



## Purpose

To determine the peak eccentric and concentric power output of novice lifters on an FWED, using three different inertial masses.

## Introduction

A flywheel exercise device (FWED) allows for both concentric and eccentric load without gravity. Subjects rotationally accelerate an inertial mass (disc) on the concentric phase of a lift and the stored mechanical energy results in a load during the eccentric phase. FWED's are promising in strength and conditioning, rehabilitation, and human spaceflight exercise countermeasures. Selection of the proper inertial mass is a critical factor in exercise programming and usage of the device.

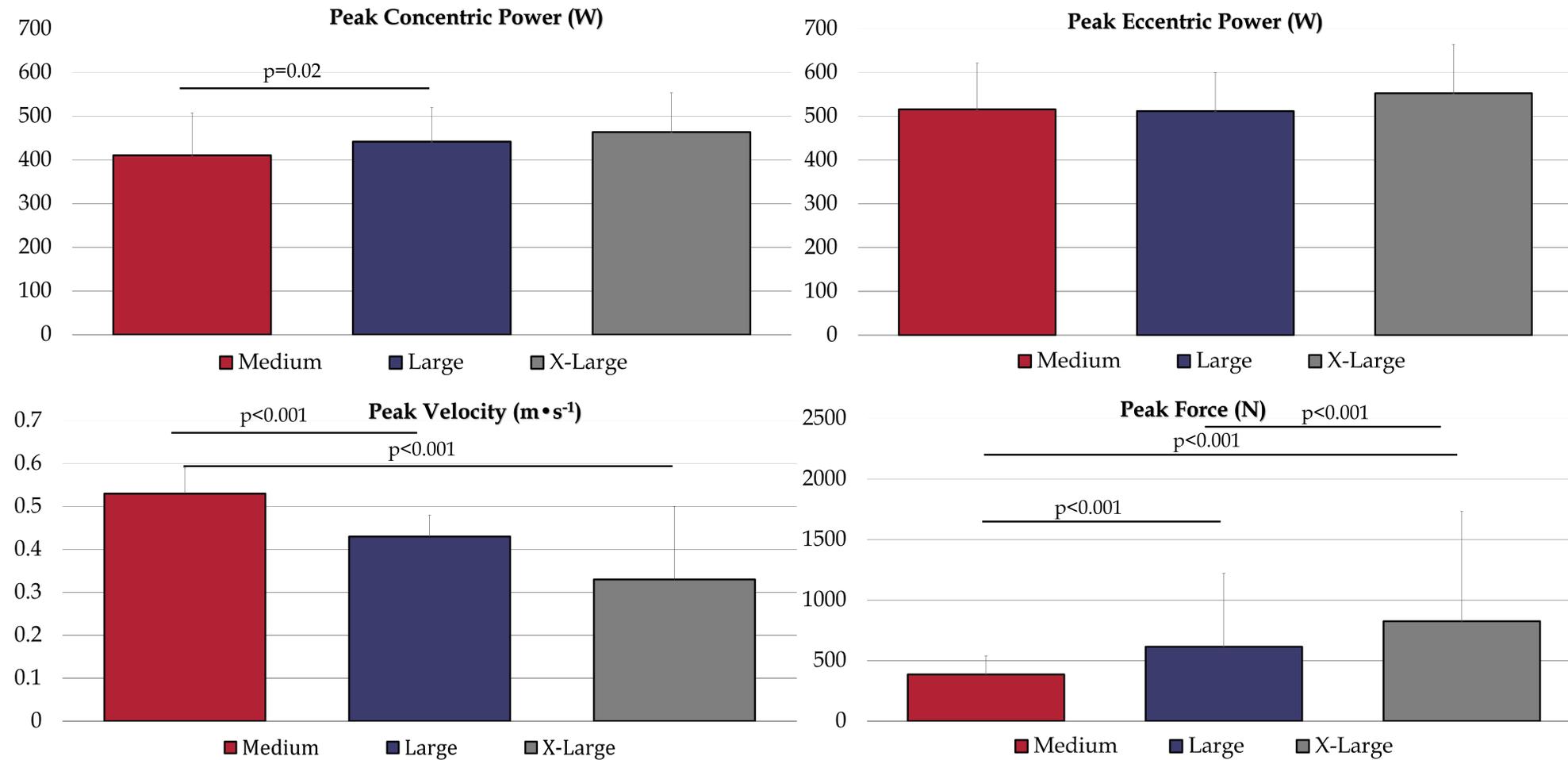
## Methods

- Nine recreationally active individuals (23.8±2.8yrs, 74.1±17.2kg, 166.4±7.8cm) participated in four sessions, separated by 24-48hrs.
- During session 1, baseline anthropometrics were collected, and a standardized familiarization protocol was performed.
- During each testing session, subjects performed 3 sets of 14 maximal effort belt squats with randomly assigned inertial loads of 0.025kg•m<sup>2</sup>, 0.05kg•m<sup>2</sup>, 0.07kg•m<sup>2</sup> (designated M, L, and XL, respectively). Loads were balanced across subjects.
- The first two repetitions were used to build rotational momentum and were omitted from analysis.
- Data were obtained from the device and reported as peak concentric power (W), peak eccentric power (W), peak force (N), velocity (m•s<sup>-1</sup>), and range of motion (cm) for each repetition. The ratio of concentric to eccentric power was calculated.
- Variables were averaged across subjects and were compared across loads.
- Significant differences in variables were evaluated via a one-way repeated measures ANOVA with alpha set at  $p \leq 0.05$ .

## Results

- Significant differences were found in peak concentric power for all loads.
- There was a significant difference ( $p < 0.0001$ ) in the eccentric and concentric ratio between the M (1.36±0.14W) and L (1.22±0.14W).
- There were differences in flywheel speed between M and L, M and XL.
- A significant difference was found between all loads for repetition force.

## Results



## Practical Applications

The ability to identify loading for peak power can be beneficial for both sport and exercise scientist, as well as coaches. Measuring power output of an athlete using a flywheel could help in assigning training loads for track and field, football, baseball, volleyball etc.. These data indicate if differentiating eccentric power is important, the participants may need to be coached or given visual feedback to resist the flywheel rotation on the downward phase of the movement.

## Conclusion

High intensity strength training improves strength, power, bone mass, insulin sensitivity and overall health. Little is known about the appropriate inertial mass to optimize an athlete's power output using a flywheel. The larger inertial masses resulted in greater force and concentric power. However, there were no differences in eccentric power. Anecdotally, the eccentric power can be manipulated by either resisting intensely on the descending phase or by descending rapidly with lower effort.

