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ADVANCED RESISTIVE EXERCISE VERSUS INTERIM RESISTIVE EXERCISE IMPACT ON BIOMARKERS OF BONE TURNOVER AND SUBSEQUENTLY SPINE HEALTH FOR ASTRONAUTS UNDERGOING PROLONGED SPACE FLIGHT: A SYSTEMATIC REVIEW AND META-ANALYSIS

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Abstract

Background: Spaceflight, once a distant dream for many, is potentially becoming a commodity with recent advancements. Microgravity-related spine abnormalities are expected to increase with the increase of spaceflights conducted by individuals.

Objectives: To examine whether Advanced Resistive Exercise (ARED), Interim Resistive Exercise (IRED), or Bisphosphate and ARED (Bis+ARED) best maintained bone turnover biomarkers, minimizing subsequent effects on the spine during extended spaceflight

Methods: Following PRISMA guidelines, 86 studies were identified from PubMed, EmBase and SCOPUS. Studies had to be double-arm discussing ARED as the intervention with IRED and/or Bis+ARED as a comparison throughout multiple flight phases for calcifediol, calcitriol, and urinary calcium. Studies had to be in English; no limit on years was set. Meta-analysis of Mean Difference (MD) with 95% CI was conducted using STATA MP (v.17.0). A total of 3 studies encompassing 2 prospective cohorts and 1 clinical trial were examined in the quantitative comparison between ARED and IRED/Bis+Ared. With a total number of 52 participants.

Results: In comparison to ARED, Bis+ARED has a favored outcome in alignment with normal bounds, and statistically significant urinary calcium (MD=59.38 [Cl: 17.10, 101.66], p=0.01). While calcitriol favored Bis+ARED (MD=4.35 [CI: -12.20, 20.89]), and calcifediol favored ARED (MD= -2.08 [CI: -7.48, 3.31]), there is no difference between the 2 treatments as the results are statistically insignificant $p > 0.05$ at p= 0.61, and 0.78, respectively. - Similarly, IRED was favored in urinary calcium and calcitriol at (MD= 17.16 [Cl: -13.71, 48.03]), and (MD= 7.44 [CI= -6.94, 21.81]) respectively, although statistically insignificant, $p > 0.05$. ARED was favored in calcifediol (MD= -8.30 [CI: -14.31, -2.29]), and being

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statistically significant at p= 0.01. - The lack of studies for the intervention (ARED) and comparisons (IRED, and Bis+ARED) limits the amount of statistical comparison to be made.

Conclusion: ARED is favored over IRED, and Bis+ARED over ARED; although further trials are needed to solidify this outcome

Key Words: Spine health; Resistive exercise; Bone health; Spaceflight; Astronauts; Microgravity

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