Paper ID: 87825
oral
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IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (A1)
Interactive Presentations - IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (IP)

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IMPACT OF ISOLATION/CONFINEMENT (IC) STRESS ON HUMAN BIOPHYSIOLOGY: A MULTIOMIC ANALYSIS

Abstract

Physiological adaptation during long-distance/duration spaceflight (LDSF) (after evolving as a bipedal species under Earth's gravity) affects multiple-body systems. LDSF effects on human physiology have been extensively studied since before the 1969 landing of Apollo 11 on the Moon. The research, however, has historically investigated the gravitational forces of launching and landing above that of Earth's gravity acceleration (9.8m/s2, ge) and the impact of irradiated microgravity exposure on independent physiological systems. However, the mechanisms of these adaptations have not yet been fully elucidated to provide space agencies with successful countermeasures for longer and further spaceflight; humanity remains attached to Earth's umbilical cord. At humanity's core is the need to belong; we are social creatures and are reported as suffering from comorbid conditions when isolated. Therefore, there is a strong relationship between isolation/confinement ("IC") stress and immunity and epigenetic changes (concerning disease propensity) that may contribute to these LDSF deleterious mechanisms.

Multiomic research is needed to analyze IC stress on multiple systems to delineate the physiological adaptations. Unlike research focusing on one area (i.e., cardiovascular, bone), a multiomic approach is deemed more accurate to assess faulty mechanisms. As a result, this thesis research will examine the impact of IC stress on specific immunosuppressive and epigenetic mechanisms. The research design is a quantitative, quasi-experimental, repeated measure of blood, saliva, and hair samples for these biomarkers, with a pretest-posttest design utilizing volunteer male and female participants at terrestrial space analogs.

The hypothesis assumes IC causes significant stress to dysregulate immunosuppressive factors (i.e., HPA Axis genes and brain-derived neurotrophic factors (BDNF)) contributing to inflammatory responses via any of the three epigenetic mechanisms contributing to genomic instability. Where significance occurs, evidence-based countermeasures could be developed to contribute to humanity's evolution into a space-faring civilization, and therapies could be developed for humanity with related ailments.