

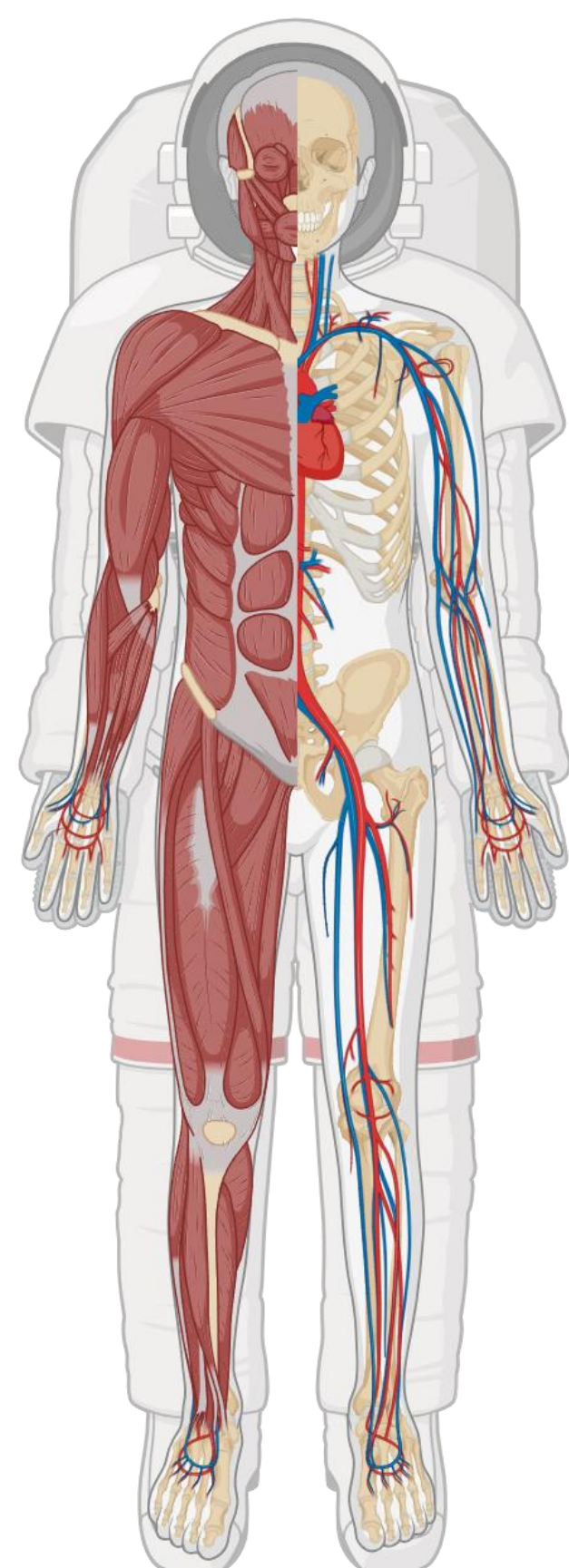
Effects Of 5-day Metabolic Reduction On Exercise Demands And Performance

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Background

- Many animals reduce metabolic rate and core temperature to survive harsh environments and conserve resources while preserving skeletal muscle health.
- Inducing these changes in humans could have practical applications for decreasing use of finite resources in scenarios such as spaceflight or austere terrestrial environments.
- A sublingual loading dose of dexmedetomidine followed by an 18-hour subcutaneous infusion effectively reduces metabolism in healthy volunteers.
- The effects of sustained metabolic reduction on muscle strength are unknown.



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AIM: To examine changes in skeletal muscle strength and aerobic capacity during the allocated daily exercise portion of a 5-day metabolic reduction protocol.

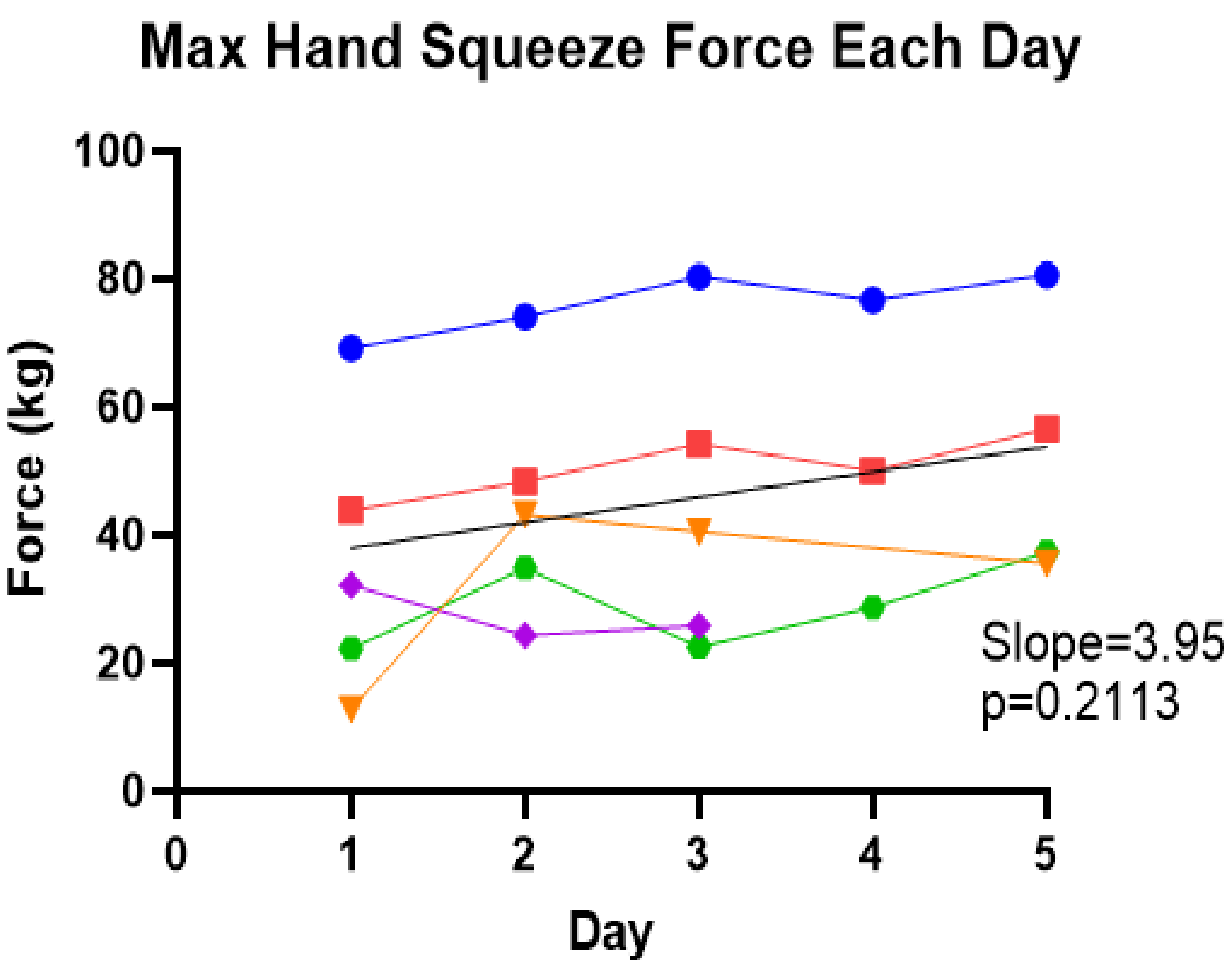


Figure 1. Trend in each participants' peak isometric hand squeeze strength during the protocol

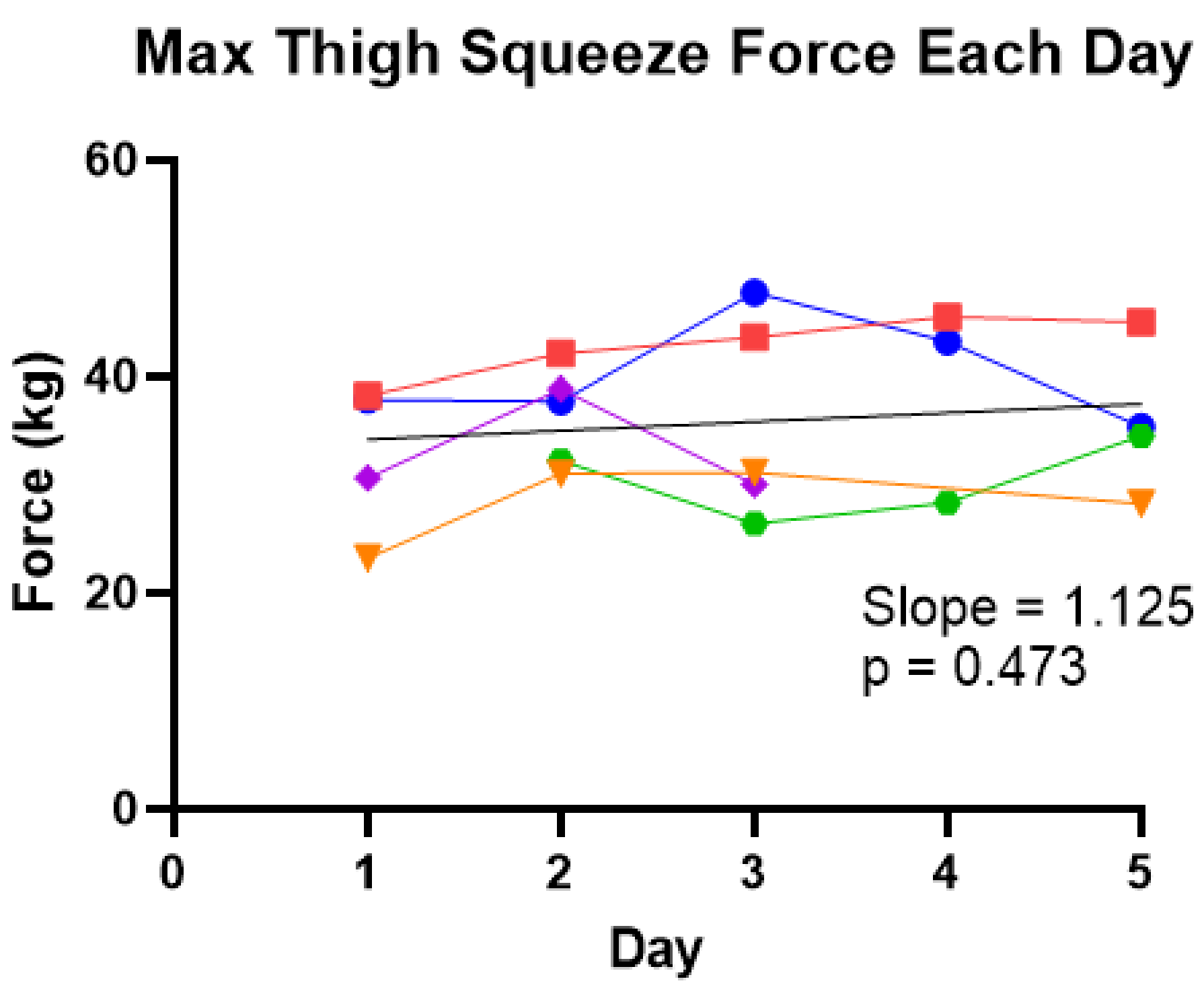


Figure 2. Trend in each participants' peak isometric thigh squeeze strength during the protocol

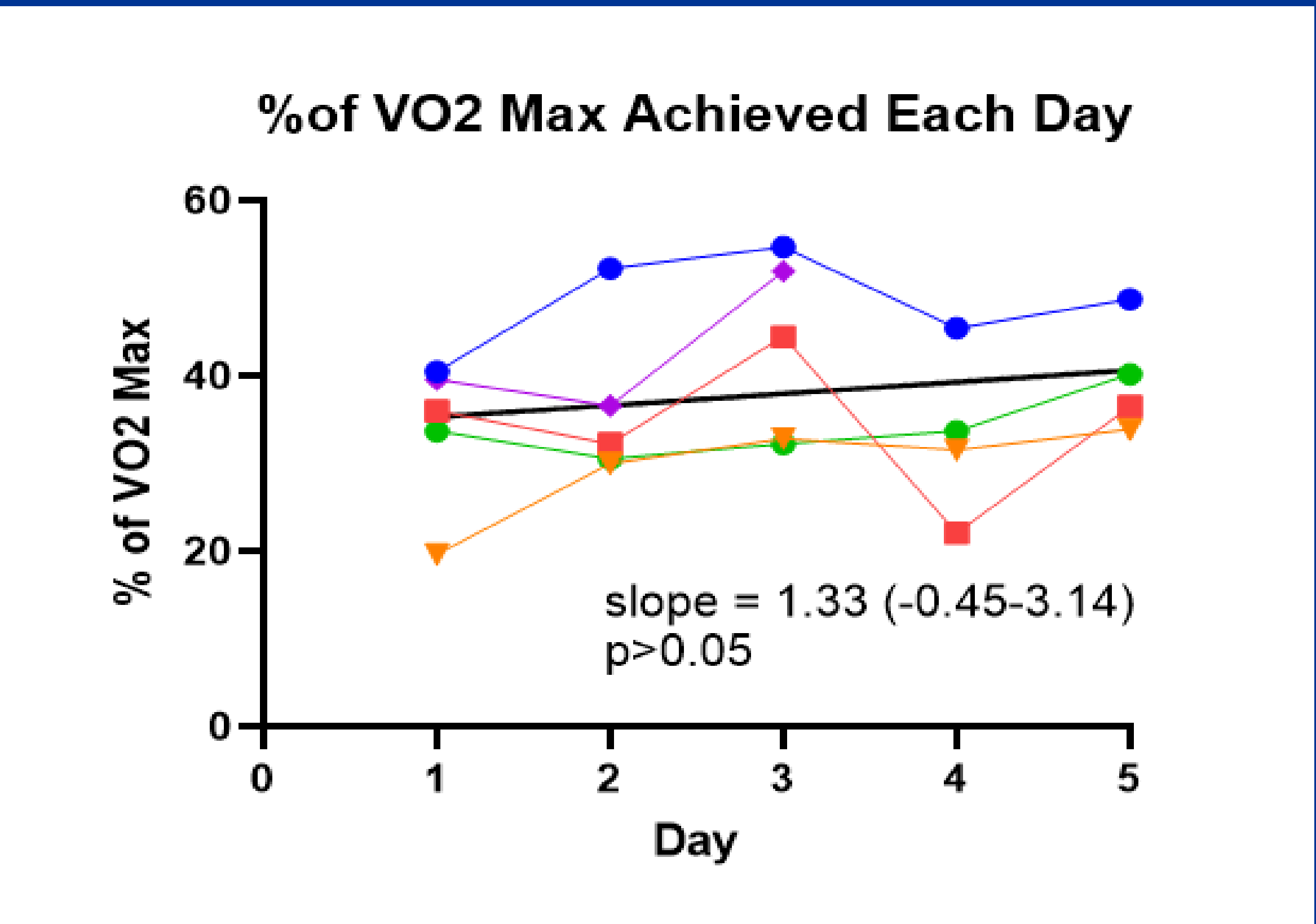
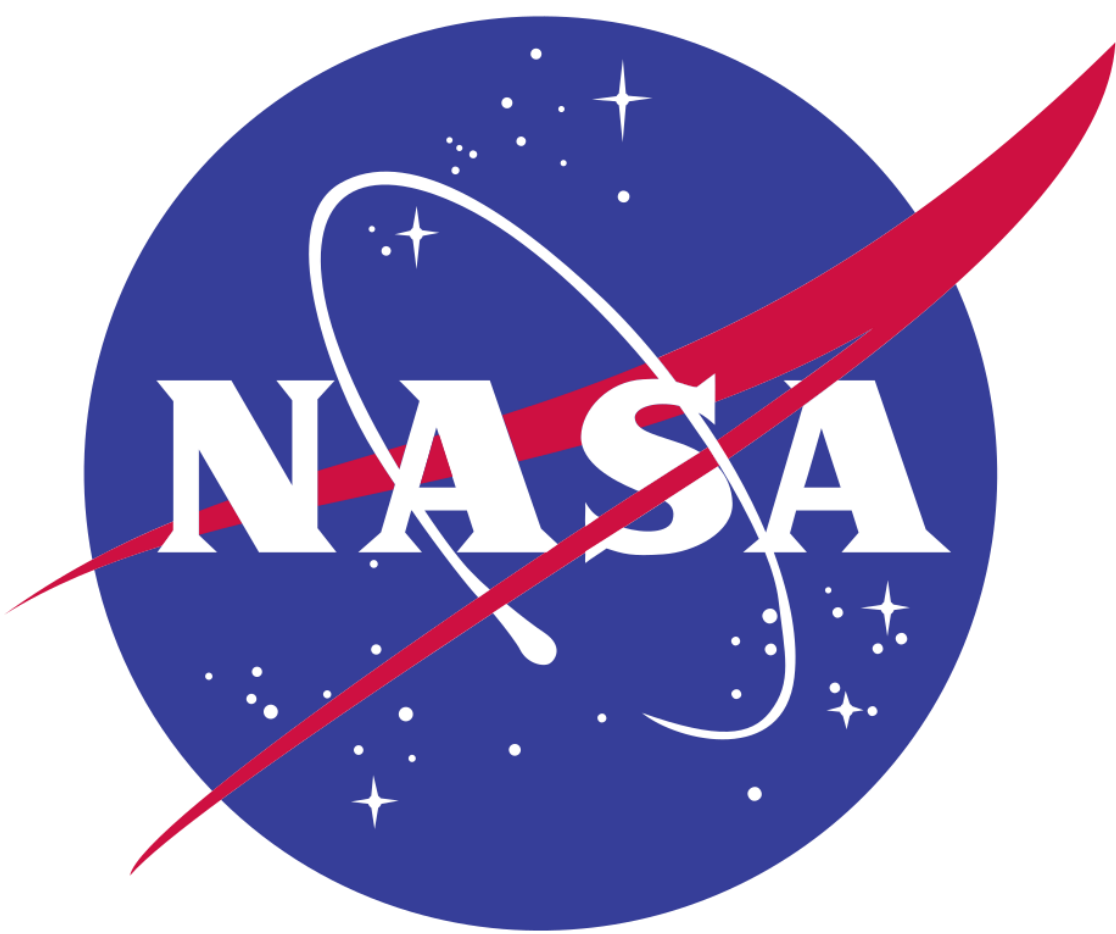


Figure 3. Changes in each participants' %VO2 max during exercise per day

N=5	
Age (IQR)	52 (32-54)
Male n (%)	4 (80%)
Race n (%)	
Asian	1 (20%)
Black	1 (20%)
White	3 (60%)
Ethnicity n (%)	
Non-Hispanic or Latin-X	5 (100%)
Weight (kg)	73.5 (63.1-78)
Muscle Mass (kg)	34 (28-37.4)
Bodyfat %	15.6 (11.7-24.3)
BMI (kg/m2)	22.6 (21.9-26.4)
Grip Strength (kg) (screening)	86 (56-90)
VO2 Max (mL/kg/min) (screening)	38 (35.3-40)

Table 1. Baseline characteristics of all participants

Conclusion: Our results suggest that flywheel resistance exercise was well tolerated during five days of DEX-induced metabolic suppression. The metabolic demands of exercise remained stable, and maintained whole body isometric strength, though handgrip strength declined modestly.



Methods

- 5 participants completed 5-day, controlled laboratory studies. They received an oral loading bolus of dexmedetomidine (1 µg/kg) followed by an 18-hour SQI (1 µg/kg) each day. Metabolic rate and reduction was assessed using indirect calorimetry and doubly labeled water.
- During the waking period of each 24-hours, a whole-body isometric and flywheel exercise protocol was completed, with rest and exercise metabolic demands measured via gas analysis.
- Grip strength was measured prior to the exercise session, and peak isometric strength was measured using the KINVENT Physio IsoBall. Flywheel performance was measured using the kBox flywheel.

Results

- Flywheel performance was stable (average change in power = +0.3 ± 44.7 W·day⁻¹; average force = -117 ± 538 N·day⁻¹). Day to day variability indicated heterogeneous tolerance (CV 38-55%)
- Percent VO2 max during exercise and peak isometric strength showed no difference over 5 days (both p>0.05)
- We observed a mean decrease of 1.4kg in grip strength over the 5-day protocol (p<0.01)

Acknowledgements

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