

Daily Use of Grip Strength Trainer and Improvement in Grip Strength

Team 1-8

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Introduction and Motivation

- Having a good hand grip strength (HGS) is a fundamental trait to maintain for many aspects of daily living, and is an important ability for sports such as climbing, weightlifting, biking, tennis, baseball, etc
- A lot of people are **daunted by exercising**, believing it can take a lot of time and effort to see results, we want to test this idea, to see if it is possible to see meaningful results in a two week period with a short, low effort exercise.
- A past study in elderly adults showed that a 12 week suspension based training program had significant improvement HGS. [6]
- Results of this study would **help inform training program selection** for those looking to increase their grip strength for sports, daily activities, or overall health

Research Question

Does daily low-load isometric resistance training affect HGS and grip endurance in young adults over a two-week period?

Training Protocol

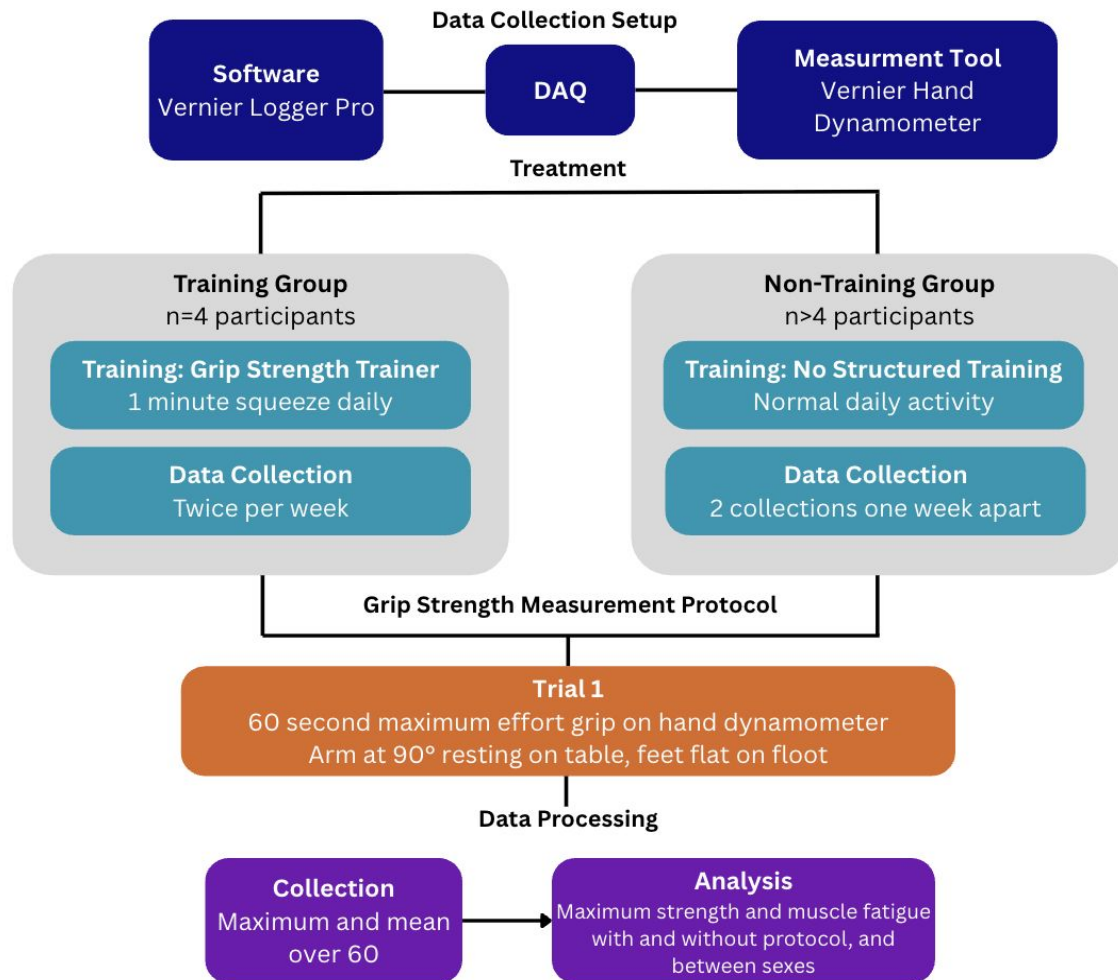
Training type: 1 minute constant squeeze of grip strength trainer

- 8/10 difficulty level on trainer

Training group (2 male, 2 female): Data collected twice/week

Non-training group (9 participants): Data collected once/week





Independent/Dependent Variables

Dependent:

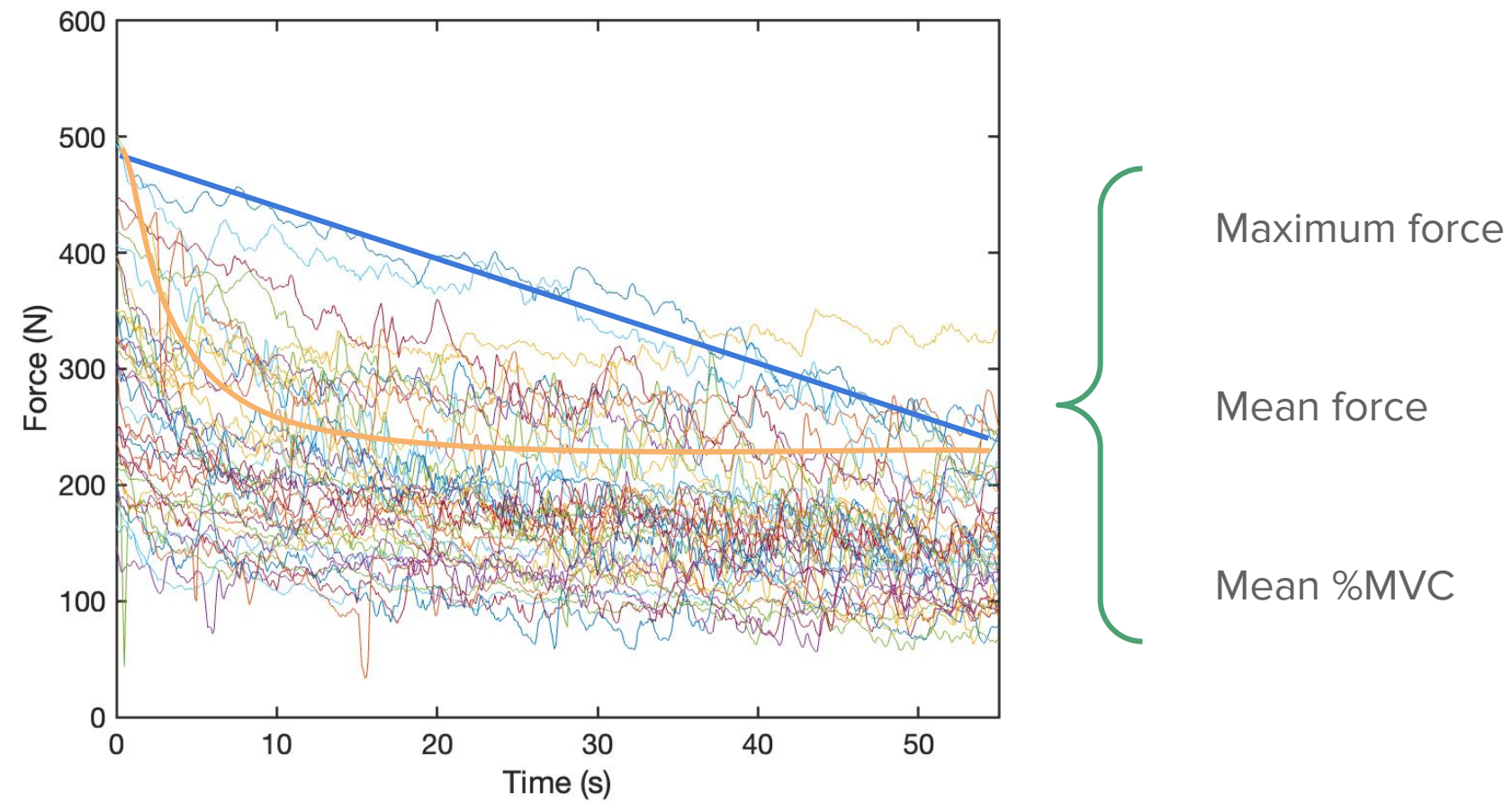
1. Maximum hand grip strength (maximum force)
2. Endurance time/rate of fatigue

Independent:

1. Treatment group: Daily isometric grip trainer squeeze vs no training regime
2. Sex of participant

Sensor Setup and Specifications

Sensor	Vernier Hand Dynamometer
Range	0-600N
Resolution	0.2159N
Safety Range	0-850N
Software	Vernier Logger Pro
DAQ	Labquest Mini



Theoretical model for strength increase

Baseline measurements and control group compared to established normative data [7][8]

Hypertrophy [9]:

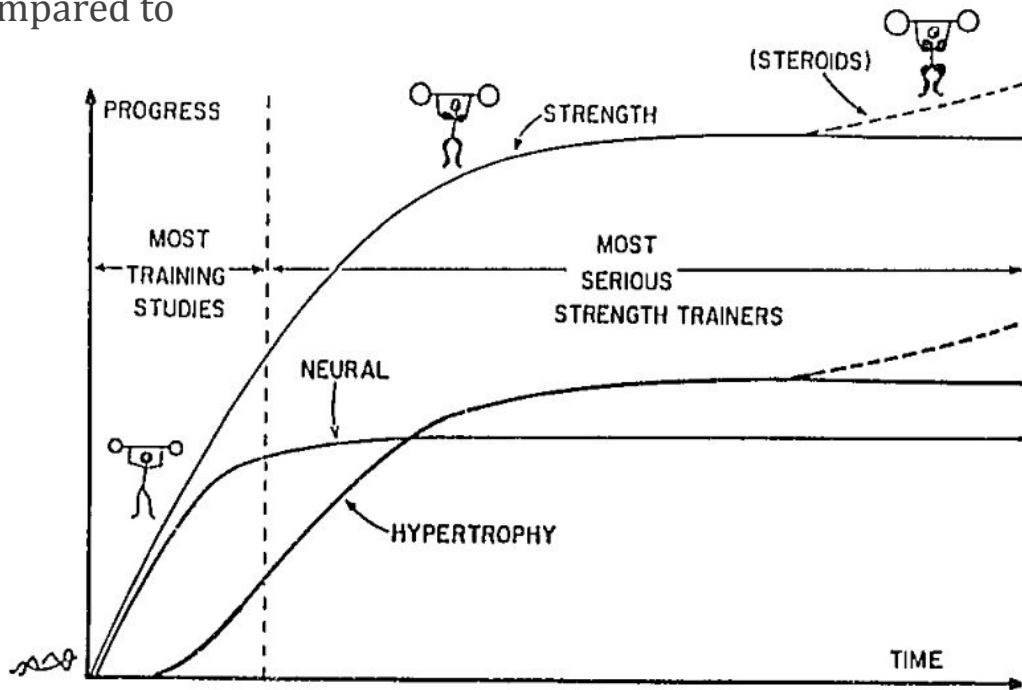
strength $\propto$ muscle CSA

Neural adaptation [10]:

strength $\propto$ neural adaptation factor

Model (RT over short time period):

$$F(t) = F_0[1 + A(1 - e^{-kt})]$$



Theoretical model for muscle fatigue (Rohmert curve)

Rohmert's law establishes that exerted force decays exponentially

Model for endurance time [11]: $ET = b_0(MVC)^{b_1}$

where ET = endurance time

MVC = fraction of maximum voluntary contraction

$b_0 = 33.55$

$b_1 = -1.61$

Male (ages 20-24):

50th percentile: 48.0 kg
470.88 N

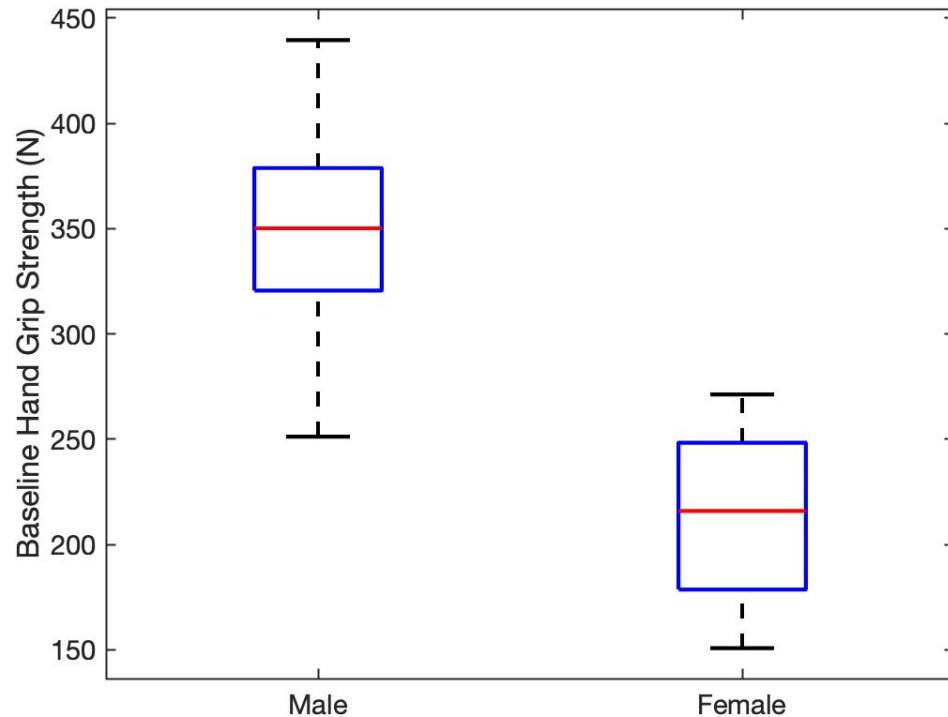
Female (ages 20-24):

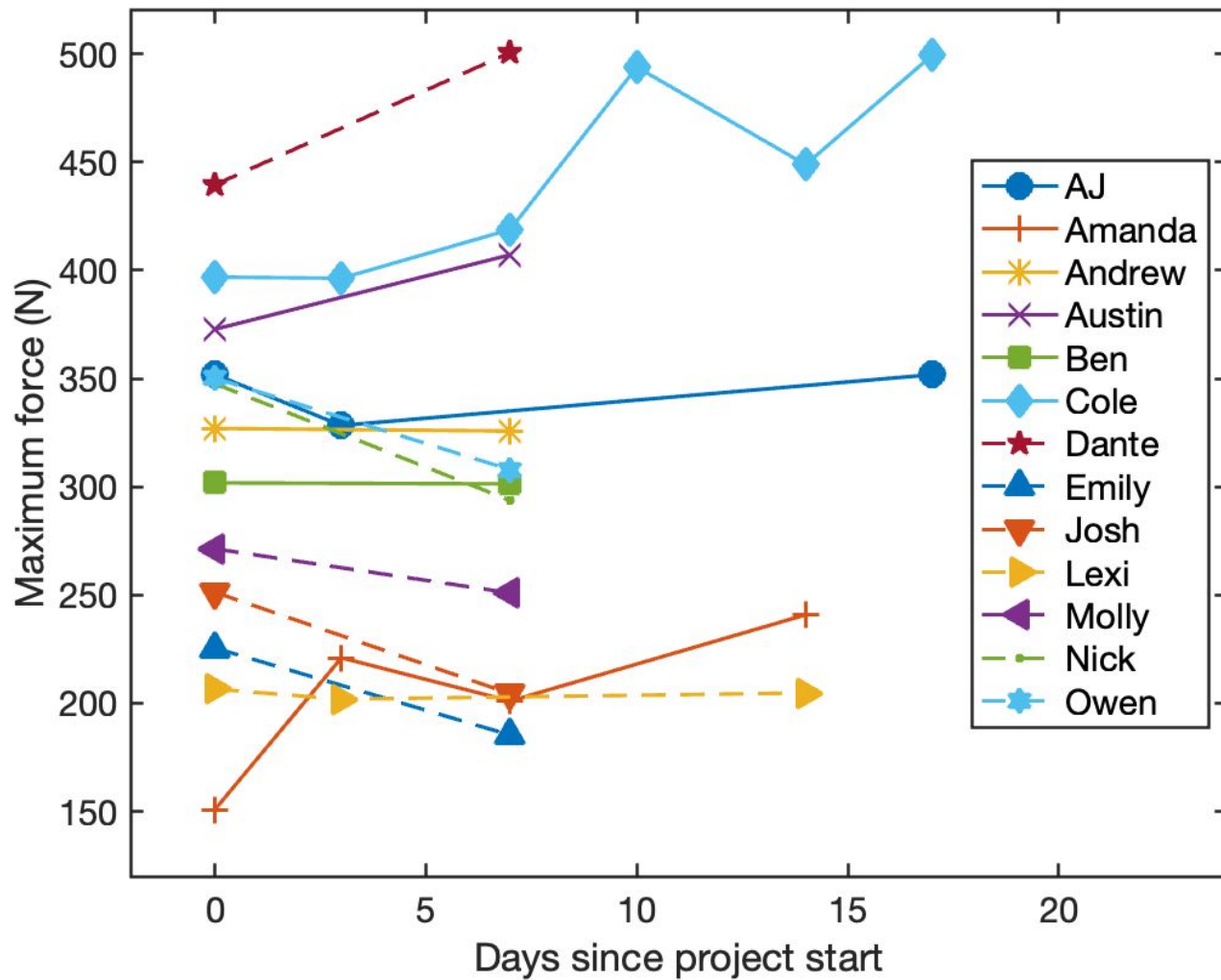
50th percentile: 28.6 kg
280.57 N

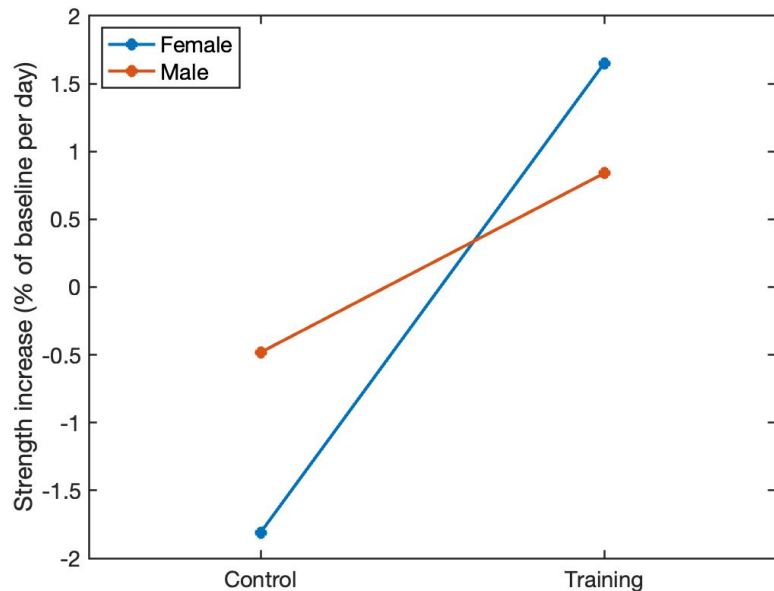
95% CI for baseline HGS:

$$\mu_{\text{female}} - \mu_{\text{male}} = [-210, -61]$$

$$\mu_{\text{trt}} - \mu_{\text{ctrl}} = [-219, 131]$$







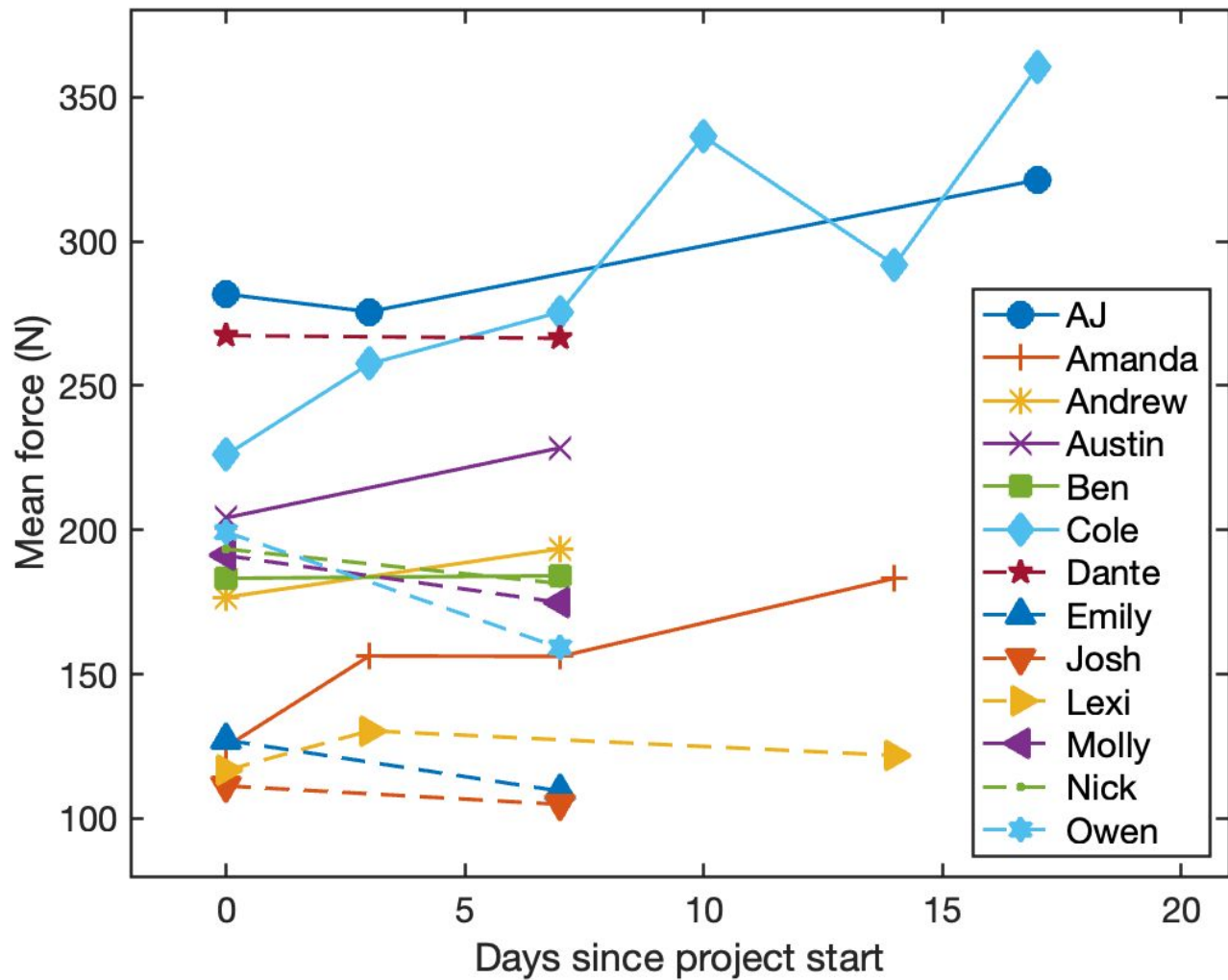
95% Confidence Intervals

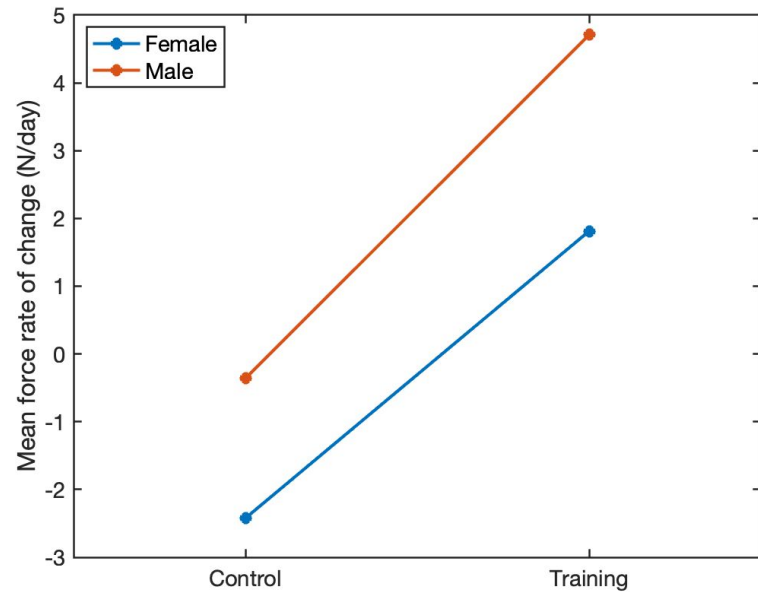
Treatment: $[-0.27, 4.3]$

Sex: $[-3.6, 3.8]$

Analysis of Variance

Source	Sum Sq.	d.f.	Mean Sq.	F	Prob>F
Sex	0.1633	1	0.1633	0.06	0.8193
Training	13.9169	1	13.9169	4.72	0.058
Sex:Training	2.786	1	2.786	0.94	0.3566
Error	26.5591	9	2.951		
Total	41.2812	12			





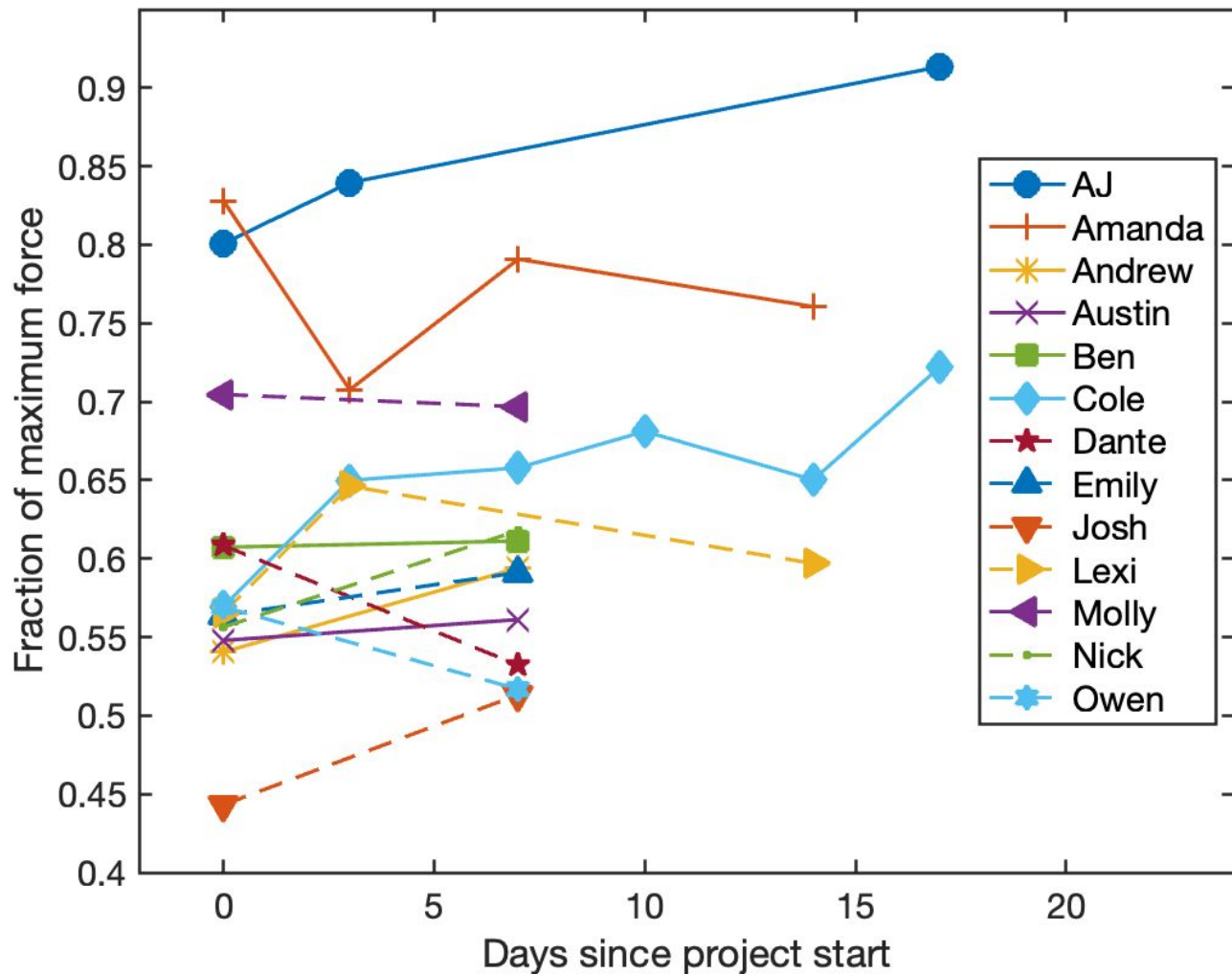
95% Confidence Intervals

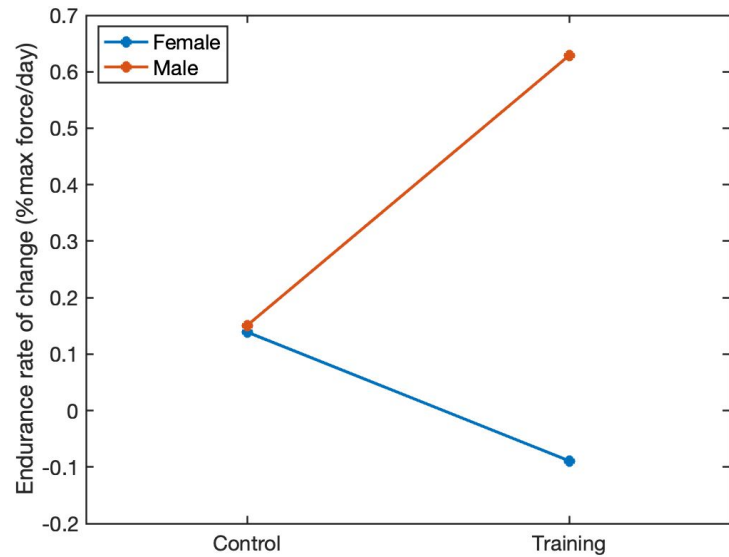
Treatment: $[-0.08, 8.2]$

Sex: $[-5.4, 3.3]$

Analysis of Variance

Source	Sum Sq.	d.f.	Mean Sq.	F	Prob>F
Sex	14.981	1	14.9813	1.96	0.1955
Training	52.681	1	52.6805	6.87	0.0277
Sex:Training	0.419	1	0.4194	0.05	0.8203
Error	68.967	9	7.663		
Total	130.035	12			





95% Confidence Intervals

Treatment: $[-0.59\%, 0.84\%]$

Sex: $[-0.84\%, 0.38\%]$

Analysis of Variance

Source	Sum Sq.	d.f.	Mean Sq.	F	Prob>F
Sex	0.00003	1	3.23715e-05	0.7	0.423
Training	0	1	3.80623e-06	0.08	0.78
Sex:Training	0.00003	1	3.0353e-05	0.66	0.4373
Error	0.00041	9	4.59469e-05		
Total	0.00047	12			

Discussion

- 2 out of 6 training participants dropped out of the study early
- We could only get 2 out of 3 data collections we planned on getting for the non training group, as the last collection happened on a day without lab
 - This is not critical as we expect negligible change
- Data collection time crunch
 - wanted more trials and more collection days
- Adherence to training program hard to enforce

CONCLUSIONS

Variance too high!

Sample sizes too small!

Some promising trends...

Future Work

- Longer time period
- Include more participants
- Need non-control participants to follow up consistently
- We need a better defined system for determining a way to set grip trainer to appropriate weight depending on individual
- Relating grip strength to other biometric information like height, weight, hand length, forearm circumference would be interesting

References

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