

Effects of high intensity aerobic training in ambulant subjects with incomplete SCI – a randomized controlled trial

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CONCLUSIONS AND IMPLICATIONS

High intensity aerobic training for 12 weeks exhibited increased physical capacity and induced a positive effect on physical activity levels.

High intensity interval training by walking or running seems to be feasible in ambulant subjects with SCI and should be considered incorporated in training programs.

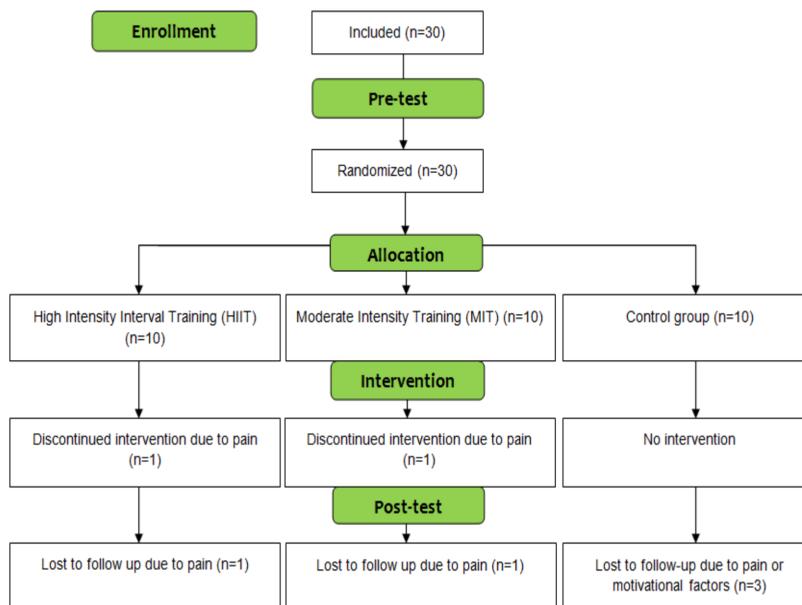
INTRODUCTION

Aerobic exercise at a high intensity seems to be most beneficial to increase a person's physical capacity.¹ The low levels of physical capacity and high prevalence of cardiovascular diseases in the SCI population underline the need for effective aerobic exercise programs. Studies that examine the efficacy and feasibility of high intensity training in this population are needed.²

Objectives

To investigate the effects of a 12-week high intensity aerobic exercise intervention on physical capacity and physical activity levels in ambulant subjects with incomplete SCI early after discharge from rehabilitation.

Study design



METHODS

Participants

Inclusion criteria: Age 18-70 years, incomplete lesion (AIS-D), admitted for rehabilitation, and able to walk on a treadmill for 5 minutes at 3 km/hour (without assistive walking aids).

Characteristics

	HIIT (n=10)	MIT (n=10)	Control (n=10)
Age (years)	50 (15)	34 (15)	41 (19)
Body weight (kg)	86 (20)	77 (15)	80 (13)
BMI (kg/m ²)	26.0 (4.1)	24.8 (4.5)	25.5 (4.5)
Male : Female ratio	8:2	8:2	9:1
Traumatic (n)	9	6	9
Time since injury (days)	68 (31)	65 (34)	73 (24)
Neurological level			
Cervical 1-8	7	4	7
Thoracic 1-5	1	1	1
Thoracic 6-12	0	3	0
Lumbar 1-5	2	2	1
Sacral 1-5	0	0	1

Interventions

12-week individual training program at home by walking/running, wearing a heart rate monitor to verify the intensity.

High Intensity Interval Training (HIIT)

Two sessions per week, interval training 4 x 4 minutes at 85-95% of peak HR, with three minutes walking in between at 70% of peak HR.

Moderate Intensity Training (MIT)

Three sessions per week, walking for 45 minutes at 70% of peak HR.

Control group

Treatment as usual, without any training restrictions.

Measurements (pre- and post-tests)

Physical capacity

Maximal exercise testing on a treadmill (peak oxygen uptake; peakVO₂, peak HR and blood lactate concentrations [La-]).

Physical activity

Seven days continuously activity monitoring (total daily energy expenditure (TDEE) and daily amount of steps) measured with the SenseWearTM Pro2 Armband (SWA).

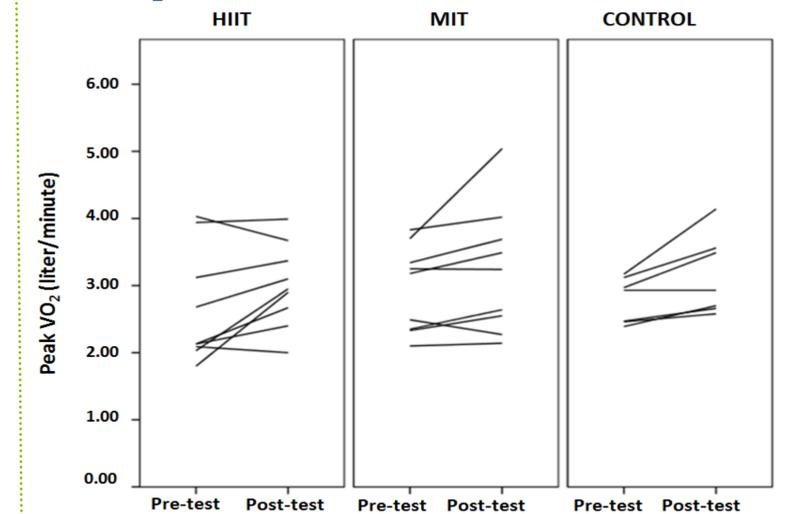
RESULTS

The mean pre-test peakVO₂ for all subjects was 2.76 liter/min (SD 0.71), with no significant differences between the groups. After intervention, all groups increased peakVO₂ (HIIT+13%, MIT +9% and CG +10%), without any significant differences between the groups. The physical activity level increased significantly only in the HIIT group (daily amount of steps: 836, 95% CI: 84–1589, p=0.03 and TDEE: 173 Kcal, 95% CI: -37–384, p=0.09).

Physical capacity and activity – pre- and post-test

	HIIT (n=9)		MIT (n=9)		Control (n=7)	
	pre	post	pre	post	pre	post
Peak VO ₂ (l/min)	2.66 (0.84)	3.01 (0.62)	2.95 (0.64)	3.23 (0.94)	2.72 (0.32)	2.99 (0.43)
Peak VO ₂ (ml/kg/min)	32.3 (9.6)	35.7 (5.3)	39.1 (10.2)	42.3 (12.0)	37.3 (5.8)	40.0 (6.8)
Peak HR (beats/min)	167 (14)	173 (15)	182 (18)	184 (15)	179 (12)	183 (14)
RER (ratio)	1.23 (0.10)	1.21 (0.07)	1.20 (0.12)	1.19 (0.07)	1.22 (0.05)	1.23 (0.05)
[La-] (mmol/liter)	8.75 (2.29)	8.66 (1.21)	10.00 (3.33)	10.4 (2.81)	7.89 (0.97)	7.85 (2.62)
Daily amount of steps	5381 (2854)	6217 (3080)	6161 (3692)	6125 (2175)	5162 (1597)	5109 (1021)
TDEE	2571 (458)	2744 (359)	2730 (651)	2768 (531)	2480 (363)	2595 (354)

Peak VO₂ – individual changes



DISCUSSION

Training logs revealed that subjects in the MIT and control group also had been exercising extensively at high intensity. This might, in addition to the small sample size, explain the lack of significant differences in physical capacity between the groups.



REFERENCES

- Helgerud J, Hoydal K, Wang E, Karlsen T, Berg P, Bjerkaas M, et al. Aerobic high-intensity intervals improve VO₂max more than moderate training. *Medicine and science in sports and exercise*. 2007;39(4):665-71.
- Nightingale TE, Metcalfe RS, Vollaard NB, Bilzon JL. Exercise guidelines to promote cardiometabolic health in spinal cord injured humans: time to raise the intensity? *Archives of physical medicine and rehabilitation*. 2017.

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