Hypoxic Training

In-House Testing

Background

- Rented portable hypoxic tent for 6 weeks.
- Intervention designed to see if hypoxic conditions would elicit greater physiological improvements.
- Recent research with athletes shows improved training adaptations in hypoxia:

Galvin, H.M., Cooke, K., Sumners, D.P., Mileva, K.N. & Bowtell, J.L. (2013) Repeated sprint training in normobaric hypoxia. *Br J Sports Med.* 47; i74-i79.

Manimmanakorn, A., Hamlin, M.J., Ross, J.J., Taylor, R. & Manimmanakorn, N. (2013). Effects of low-load resistance training combined with blood flow restriction or hypoxia on muscle function and performance in netball athletes. *J Sci Med Sport.* 16(4); 337-342.

Baseline Testing & Intervention

Baseline Testing

- Club Incremental Test
- Venous blood sampling

Intervention

- Lactate Threshold training.
- OBLA (4mmol lactate) 95 – 105% HR used.
- 3 x 8 minutes (30’ session)
- Aim 3 x per week for 4 weeks.
- Aim for 12 exposures to hypoxic conditions.
- Heart rate and SpO_2 monitored at end of 8 min blocks.

Baseline Testing & Intervention

Intervention

- Group 1 (Moderate Hypoxic & Heat)

- 2600m
- O_2 15.3%

- AE - Woodway
- BM - Cycle

Baseline Testing & Intervention

Intervention

- Group 2 (Mild Hypoxic & Heat)

- Set to sea level, however, chamber did not maintain sea level O_2

- 200 - 1100m
- O_2 20.2 – 18.2%

- DS - Woodway
- JB - Cycle

Climate and Physiological Responses - Differences

- Group 1 Moderate Hypoxia

- Temp. Range 21.7 – 33.2 ^{O}C
- Humidity Range 16 – 88 %
- SpO_2 Range 81 – 98%

- Group 2 Mild Hypoxia

- Temp. Range 22.3 – 33.1 ^{O}C
- Humidity Range 39 – 83%
- SpO_2 Range 96 – 99%

Practical Issues

- Sea level setting not maintained.
- Due to other commitments it was not possible for all players to complete all sessions (e.g U21 matches, college, FA qualifications)
- JB not a player! Training different.

No. Of Sessions Completed

AE	9
BM	8
DS	5
JB	15

Results

- Subjective Responses

- All participants said they felt good using the chamber and felt fitter.
- BM (Hypoxia & Cycle) in particular reported he felt a significant improvement.
- Potential placebo effect for DS?

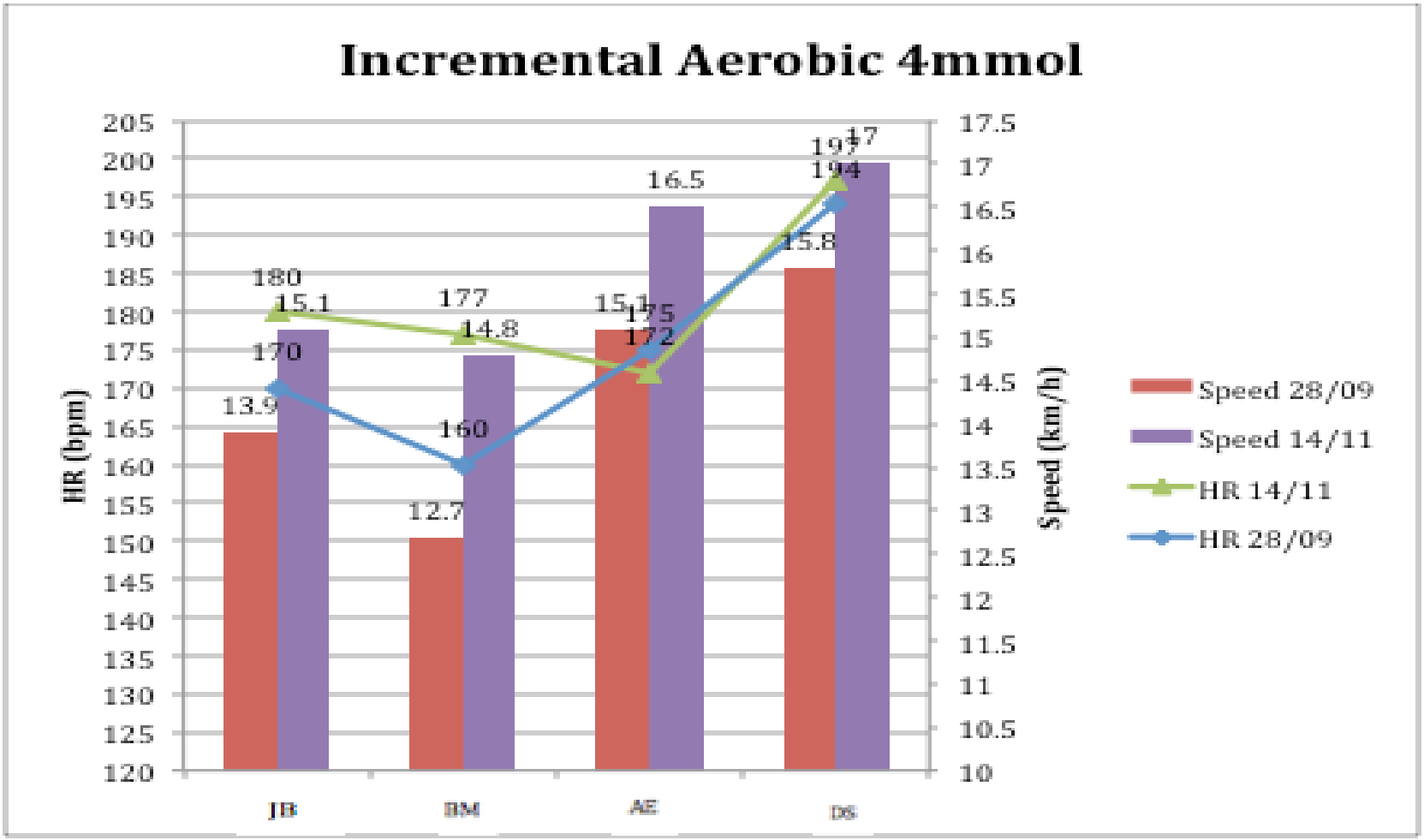
Results

4mmol Speed (km/h)

Player	Baseline	Re-Test	% Change
AE	15.1	16.5	9.27%
BM	12.7	14.8	16.54%
JB	13.9	15.1	8.63%
DS	15.8	17	7.59%
Average	14.1	15.9	10.51%

Mod. Hypoxic	12.90%
Mild Hypoxic	8.11%

Results


Incremental Aerobic 4mmol
HR (bpm)
Speed (km/h)
205
200
195
190
185
180
175
170
165
160
155
150
145
140
135
130
125
120
17.5
17
16.5
16
15.5
15
14.5
14
13.5
13
12.5
12
11.5
11
10.5
10
180
15.1
177
14.8
175
15.1
172
15.8
197
17
194
16.5
170
13.9
160
12.7
JB
BM
AE
DS
Speed 28/09
Speed 14/11
HR 14/11
HR 28/09

Discussion

- BM showed greatest improvement of 16.54% (Hypoxia & Cycle)
- Overall moderate hypoxia showed larger improvements. (Statistical significance?)
- Due to sea level setting issue all participants had slight hypoxic stimulus. Reason for all improvements? Lower % change at sea level?
- Larger study group needed and different areas require investigation.

Discussion

- Provides a foundation for potential usage of hypoxia for different training goals.

- Possible intervention for:

- Mid to long-term rehabilitation (evidence for physiological effects after 4+ weeks of training, 8+ sessions)

- Pre-season (based on first inc. test of season)

- Load compromised players requiring extra conditioning.

- Other protocols / training goals (e.g RSA?, strength?, lower aerobic?)

Discussion

- Further research required:

- Responders v reduced responders?
- Ideal no. of exposures
- Time of exposure
- Relationship with injury recovery – reduced O_2 healing effect?
- Level of hypoxia (sea level group required)
- Ideal SpO_2 Range
- Temp. and Humidity Range
- Hematological changes? – potential mechanism for improvement

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