordination and balance. Muscle fibre cross-sectional area (CSA) was determined by histomorphometric analysis. Protein synthesis and proteolysis and their respective pathway were analysed by Western Blot quantification.
Results and Discussion. HMB treatment maintained soleus muscle mass, aerobic fitness, coordination and balance. The positive protein balance showed in treated mice can explain in part these results.
Conclusion. HMB could thus be envisaged as a nutritional countermeasure for spaceflight, but remains to be tested in humans.

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