

# Muscle potentiation following handcycling exercise in people with spinal cord injuries

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## Summary

We examined the work completed by 19 wheelchair users during a maximal effort task (handcycling sprinting) before and after high and moderate intensity exercise to determine the effects of exercise intensity on muscle fatigue and potentiation. Potentiation was observed after both moderate and high intensity exercise, with more subjects exhibiting potentiation following moderate compared to high intensity.

## Introduction

Understanding the muscle response to different exercise intensities and training routines in people with spinal cord injuries (PwSCI) is an important step in optimizing adaptive sports performance. One way to increase performance is through post-activation potentiation (PAP), which is an increase in muscle force generating capacity following muscle use [1]. However, it is still unclear which exercises are beneficial in inducing PAP in PwSCI and which induce fatigue. Fatigue could exacerbate shoulder injuries that are common in this population [2]. Therefore, the aim of this study was to investigate the effect of handcycling exercise on performance—in this study, quantified as work—in PwSCI.

## Methods

Following IRB approval, wheelchair athletes were recruited from the University of Illinois adapted sports program. Subjects participated in 2 recumbent handcycling sessions in which they completed 3 sprint tests: one baseline sprint before exercise, one after a high intensity interval training (HIIT) session, and one following a moderate intensity continuous training (MICT) session (Fig 1). Both HIIT and MICT were tailored to each participant's fitness levels [3].

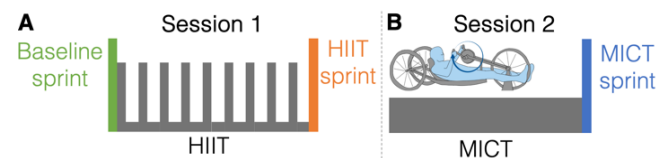


Figure 1: Exercise sessions and sprint tests

Power output (PO) was collected with a power meter on the handcycle (2Hz, SRM). PO was smoothed with a moving average filter and integrated with respect to time (MATLAB, R2021a) to obtain the total work (J) completed during each sprint. Percent difference in total work was compared for post-MICT and post-HIIT sprints compared to baseline. We assumed a maximum within-subject variability of 5% [4-7]. The threshold for PAP was calculated as 1.5 times the within-subject variability [1]. Thus, a 7.5% or greater increase in total

work was considered a potentiated response. A 7.5% or greater decrease in work was considered fatigued. Work was compared with a Wilcoxon signed ranks test if not normally distributed, and a paired t-test if normally distributed.

## Results and Discussion

Data from 19 wheelchair athletes (9 female, 10 male, age:  $25.5 \pm 7.0$  years) were analyzed. Sessions were completed  $4.0 \pm 2.6$  days apart. Total work (Fig. 2A) was not different between post-MICT and post-HIIT tests (median 3964 J and 3463 J, respectively), though each was higher than baseline (3218 J,  $p = 0.0001$  and  $p = 0.001$ , respectively). In the post-MICT sprint, 11 subjects were potentiated, 7 exhibited no effect, and 1 was fatigued. Post-HIIT, 10 subjects were potentiated, 8 had no effect, and 1 was fatigued (Fig. 2B).

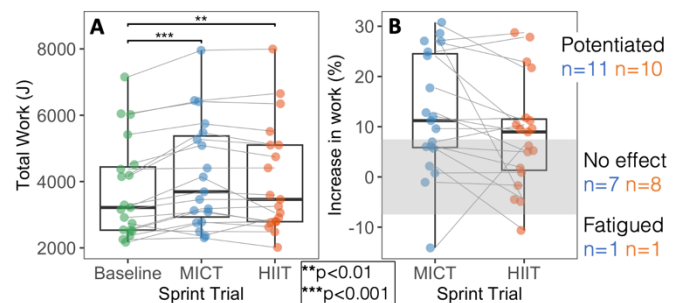


Figure 2: A) Work completed. B) % increase in work compared to baseline for post-MICT and post-HIIT. Gray lines connect subjects.

## Conclusions

This was the first study to examine PAP in handcycling with PwSCI. Most subjects (94.7%) were able to maintain or improve their baseline sprint performance, which indicates low fatigue levels following exercise. With this information, we can work to both improve elite handcycling performance and reduce shoulder injuries in wheelchair users.

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## References

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