Muscle Volume Increases Following 16 Weeks of Resistive Exercise Training with the Advanced Resistive Exercise Device (ARED) and Free Weights

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Introduction

Muscle atrophy and induced muscle strength have been observed following long-duratiion space flight (LeBlanc, 2000; Trappe, 2009). Decreased muscle performance is considered a human health and performance risk by the Human Research Project at the Johnson Space Center, National Aeronautics and Space Administration (NASA). Decreased muscle function may impact crew performance and mission success during long duration missions and planetary exploration.

The interim Resistive Exercise Device (iRED) has been utilized since the first International Space Station (ISS) mission as a countermeasure to prevent muscle loss and atrophy in space flight (LeBlanc, 2000; Trappe, 2009). The Advanced Resistive Exercise Device (ARED) is designed to improve upon the limitations of the iRED, including increased range of motion, variable loading, and lower eccentric forces (Shackelford, 2004). The ARED was developed by NASA to address iRED’s limitations (variable loading, limited range of motion, and lower eccentric forces) that may have decreased its efficacy. ARED, recently deployed on ISS during Expedition 18, represents a 729 kg resistance and provides an opportunity to evaluate the structural force (50 kg) of the ISS. The ARED consists of 80 kg of resistance, 60 mm slices with a 10 mm gap) to simulate the return of human subjects to the ISS in the future.

Purpose

The purpose of this study was to compare the efficacy of ARED and FW training to induce hypertrophy in specific muscle groups in ambulatory subjects.

Thigh Muscle Volume

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MRI Methods

Magnetic Resonance images (MRI) were acquired pre- and post-training. Cross-sectional area (CSA) was calculated within each slice of the Rectus Femoris (RF), the Vastus Medialis (VM), the Vastus lateralis (VL), the Biceps Femoris (BF), and the Hamstring group (H). Cross-sectional area (CSA) = (# of pixels) x (Pixel size x pixel size) x (Slice thickness). Repetition Time/Echo Time for thigh was 800/400 and for the calf was 800/350. Images were analyzed using the GNU Image Manipulation Program (GIMP 2.6.6, Berkley, California).

References

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