IJAE
Vol. 121, n. 1 (Supplement): 81, 2016
ITALIAN JOURNAL OF ANATOMY AND EMBRYOLOGY

Effects of recombinant Irisin on the musculoskeletal system of hind-limb suspended mice

[1] Graziana Colaianni - [1] Teresa Mongelli - [1] Concetta Cuscito - [1] Luciana Lippo - [1] Paolo Pignataro - [1] Giacomina Brunetti - [2] Giorgio Mori - [3] Giovanni Passeri - [1] Silvia Colucci - [4] Saverio Cinti - [5] Maria Grano

[1] Department of Basic Medical Science, Neuroscience and Sense Organs, University of Bari, Italia - [2] Department of Clinical and Experimental Medicine, University of Foggia, Italia - [3] Department of Clinical and Experimental Medicine, University of Padova, Italia - [4] Department of Experimental and Clinical Medicine, University of Ancona, Italia - [5] Department of Emergency and Organ Transplantation, University of Bari, Italia

We previously showed that Irisin, a myokine released from skeletal muscle after physical exercise, plays a central role in the control of bone mass, driving positive effects on cortical mineral density and geometry in vivo (1). Here we demonstrated that r-Irisin treatment prevents bone loss in hind-limb suspended mice when administered during suspension and recovers bone mass when mice were injected after a suspension period (4 weeks) during which they developed bone loss. Micro computed tomography of femurs showed that r-Irisin treatment positively affected both cortical and trabecular bone. As expected, unloaded mice treated with vehicle displayed a remarkable decrease of cortical and trabecular bone mineral density (BMD), whereas in Irisin-treated unloaded mice no loss of BMD was observed with respect to control mice kept under normal loading. Likewise, by treating mice after they already developed disuse-induced bone loss, r-Irisin was able to restore the damaged mineral component. Furthermore, trabecular bone volume fraction (BV/TV), which dramatically decreased in unloaded mice, was prevented by r-Irisin therapy. In particular, r-Irisin treatment preserved the number of trabeculae (Tb.N) and the fractal dimension, an index of optimal micro-architectural complexity of trabecular bone.We also showed that r-Irisin treatment protects muscle mass suffering from atrophy during unloading. Thus, unloaded mice treated with vehicle displayed a severe loss of muscle mass, as confirmed by ~ 60% decline of vastus lateralis weight and ~33% decrease of fiber cross-sectional area. Conversely, Irisin-treated unloaded mice showed no loss of muscle weight and similar fiber cross-sectional area to control mice. Our data reveal for the first time that r-Irisin treatment prevents and retrieves disuse-induced bone loss and muscle atrophy. These findings may lead to develop an Irisin-based therapy for the prevention and treatment of osteoporosis and sarcopenia in all patients who cannot perform physical activity, as occurs during aging and immobility, and it could also represent a countermeasure for astronauts exposed to microgravity during space flight missions.

This work was supported in part by ERISTO grant (to M.G.), by MIUR grant ex60% (to M.G.) and by SIOMMMS grant (to G.C.).

References

[1] Colaianni et al. (2015) PNAS;112(39):12157-62.

Keywords

Osteoporosis; sarcopenia; mechanical loading; Irisin.