

# ProGress Study: COMPARISON OF PROGRESSIVE RESISTANCE TRAINING ON A SHORT ARM CENTRIFUGE WITH GROUND-BASED TRAINING

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**The ProGress study introduces resistance training with centrifugal acceleration as a novel countermeasure against space-induced musculoskeletal deconditioning**

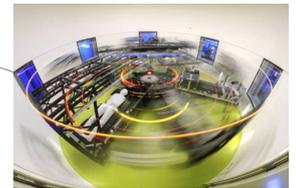
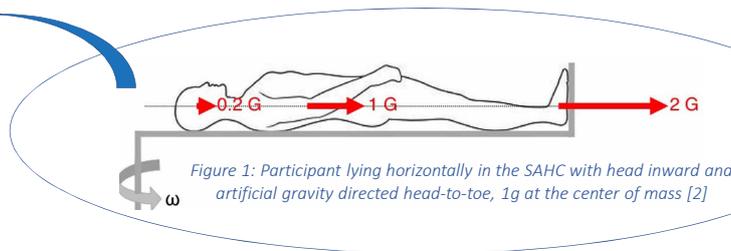
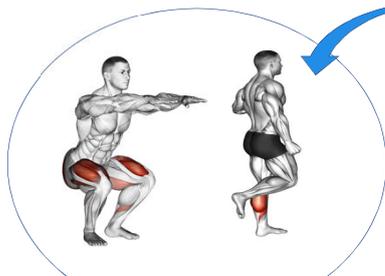
## Introduction

Current exercise countermeasures on the ISS, such as resistance and aerobic training, are only partially effective due to the absence of gravitational force [1]. **The ProGress study investigates the effectiveness of progressive resistance training on a Short Arm Human Centrifuge (SAHC) compared to conventional methods.** The SAHC introduces a steep force gradient during centrifugation, creating higher hydrostatic loads and tissue pressures in the lower legs. This study explores how these unique conditions influence physiological adaptations.

## Objectives

1. Comparing the changes in quadriceps muscle volume, as measured by MRI, after 12 weeks of high-intensity resistance training on an SAHC versus traditional ground-based training
2. Evaluation of muscle strength, vertical jump performance, body composition, and V'O<sub>2</sub> max, as well as conducting myofiber type-specific and metabolomic analyses of biopsy samples

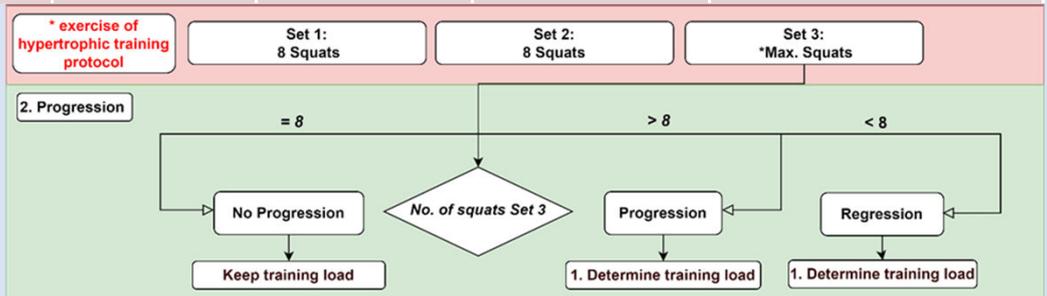
**Keywords**  
 Microgravity,  
 Resistance Training,  
 Short Arm Human Centrifuge,  
 Musculoskeletal Health



## Methodology

Exercise	Reps	Sets	Load (%3RM)	Rest Between Sets (s)	Rest Between Exercises (s)	Movement Velocity (s)
Squats	8	3	80	30	60	3:0:3
Calf raises	8	3	80	30	30	1:1:1
Deep squats	8*	3	80	30	60	3:0:3

This multicenter trial at DLR Cologne and Hildesheim involves **20 participants** (18-45 years) assigned to centrifuge or fitness training. Both groups complete **36 progressive sessions over 12 weeks**, adjusting centrifuge speed or weight for **progression**



## Conclusion

The findings from the ProGress study will provide critical insights into **the effectiveness of replacing Earth gravity with centrifugal acceleration in maintaining muscle health during extended periods of microgravity.** If successful, the ProGress study could **revolutionize exercise countermeasures for astronauts**, enhancing their physical resilience in space and upon return to Earth as well as giving valuable insights for strength training

## Reference

- [1] Scott, J.M., et al., *Effects of exercise countermeasures on multisystem function in long duration spaceflight astronauts.* npj Microgravity, 2023. 9(1): p. 11
- [2] Clément, G., et al., *Artificial gravity as a countermeasure for mitigating physiological deconditioning during long-duration space missions.* Frontiers, 2015. 9: p. 92.

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