

EFFECTS OF RUNNING VS. SPECIFIC AEROBIC TRAINING IN YOUNG ELITE HANDBALL PLAYERS

Martin Buchheit ^{1, 4}, Paul B. Laursen², Fabien Leblond ^{3, 4}, Christine Renaud³, David Ruch³, Jennifer Kuhnle⁴ and Said Ahmaidi¹



¹Laboratory of Exercise Physiology and Rehabilitation, Faculty of Sport Sciences, University of Picardie, Jules Verne, 80025, Amiens, France.

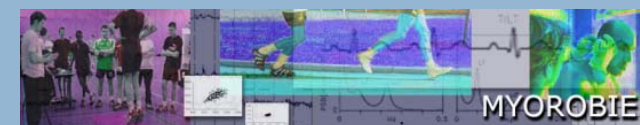
²School of Exercise, Biomedical and Health Sciences, Edith Cowan University, Joondalup, WA, Australia.

³Picardie handball league, Pont Sainte Maxence, France

⁴Myorobie Association, Montvalezan, France



ECSS 2008



Today's training session...



- Why specific HB training?
- Can specific HB aerobic training be confidently used to improve aerobic fitness and performance?
 - ▣ **Acute** cardiorespiratory responses to specific HB training vs. high intensity intermittent running exercises (HIT)
 - ▣ **Chronic** effects of specific HB training vs. HIT thorough half a competitive season
- Perspectives

Why specific training?



Why using specific training?

- Maintaining **technical skills is highly primordial** in team-sports
- Activation of muscle groups as they are engaged during match-play → **effective transfer** to the competitive environment
- **Running is not usually the favourite** activity of handball players ;)
- Empirically, **lower painfulness** (+++ motivation)
- Worldwide handball coaches have been using specific training for years
- Small **soccer** games was **as effective as HIT** in enhancing aerobic fitness in junior players (*Impellizzeri et al., 2006*)

Why using specific training?

- However, there was NO data, neither on acute responses, nor on chronic adaptations to specific aerobic handball training



Small handball games (SHBG)

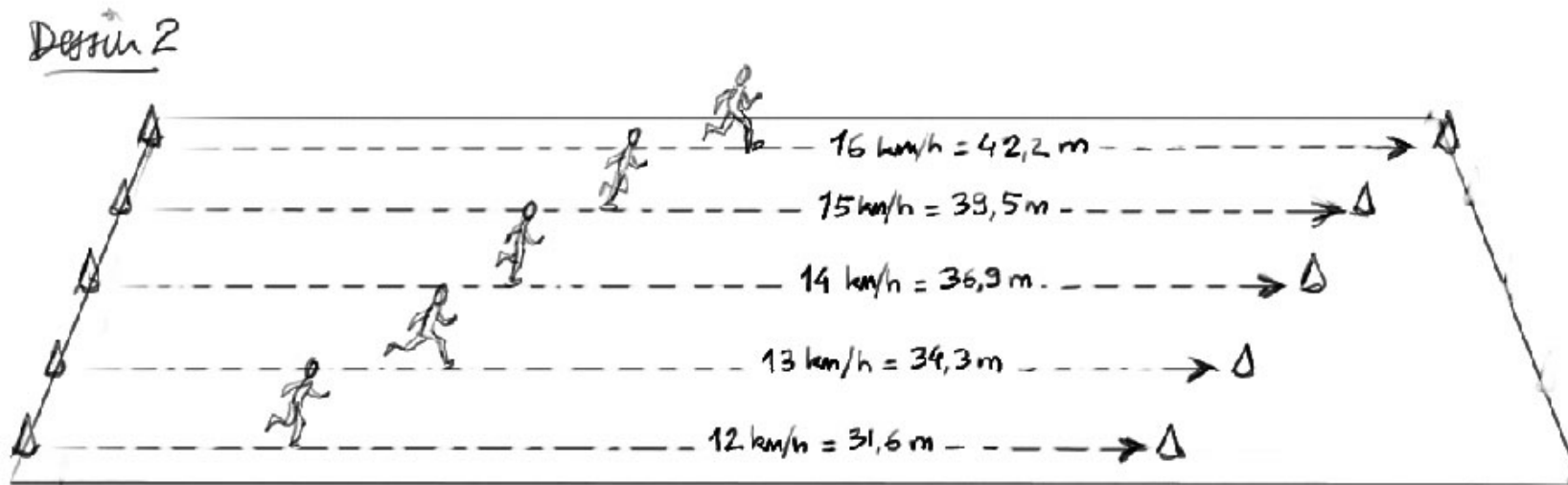
- Organised as 4-a-side, excluding goalkeepers.
- Intensity: as high as possible; coaches encourage the players in order to achieve an intensity high enough (*Hoff et al., 2002; Rampinini et al., 2007*).
- Simplified handball rules (to avoid game interruption and increase exercise load):
 - ▣ dribbling and defence contacts not allowed
 - ▣ infringements of minor technical rules (i.e. 'walking', 'double dribble') not sanctioned
 - ▣ throw-on after a goal immediately made by the goalkeepers from their 6-m area
 - ▣ all 4 players have to be in the opponent half court for the goal to be validated
 - ▣ coach is always available to immediately replace the ball when it is kicked out from the playing area

Can specific HB aerobic training be used instead of HIT to improve aerobic fitness?

Let's be logical about this...



NO! SHBG: no 'real' control of intensity
HIT: intensity can be individualized



Individualizing HIT intensity using a reference speed :

- $v\text{VO}_2\text{max}$ or MAS (Billat, Sports Med 2001)
- V_{IFT} = an intermittently-determined reference speed, reached at the end of the 30-15 Intermittent Fitness Test (shown to be more accurate than $v\text{VO}_2\text{max}$ to schedule HIT (Buchheit et al., JSCR 2008)).

SHBG: 0 - HIT: 1

Can specific HB aerobic training be used instead of HIT to improve aerobic fitness?

Acute cardiorespiratory responses to SHBG vs. HIT

Cardiorespiratory responses to SHBG



9 skilled national level handball players

- 5.1 ± 1.1 hr.wk⁻¹

- 21.0 ± 2.9 yr,

- 181.0 ± 4.6 cm and

- 78.4 ± 8.9 kg,

→ 4 Cosmed K4, etc.

Buchheit et al., JSMS 2008

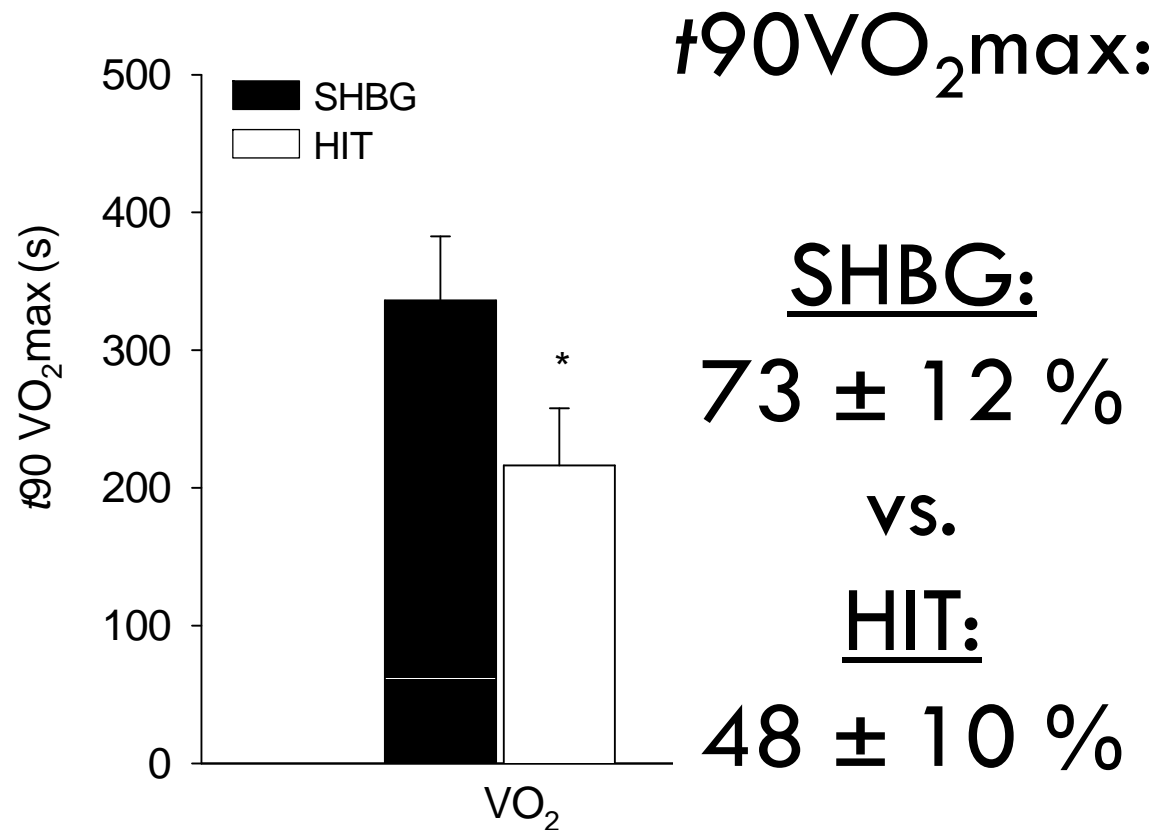
YES! time-efficient stimulus

8' SHBG:

2 x 3'45" (interspersed with 30 s rest)

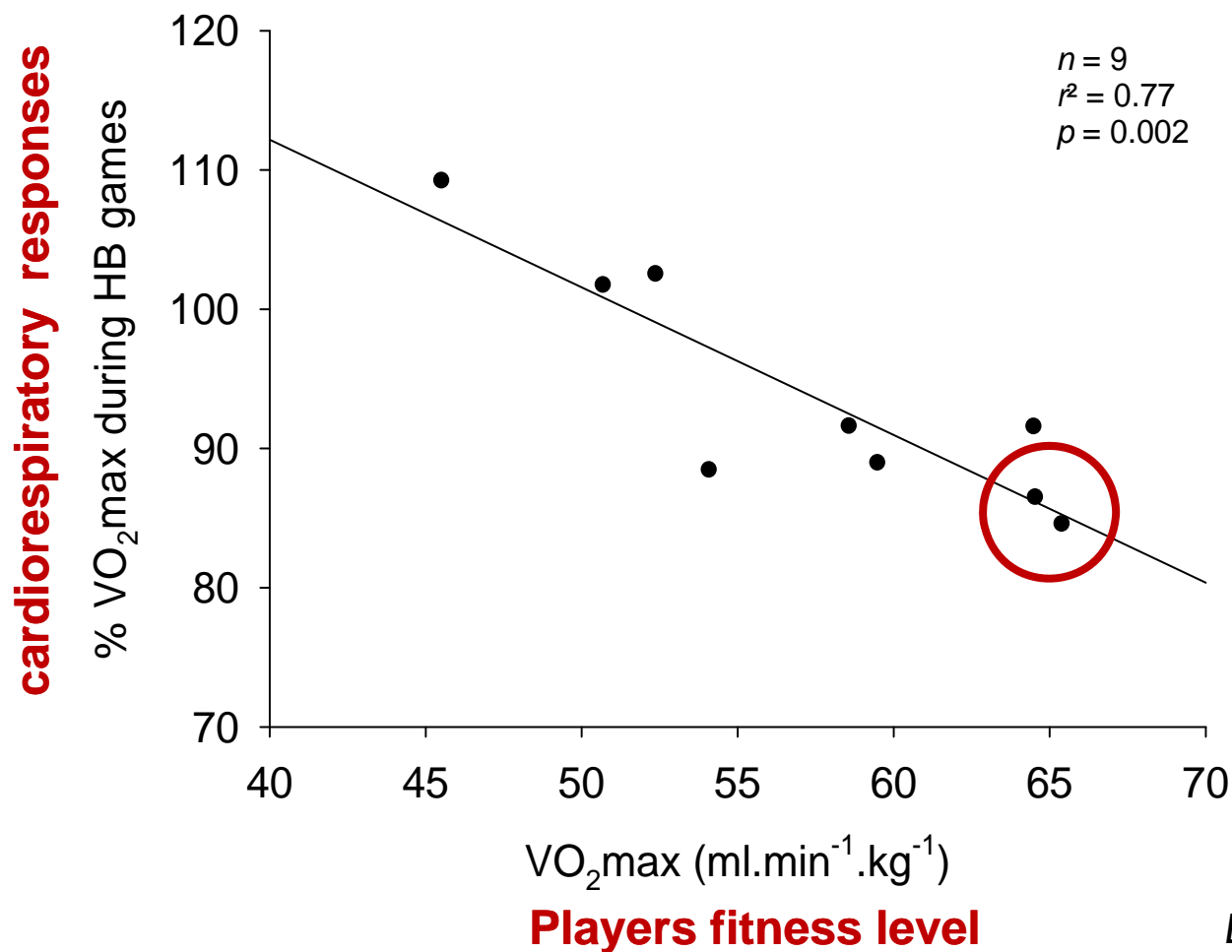
8' HIT:

16 x 15" @ 90% V_{IFT} (~120% vVO_{2max}) / 15" passive rest



SHBG: 1 - HIT: 1

NO! possible 'ceiling effect'



The fittest players may not benefit from a high intense enough stimuli

At present: SHBG: 1 - HIT: 2

.... So, on the long term, HIT should
win, no?

Can specific HB training be used to improve aerobic fitness?

Chronic adaptations: SHBG vs. HIT
thorough half a season



Participants / training intervention

- 32 highly-trained elite adolescent players (15.5 ± 0.9 y, 16 girls, 16 boys, Tanner Stages from III to V)
 - HIT (n = 17; girls = 8)
 - SHBG (n = 15; girls = 8)
- 10-week program
- 2 x 8 to 10' HIT or SHBG sessions a week, **in addition** to usual training contents
 - HB (~7.5h.wk⁻¹)
 - Strength, power and agility (~2h.wk⁻¹)
- SHBG and HIT matched for total duration
 - HIT = 2 x [14 x 15" (92%V_{IFT})-15" passive] = total 7'
 - SHBG = 2 x [2x3'15" (r=30") = total 7'

Training intervention

SHBG: similar duration than HIT



HIT: 15''@92%V_{IFT}/15''passive rest



Athletic performance assessment

- 30-15IFT $\rightarrow V_{IFT}$ (km.h⁻¹)¹
- 3 Times to exhaustion performing 15"/15" @ 100, 95 and 90% of V_{IFT} – passive rest
- Intermittent endurance index (iEI)²

¹ Buchheit, JSCR 2008; ² Buchheit et al., IJSM 2008;

Intermittent Endurance Index (iEI)

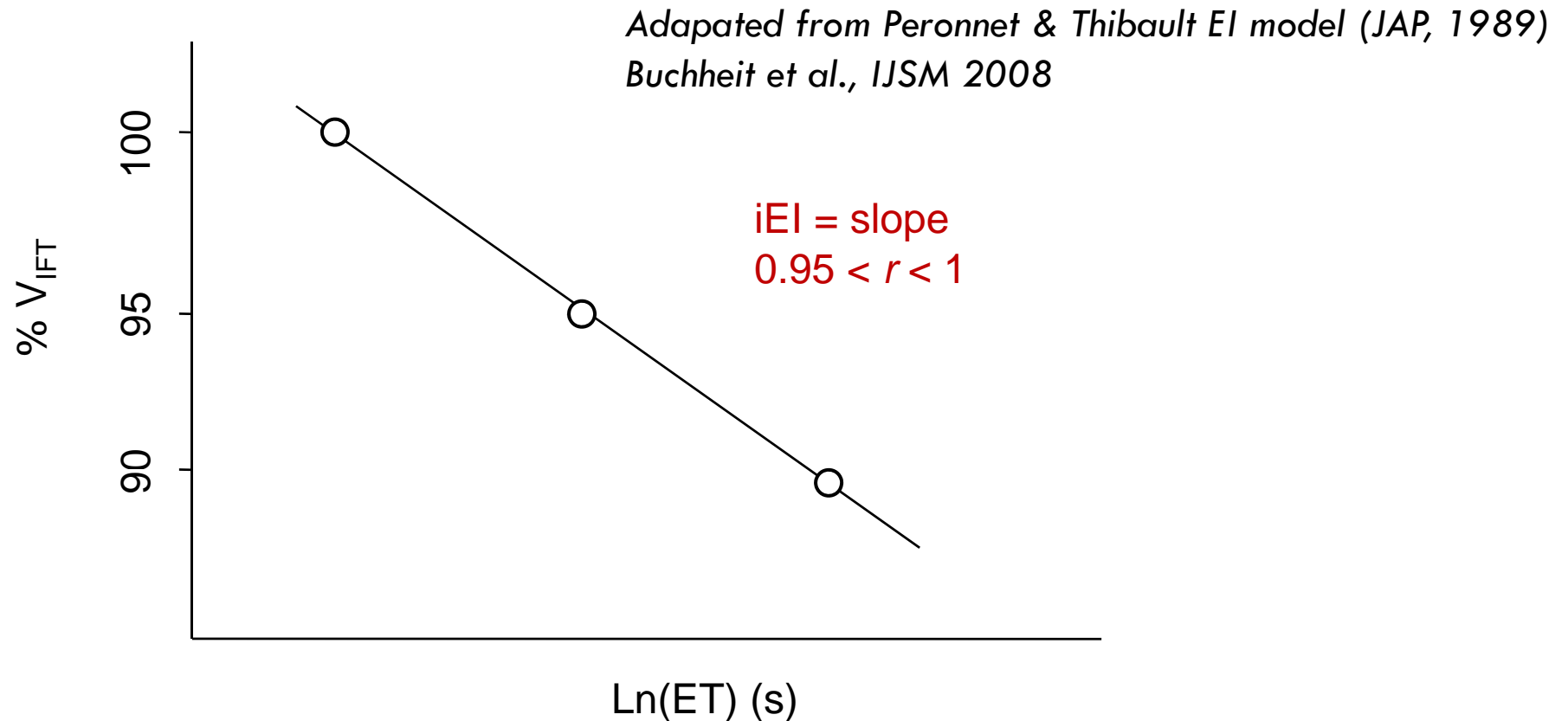


Fig 1. Relationship between percentage of V_{IFT} at which intermittent runs were performed (100, 95 and 90%) and associated times-to-exhaustion expressed logarithmically; $\text{Ln}(ET)$.

Athletic performance assessment

- 30-15IFT $\rightarrow V_{IFT}$ (km.h⁻¹)¹
- 3 Times to exhaustion performing 15"/15" @ 100, 95 and 90% of V_{IFT} – passive rest
- Intermittent endurance index (iEI)²
- Counter movement jump (CMJ)
- 10 m sprint time (10m)
- Throwing velocity (Shoot)
- best (RSA_{best}) and mean (RSA_{mean}) times on a shuttle-repeated sprint ability test³ - 6 x (2 x 15m), $r = 14''$.

¹ Buchheit, JSCR 2008; ² Buchheit et al., IJSM 2008; ³ Buchheit et al., MSSE 2008

Results



Overall athletic performance

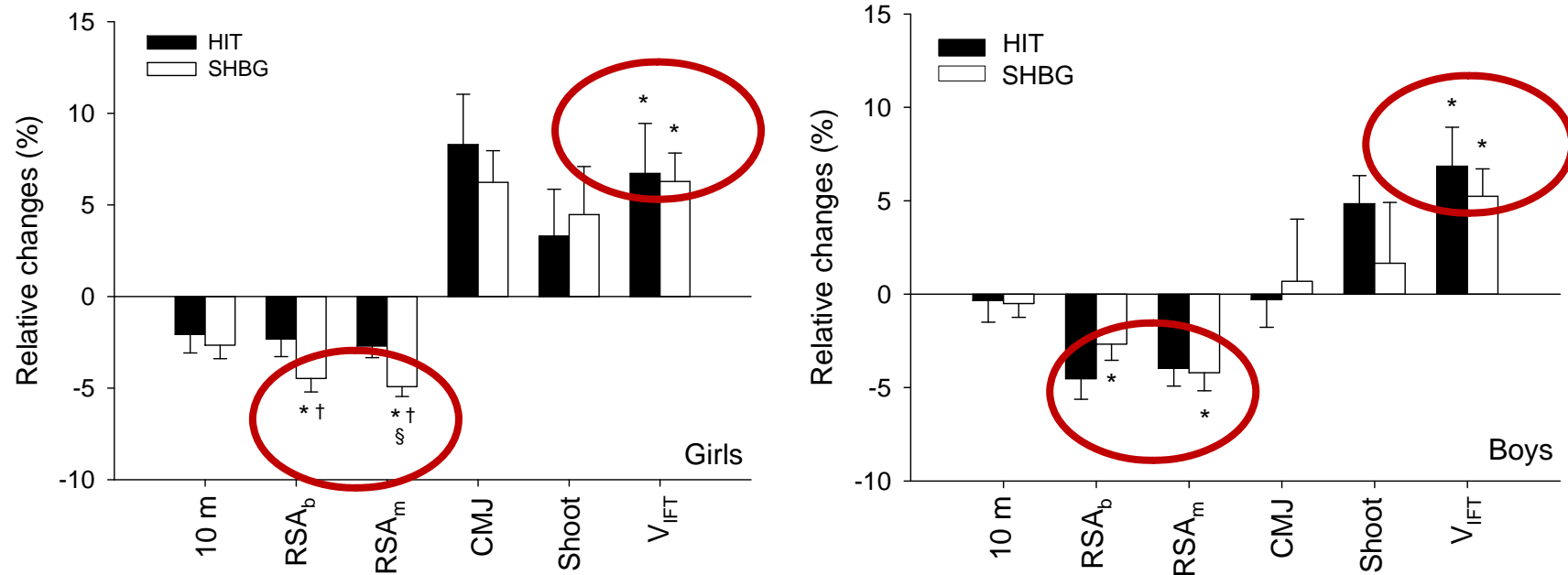


Fig 2 & 3. Training-induced change for girls in physical performance, 10-m sprint time (10 m), best time during the repeated-sprint ability test (RSA_b), mean sprint time during the RSA test (RSA_m), countermovement jump (CMJ), throwing velocity (Shoot) and velocity reached at the end of the 30–15IFT (V_{IFT}). *: large effect size (ES > 0.8). †: significant difference in relative changes between training groups ($P < 0.05$). §: significant difference between pre- and post-training revealed with the 2-factors ANOVA ($P < 0.05$).

Intermittent Endurance Index (iEI)

Buchheit et al., IJSM 2008

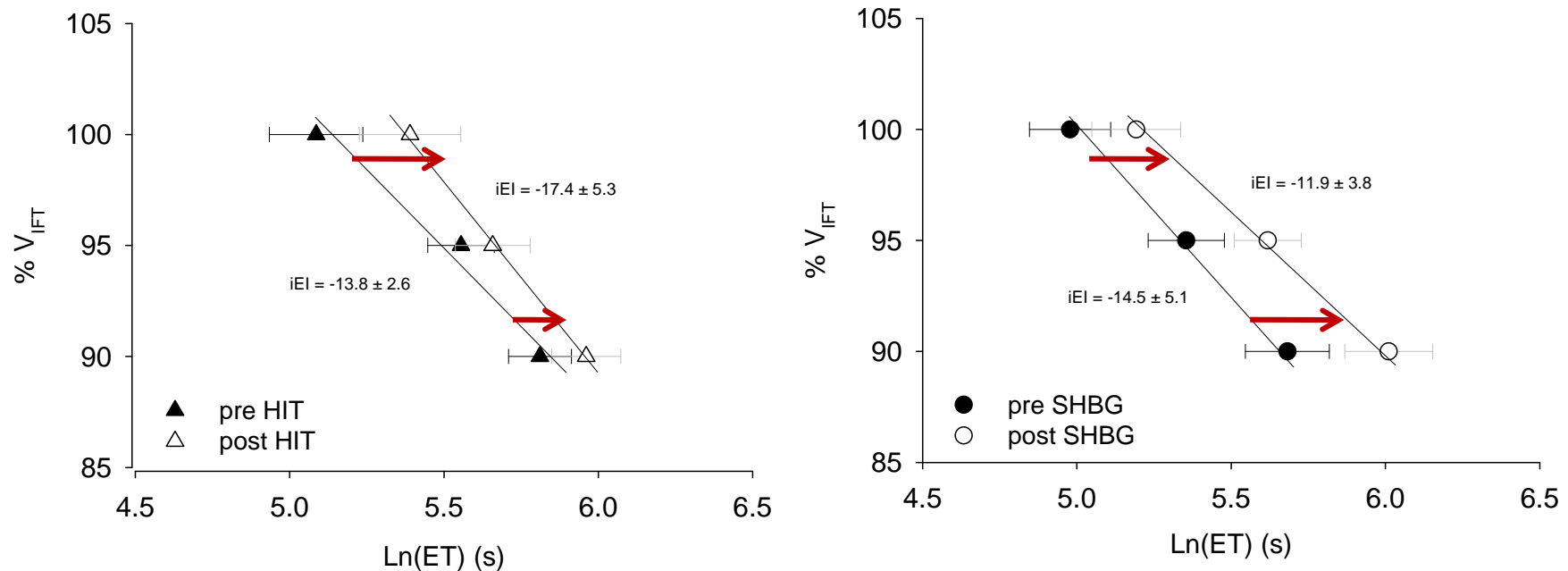


Fig 4. Changes in times-to-exhaustion at 100, 95 and 90% of V_{IFT} (expressed logarithmically; Ln(ET)) and associated intermittent endurance index (iEI) before and after high-intensity run training (HIT, triangles) or handball specific training using small-handball games (SHBG, circles) with girls and boys pooled.

No change in iEI & no difference between groups

SHBG: 4 (or more ?)- HIT: 3

Even more for SHBG?

future will tell us...

Discussion



- **Aerobic-related indices: SHBG ~ HIT**
 - ▣ Training near 'the high intensity zone' ($\geq 90\%$ VO_2max) might be enough
 - ▣ Additional aerobic solicitations (HB 7.5 hrs a week) might be of higher importance than SHBG or HIT
 - ▣ Motivation (SHBG) might overcome training precision (HIT)
 - ▣ Circumpupertal players might display very (too?) good responsiveness to 'any' kind of aerobic stimuli
- **Repeated sprint ability: SHBG > HIT**
 - ▣ Need to sprint repeatedly during SHBG but not HIT
 - ▣ Recovery intensity during HIT was passive

Conclusions



- Both small-sided handball games and high intensity running exercises are effective training modes for adolescent handball players.
- However, specific handball training should be considered as the preferred training method due to its **specificity and higher impact on repeated sprint ability.**

Perspectives



Perspectives



- What about elite adult players?
- In progress: reliability of cardiorespiratory and RPE measures
 - ▣ HR: typical error = 4 bpm
 - ▣ RPE: typical error = 0.3
- Evaluating the effect of SHBG players number on exercise load - as shown in soccer (*Rampinini et al., JSS 2007*)

EFFECTS OF RUNNING VS. SPECIFIC AEROBIC TRAINING IN YOUNG ELITE HANDBALL PLAYERS

Martin Buchheit ^{1, 4}, Paul B. Laursen², Fabien Leblond ^{3, 4}, Christine Renaud³, David Ruch³, Jennifer Kuhnle⁴ and Said Ahmaidi¹



¹Laboratory of Exercise Physiology and Rehabilitation, Faculty of Sport Sciences, University of Picardie, Jules Verne, 80025, Amiens, France.

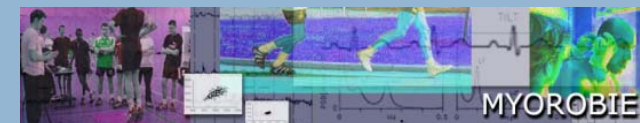
²School of Exercise, Biomedical and Health Sciences, Edith Cowan University, Joondalup, WA, Australia.

³Picardie handball league, Pont Sainte Maxence, France

⁴Myorobie Association, Montvalezan, France



ECSS 2008



		SHBG		HIT	
		Girls	Boys	Girls	Boys
Pre tests	Week -2	30-15 _{IFT} / CMJ / 10m / RSA and throwing velocity tests			
	Week -1	iEI determination (3 intermittent runs to exhaustion)			
Training period	Week 1	2 x [2x2'30"]	2 x [2x3'15"]	2 x [5'30" 15"(90%)-15"p]	2 x [7' 15"(92%)-15"p]
	Week 2	2 x [2x2'45"]	2 x [2x3'45"]	2 x [6' 15"(90%)-15"p]	2 x [8' 15"(92%)-15"p]
	Week 3	2 x [3x2'40"]	2 x [3x3']	2 x [9' 15"(90%)-15"p]	2 x [10' 15"(92%)-15"p]
	Week 4	2 x [2x3'15"]	2 x [2x4'15"]	2 x [7' 15"(90%)-15"p]	2 x [9' 15"(92%)-15"p]
	Week 5	2 x [3x3'20"]	2 x [3x3'40"]	2 x [11' 15"(90%)-15"p]	2 x [12' 15"(92%)-15"p]
	Week 6	Regeneration*			
	Week 7	2 x [2x3'15"]	2 x [2x3'30"]	2 x [7' 15"(92%)-15"p]	2 x [7'30" 15"(93%)-15"p]
	Week 8	2 x [3x2'40"]	2 x [2x4'15"]	2 x [9' 15"(92%)-15"p]	2 x [9' 15"(93%)-15"p]
	Week 9	2 x [3x2'40"]	2 x [2x4'15"]	2 x [9' 15"(92%)-15"p]	2 x [9' 15"(93%)-15"p]
	Week 10	1 x [2x2'30"]	1 x [2x2'45"]	1 x [5'30" 15"(95%)-15"p]	1 x [6' 15"(100%)-15"p]
Pre tests	Week 11	30-15 _{IFT} / CMJ / 10m / RSA and throwing velocity tests			
	Week 12	iEI determination (3 intermittent runs to exhaustion)			

SHBG vs. HIT

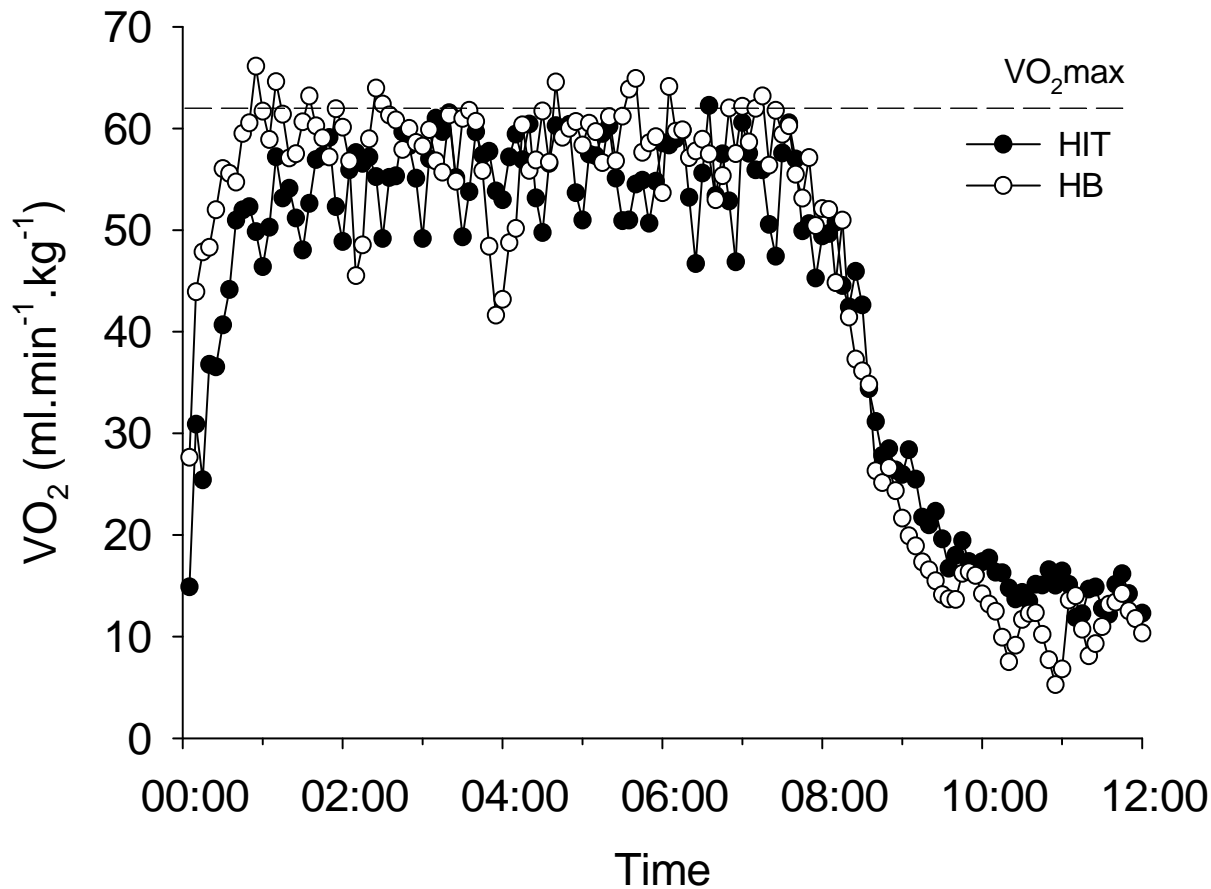
	Mean VO ₂ (ml.min ⁻¹ .kg ⁻¹)	Mean HR (bpm)	[La] _b (mmol.l ⁻¹)	RPE	Distance covered (m)
SHBG	53.3 ± 3.3	175.4 ± 8.7	8.9 ± 3.5	6.3 ± 0.5	1234.3 ± 112.3
HIT	50.1 ± 7.1	178.6 ± 7.8*	11.6 ± 2.07*	6.6 ± 0.5	1182.5 ± 52.2

Can SHBG be used to improve aerobic fitness?

- Acute cardiorespiratory responses
 - ▣ Training at or near VO_2max (90% or 95% of VO_2max at least three minutes) (*Laursen and Jenkins, 2002; Midgley and Mc Naughton, 2006; Midgley et al., 2006*).
- Chronic adaptations (i.e., > several weeks)
 - ▣ Maximal aerobic power
 - ▣ Aerobic 'endurance'



Cardiorespiratory responses to SHBG



8' SHBG:

2 x 3'45" (interspersed with 30 s rest)

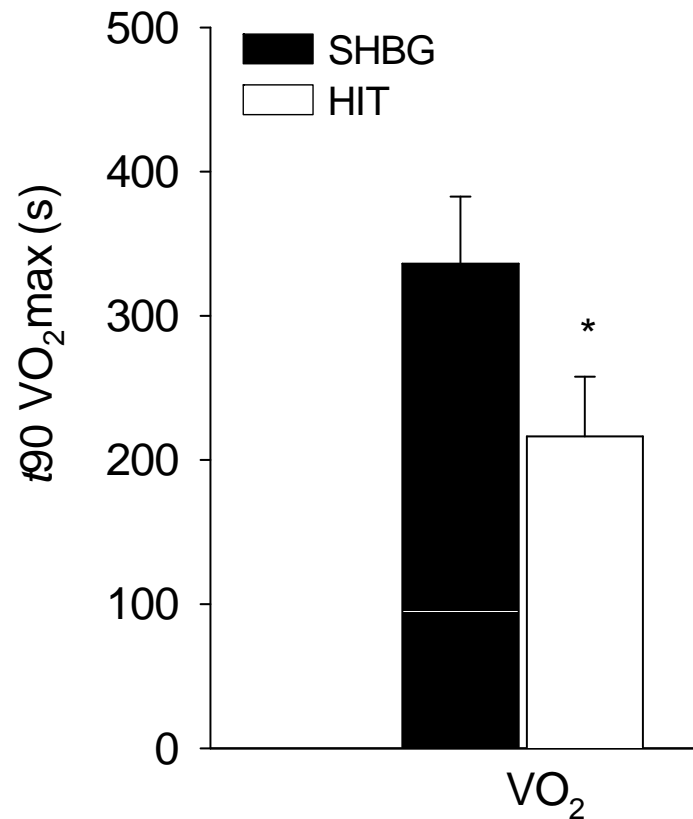
8' HIT:

16 x 15" @ 90% V_{IFT} (~120% $v\text{VO}_{2\text{max}}$) / 15" passive rest

V_{IFT} = speed reached at the end of the 30-15 Intermittent Fitness Test (30-15_{IFT}) (Buchheit JSCR 2008) – more accurate to schedule HIT than $v\text{VO}_{2\text{max}}$

Buchheit et al., JSMS 2008

YES: SHBG = a time-efficient stimulus



t90VO₂max:

SHBG:

73 ± 12 %

vs.

HIT:

48 ± 10 %