Paper ID: 87033
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IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (A1)
Medical Care for Humans in Space (3)

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# COOLFLY: BEATING GRAVITY'S PULL WITH PERIPHERAL COOLING

**Abstract**

Achieving cardiovascular stability is crucial for the success of manned space missions. Astronauts and military pilots, subjected to dynamic acceleration conditions, experience peripheral blood pooling and cardiovascular instability, leading to sudden or prolonged blood pressure drops and potential loss of consciousness. This study evaluates the efficacy of peripheral cooling in mitigating blood pooling during parabolic flights, aiming to inform countermeasure system designs for spaceflight.

Throughout the 39th to 41st DLR parabolic flight campaigns, 17 healthy participants underwent tests with a peripheral cooling system applied to legs, thighs, and waist while standing. Employing a cross-over design, each participant experienced the cooling system during one set of 15 parabolas and acted as their control in another set. The study utilized non-invasive diagnostic tools, including continuous blood pressure monitoring, pulse wave velocity, laser Doppler, and near-infrared spectroscopy, to assess the impact of peripheral cooling on venous blood pooling and cardiovascular stability.

Findings highlighted the positive role of peripheral cooling in enhancing hemodynamic stability, notably in blood pressure and perfusion, under hyper-gravitational stress. Significant cardiovascular responses were noted during transitions into hyper-gravity, with the cooling system mitigating blood pressure reductions and perfusion decreases. Blood pressure variations during gravitational shifts were reduced by over 50

The COOLFLY study confirms the viability of peripheral cooling as an effective countermeasure in parabolic flight conditions, with implications for astronautics, military aviation, and potential clinical applications. The non-pharmacological nature of this cooling intervention offers a low-risk, easily deployable solution for maintaining cardiovascular stability in varied gravitational environments.