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Relationship between internal and external training load in recreational handcyclists

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Introduction

Handcycling:

- Physiologically efficient & lower shoulder loads
  (Dallmeijer et al., 2004; Arnet et al., 2012)

- Introduced during and after rehabilitation

To promote handcycle exercise

-> HandbikeBattle has been organized yearly from 2013

Introduction

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HandbikeBattle:

- Kaunertalergletscherstrasse in Austria; 20 km, 1 km ↑
- Teams of ex-patients from 12 Dutch rehabilitation centers

www.handbikebattle.nl

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HandbikeBattle:

- Kaunertalergletscherstrasse in Austria; 20 km, 1 km ↑
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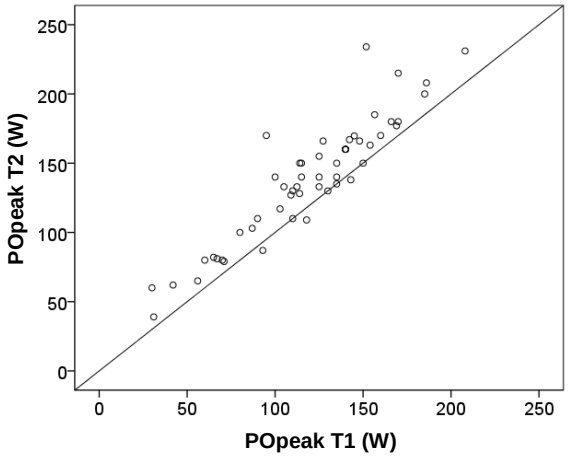
www.handbikebattle.nl

Introduction

- Training for the HandbikeBattle: (Hoekstra et al., 2017)
  - 16% ↑ POpeak
  - 7% ↑ VO2peak (Hoekstra et al., 2017)



- What kind of training regime led to these improvements?
  - Dose-response?

- Which methods can be used to assess training load in handcycling?
  - External training load: PO
  - Internal training load: HR & RPE

Purpose

To establish the relationships among internal training load methods (based on RPE and HR) and external training load (based on PO) during handcycling training sessions

Methods

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Participants

10 men with SCI

- 39.6 ± 11.5 years
- T4 complete – L2 incomplete

Design

- *Graded exercise test*
- *Training*
  - Powertap & Garmin (PO, HR, duration)
  - Online training diary (RPE)

1 - 10 Borg Rating of Perceived Exertion Scale	
0	Rest
1	Really Easy
2	Easy
3	Moderate
4	Sort of Hard
5	Hard
6	
7	Really Hard
8	
9	Really, Really, Hard
10	Maximal: Just like my hardest race

Methods

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Outcome measures:

Training IMPulse (TRIMP)

- $TRIMP_{sRPE} = sRPE \cdot t$ (Foster et al., 2001)

- $TRIMP_{HR} = t \cdot HRR \cdot 0.64 \cdot e^{1.92\ HRR}$ (Banister et al., 1975)

Training Stress Score (TSS)

- $TSS = \frac{(time \cdot normalized\ power \cdot intensity\ factor)}{(functional\ threshold\ power/3600)} \cdot 100$

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Statistics

Associations between $TRIMP_{HR}$, $TRIMP_{sRPE}$, TSS

- Within-subject correlations for group data
- Pearson correlations for individual data

Results

Association internal vs. external training load measures

moderate (*r*=0.3-0.5); large (*r*=0.5-0.7);
very large (*r*=0.7-0.9); nearly perfect (*r*>0.9)

Subject no.	Class	$TRIMP_{sRPE}$ vs. TSS		$TRIMP_{HR}$ vs. TSS	
		r	**N**	***r***	**N**
1	H3	0.92	15	0.61	15
2	H3	0.99	5	0.98	5
3	H3	0.61	45	0.82	44
4	H3	0.87	42	0.68	42
5	H3	0.77	14	0.97	14
6	H4	0.79	47	0.91	47
7	H4	0.95	20	0.95	20
8	H4	0.77	26	0.94	26
9	H4	0.92	31	0.93	31
10	H5	0.97	28	0.97	28
***r* within subjects**		**0.814**	**260**	**0.853^**	**260**

Results

- **Association internal training load measures**

Subject no.	Class	$TRIMP_{sRPE}$ vs. $TRIMP_{HR}$	
		r	N
1	H3	0.78	15
2	H3	0.96	5
3	H3	0.48	44
4	H3	0.66	42
5	H3	0.73	14
6	H4	0.70	49
7	H4	0.96	20
8	H4	0.81	25
9	H4	0.94	31
10	H5	0.94	28
***r* within subjects**		**0.767**	**310**

moderate (*r*=0.3-0.5);
large (*r*=0.5-0.7);
very large (*r*=0.7-0.9);
nearly perfect (*r*>0.9)
individual correlation

Discussion

HR-based method (r=0.85 with PO)

- Wheelchair rugby: *r*=0.81-0.84 $TRIMP_{HR}$ ~ total distance covered during the training sessions (N=14) Paulson et al., 2015

RPE-based method (r=0.81 with PO)

- Wheelchair rugby: *r*=0.59 $TRIMP_{sRPE}$ ~ total distance Paulson et al., 2015
- Handcycling: *r*=0.69 $TRIMP_{sRPE}$ ~ total distance present study

Discussion

HR- vs. RPE-based method (r=0.77)

- Wheelchair rugby: *r*=0.62 Paulson et al., 2015
- Wheelchair basketball: *r*=0.63 Iturricastillo et al., 2016
- Cycling: *r*=0.75 Rodriguez-Marroyo et al., 2012

- Ball sports -> more difficult to give a good sRPE compared to endurance activities such as handcycling

Discussion

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Low correlations in some individuals:

- Influenced by experience and training status Hampson et al., 2001
- More extensive learning protocol Soriano-Maldonado et al., 2014
- Score sRPE 20-30 min after exercise, to diminish dominance of e.g. end sprint Foster et al., 2001
- sRPE for peripheral fatigue instead of overall sRPE Lenton et al., 2008

Conclusion

Overall the results suggest that $TRIMP_{sRPE}$ and $TRIMP_{HR}$ seem to be valid tools for quantifying the handcycling training load in people with paraplegia.

However, it is recommended to use different training load measures when possible.

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Thank you for your attention!

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Keynote speakers (confirmed)
John Buckley
Mindy Levin
Kathleen Martin Ginis
Brett Smith
Walter Thompson

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