Paper ID: 100879
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IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (A1)
Interactive Presentations - IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (IPB)

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LUNG FUNCTION ALTERATION IN CREWMEMEBER OF SIMULATED MOON-BASED RESEARCH STATION: A MULTI CENTER STUDY

Abstract

Introduction: Pulmonary function tests (PFTs) are essential tools for monitoring lung health, particularly in environments that may impair respiratory function, such as space exploration. Astronauts face unique challenges, including microgravity, elevated G-forces, radiation, and exposure to planetary dust, which can alter pulmonary function. This study aimed to evaluate changes in lung function during analog space missions in two research centers in Poland, LunAres and the Analog Astronaut Training Center (AATC), to better understand the impact of simulated space conditions on respiratory health.

Methods: A multicenter observational study was conducted in 2024 during two separate analog missions. The first mission involved five participants at LunAres, while the second included four participants at AATC. PFTs were performed pre-flight, on-flight, and post-flight using a digital spirometer. Eighteen pulmonary parameters, including forced vital capacity (FVC), forced expiratory volume in 1 second (FEV1), and peak expiratory flow (PEF), were measured. Data were analyzed using descriptive statistics, paired t-tests, and one-way ANOVA with Bonferroni post-hoc tests.

Results: No significant differences were observed in FVC, FEV1, or PEF across the three measurement times in either mission. However, slight variations were noted: FVC increased slightly during the missions, while FEV1 and PEF showed minor reductions post-flight in the AATC mission. Anthropometric factors, such as BMI, and pre-existing conditions (e.g., asthma) did not significantly influence the results. The overall pulmonary function of participants remained within normal ranges, suggesting resilience to the simulated space conditions.

Conclusion: This study demonstrates that pulmonary function remains stable during analog space missions, with no significant adverse effects observed. These findings provide valuable insights into the adaptability of human lungs under simulated space conditions, supporting the feasibility of long-duration missions. Further research is needed to explore the cumulative effects of prolonged exposure to space environments and to refine countermeasures for maintaining respiratory health in astronauts.