



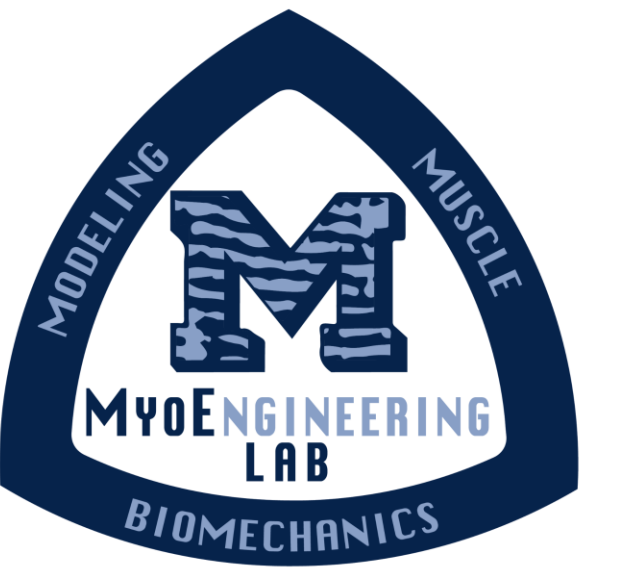
## Comparison of Concentric vs Eccentric Contractions to Measure Exercise Induced Fatigue

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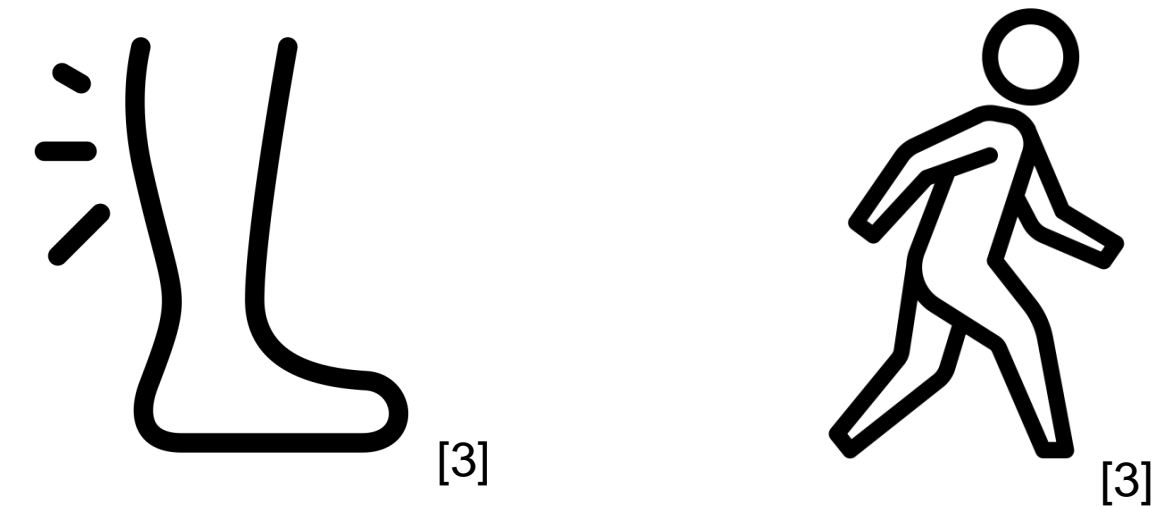
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### Introduction

❖ Muscular fatigue of the plantarflexors is common in various populations such as the elderly [1]

❖ Plantarflexor fatigue may have implications on the biomechanics of functional movement [2]



❖ Must quantify fatigue of plantarflexors to understand if fatigue is induced, how quickly it is induced, and measure recovery time.

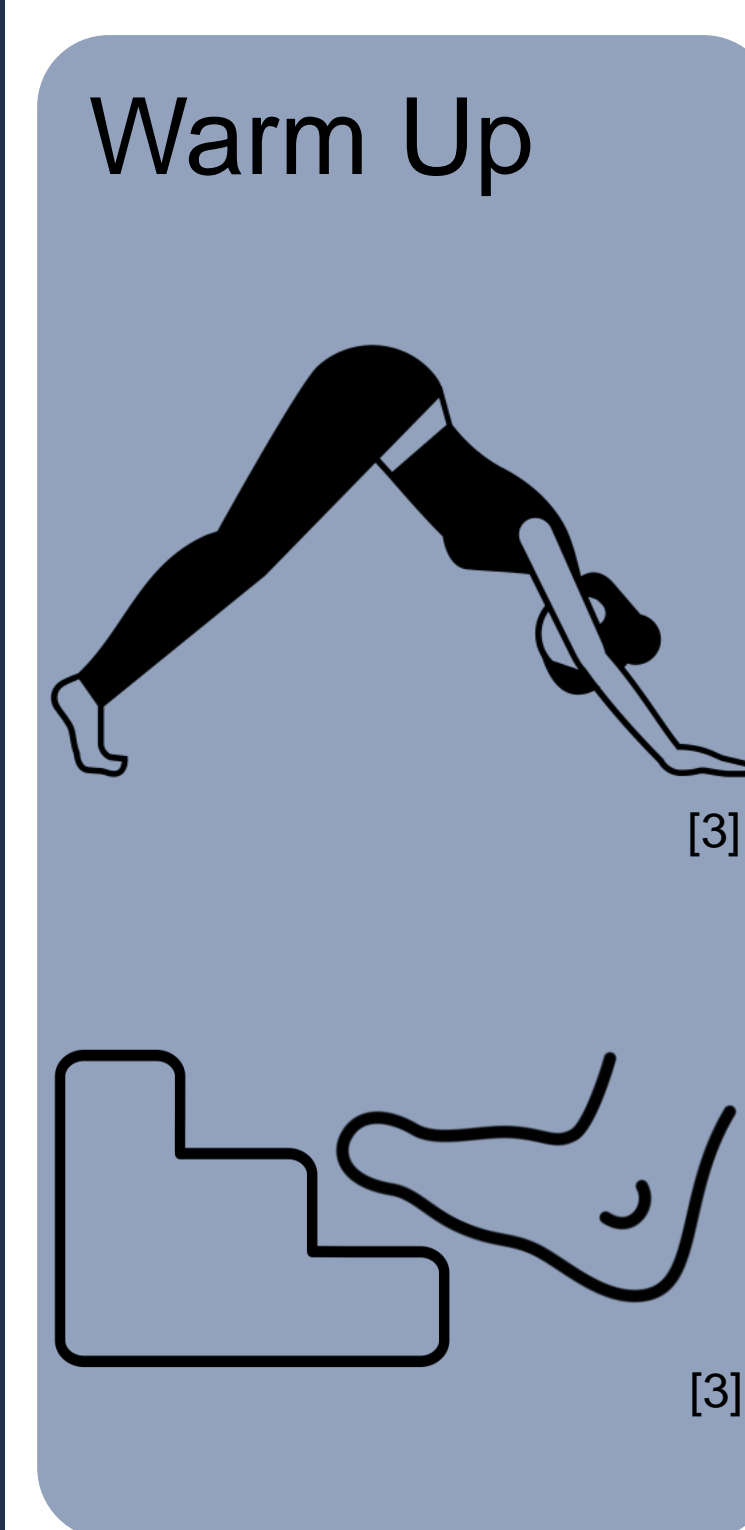
**Are concentric or eccentric isokinetic contractions more effective at fatiguing the plantarflexors?**

### Methods

#### Participant Demographics

N = 3	Age (years)	Gender	Height (m)	Weight (kg)
P1	23	Male	1.83	70.3
P2	24	Female	1.68	55.3
P3	22	Male	1.78	67.6

#### Fatiguing Protocol



#### Maximum Voluntary Isometric Contraction (MVIC)

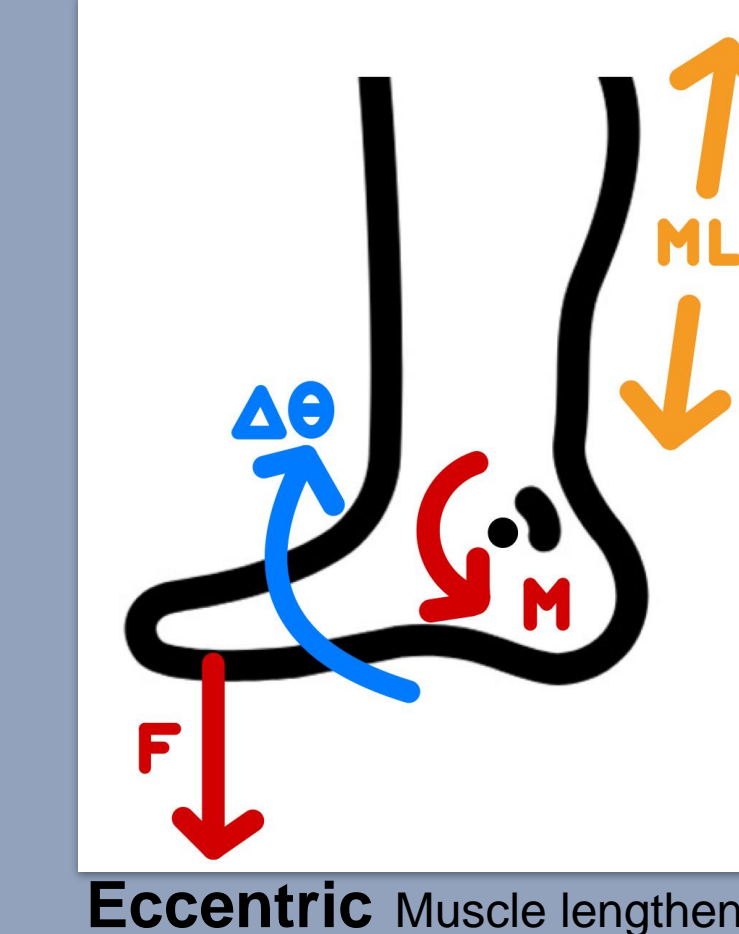
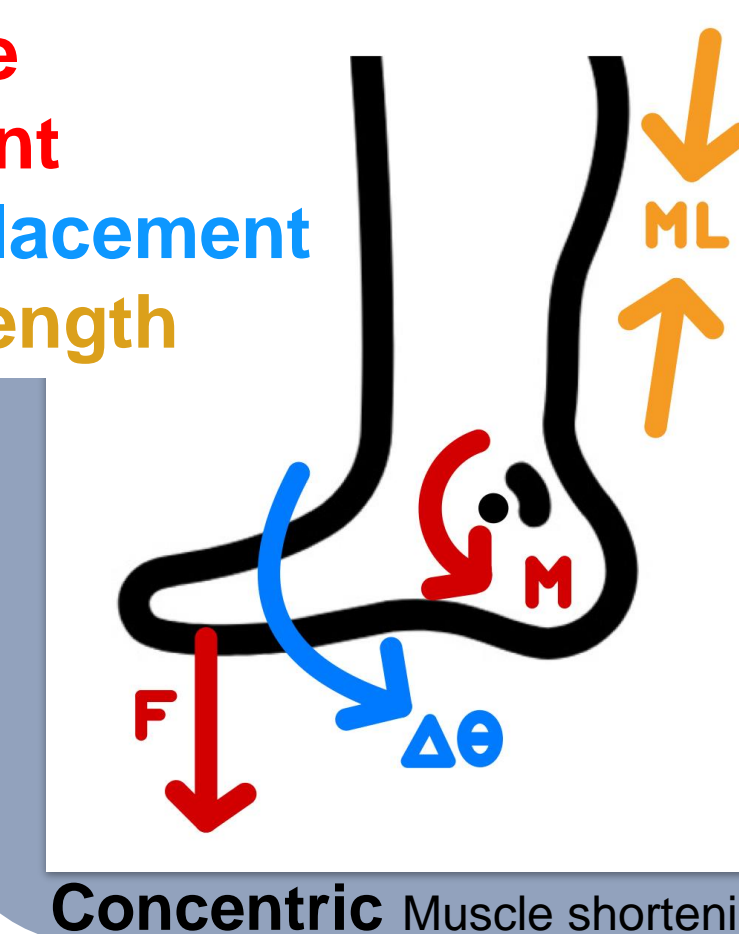
- Mean joint torque for 5 seconds at 3 reps/set



Repeat until 75% of initial MVIC

#### Isokinetic Fatigue

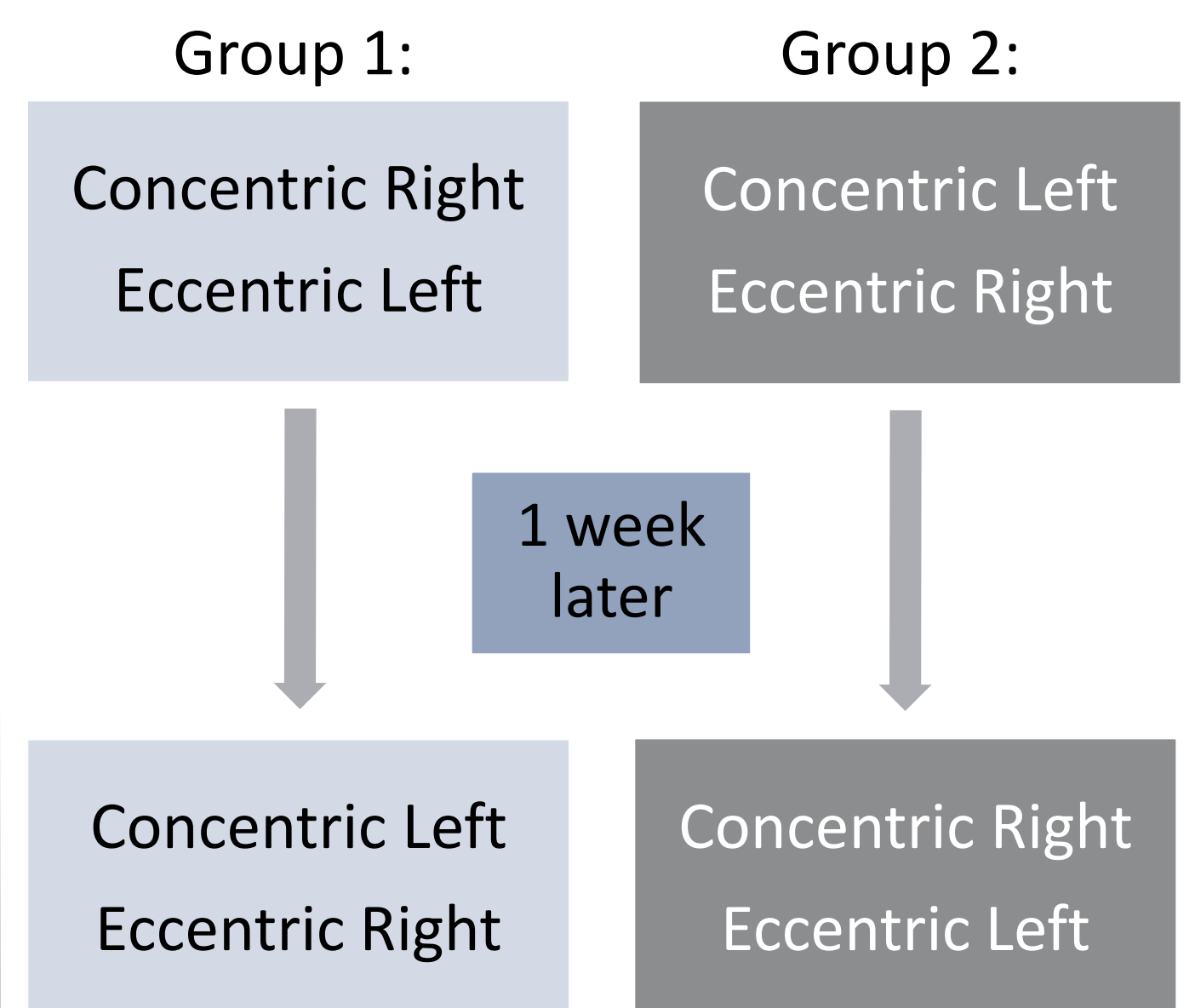
- Constant muscle velocity at 60 deg/s
- 80 reps/set at maximum effort
- 35 degrees range of motion; 15 deg dorsiflexion to 20 degrees plantarflexion



#### Post Fatigue Recovery

- 90 second rest
- MVIC
- Terminate when 95% of initial MVIC is reached

#### Randomized Test Setup



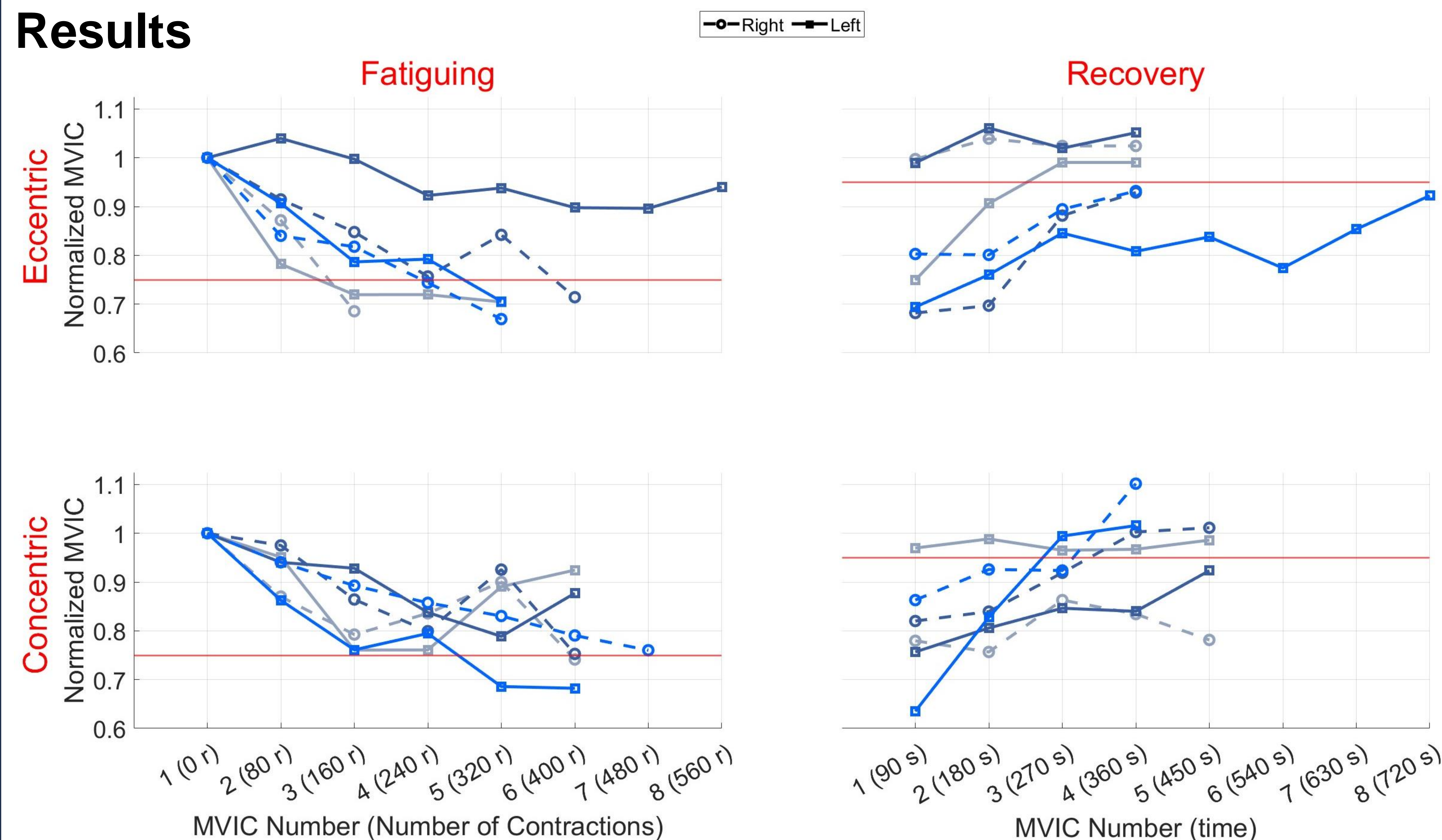
#### Experimental Setup



❖ Instrumented dynamometer to quantify ankle joint torque

Joint	Angle (deg)
Ankle	100
Knee	130

### Results



❖ Both eccentric and concentric showed the ability to fatigue by reaching 75% of the initial MVIC

❖ Both eccentric and concentric recovered at similar rates

### Conclusions

- ❖ Eccentric fatigue is difficult for properly isolating plantarflexors
- ❖ Eccentric is painful and uncomfortable
- ❖ **Concentric fatigue is more comfortable and natural, and will be recommended in future functional movement research**
- ❖ Pending data collection for statistical power

- 1) Eccentric and Concentric fatigue **both successfully reached 75% MVIC** without notable difference
- 2) Eccentric and Concentric **both recovered at similar rates**

### Acknowledgments

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### References

- [1] Smith, Ross E, et al. "The Effects of Plantarflexor Weakness and Reduced Tendon Stiffness with Aging on Gait Stability." *PLoS One*, vol. 19, no. 4, 16 Apr. 2024.
- [2] Y. Gimmon, R. Riemer, L. Oddsson, and I. Melzer, "The effect of plantar flexor muscle fatigue on postural control," *Journal of Electromyography and Kinesiology*, vol. 21, no. 6, pp. 922–928, Dec. 2011
- [3] Icons from Noun Project