

## Resistance Exercise During Hindlimb Unloading in Rats Mitigates Disuse-induced Bone Loss

MICHAEL HEDGES<sup>1</sup>, CORINNE METZGER<sup>1</sup>, CHANGWOOCK LEE<sup>2</sup>, STEVEN RIECHMAN<sup>2</sup>, and SUSAN A. BLOOMFIELD<sup>1</sup>

<sup>1</sup>Bone Biology Laboratory; Department of Health and Kinesiology; Texas A&M University; College Station, TX

<sup>2</sup>Human Countermeasures Laboratory, Department of Health and Kinesiology, Texas A&M University; College Station, TX

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### ABSTRACT

Disuse-related bone loss affects various populations of individuals including astronauts, bedridden patients, those with spinal cord injuries, and, to not as drastic a degree, the increasing population living sedentary lifestyles. The lack of mechanical stimulation on bones can lead to bone loss and an increased risk of low bone mass, osteoporosis, and fractures. Therefore, the goal of this study was to determine the effects of resistance exercise on bone during a period of disuse in skeletally mature rodents.

Male rats were placed into three different groups, hindlimb unloading, (HU), hindlimb unloading with resistance training (HU+RE), and cage control (CC), for 4 weeks. Resistance exercise was accomplished by jump training 3 days a week with progressive increases in weights added to a vest placed on the rat (10%-40% body weight in added weight). The right tibia of each rat was harvested and bone mass parameters were measured using peripheral quantitative computed tomography (pQCT) scans of the proximal metaphysis and midshaft tibia. At the proximal tibia, HU rat means were significantly lower than those of CC in total mineral content, cortical content, and cancellous density ( $p < 0.05$ ). HU+RE had significantly higher total bone content, trabecular content, cancellous density, and cortical content than the HU group ( $p < 0.01$ ). Total content was significantly different between CC and HU+RE ( $p < 0.05$ ). No differences were seen among group means for any variable at the midshaft tibia (100% cortical bone). Resistance exercise can mitigate bone loss during a period of disuse, especially in the cancellous-rich compartment of metaphyseal bone. This highlights the importance of resistance training during periods of disuse, as well as demonstrating the importance of regular loading of bone for individuals leading sedentary lifestyles.