

# The Impact of Monitoring Strategies on a Team Sport Through an Olympiad: Physical Development, Taper & Recovery

*Dave Hamilton Lead Strength and Conditioning Coach:  
Great Britain Women's Hockey*



ENGLISH  
INSTITUTE OF  
**SPORT**



adidas

TOUCH

XTREME 24

ASHERLY BALL

X 24

# Overview

- Program and Competition: Demands and Challenges (10)
- Monitoring: Defined (3)
- Physical Development: Overview 2009-2012 (10)
- Monitoring Strategies – Impact & Findings
  - Year 1 (2009-10)– Goal: Develop Understanding of Program Demands (10)
  - Year 2 (2010-11)– Goal: Finalise Monitoring Model for Olympic Year 2012 (15)
  - Year 3 (2011-12)– Goal: Actualisation Phase (15)
  - General Findings (5)
- Summary: Learning



ENGLISH  
INSTITUTE OF  
SPORT



A female hockey player in a red Team GB uniform is lying on the ice, looking up with a determined expression. She is wearing a red jersey with "TEAM GB" and the Olympic rings logo, and red shorts with the Adidas logo. Her name "Alex Darr" is visible on the back of her jersey. She is holding a hockey stick with "Alex Darr" written on it. The background is a blue wall.

# Program and Competition

*Demands and Challenges*



# Demands and Challenges

## Structure

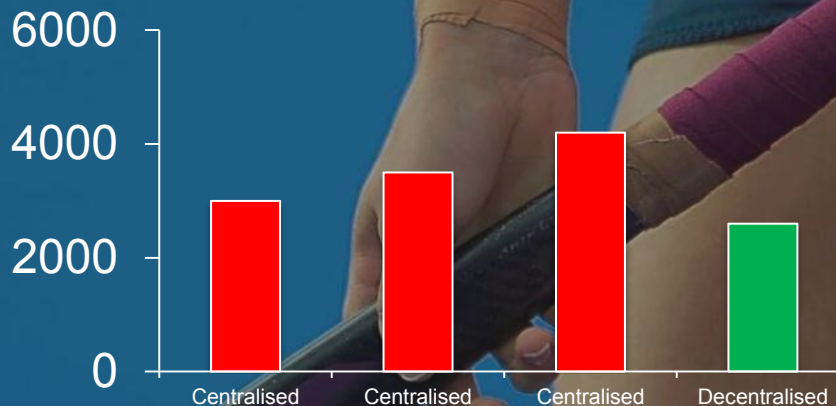
- 30 Athletes (3 Nations)
- 48 Week Season

## Purpose

- High Frequency Training
- Work Capacity

## Challenges

1. Club v Country
2. Concurrent – High Loading
3. Player Management



Mon	Tues	Wed	Thu	Fri	Sat	Sun
Gym (legs)	Hockey (tech)	Gym (Upper & Robustness)	Hockey (Tech)	Gym (Total-Body)	Club Game/Conditioning	Mobility
Hockey	Hockey (inter-squad)	Rest	Hockey (SSG)	Rest	Rest	Rest



**ENGLISH INSTITUTE OF SPORT**

# Demands and Challenges

## Sport

### Match Demands

### Average (Range)

Distance Covered

7km (6-9km)

Work Rate (m/min)

148 (137-165)

Heart Rate (% max)

90 (85-98)

% Time High Intensity Actions  
(15km/h+)

23

Low to Ground Actions

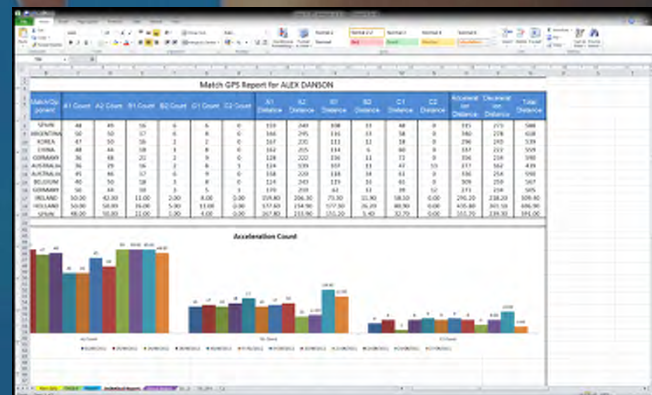
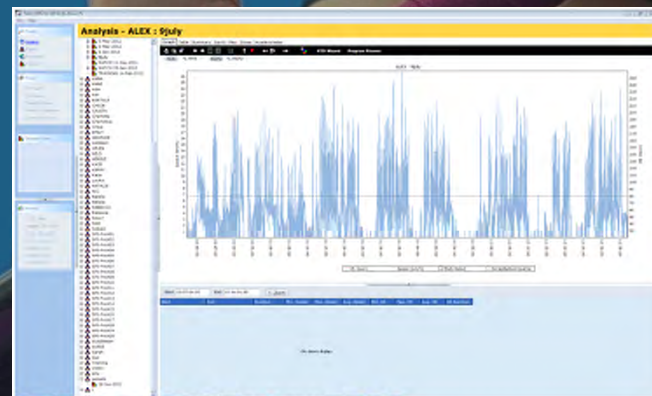
110 (90-140)

Distance covered (m) Acc/Dec

500-620

## Competition

- Consecutive Matches
- Multiple Competitions



video



# Monitoring

*Definition*





# Definition

Monitoring: A set of activities designed to help establish the acute training status of an athlete, so that appropriate and timely training adjustments can take place to ensure on going performance targets are attained.

## Why?

- Physiological Stress = Physiological Change
- Individuals within Team
- Impact (Recovery Strategy, Physical Development, Competition)
- Coach Interaction - value

It does not need to be complicated – Just Reliable



ENGLISH  
INSTITUTE OF  
SPORT

# Physical Development

*Overview 2009-2012*

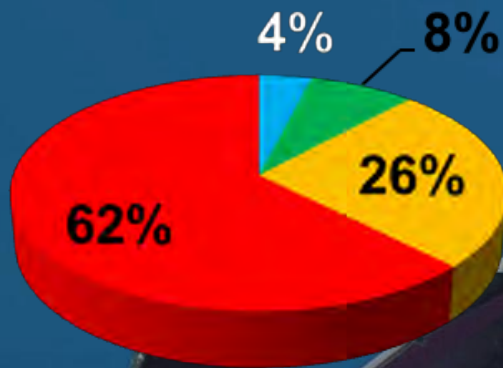


# Overview: 2009-2012

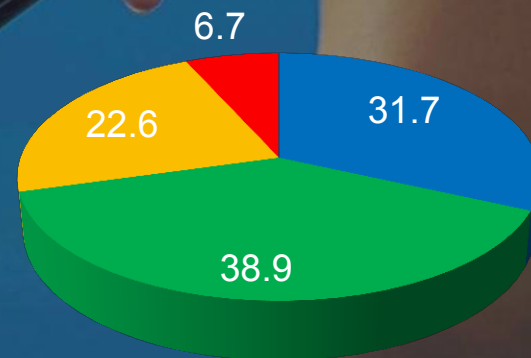
## Strength & Conditioning Targets

	Speed		40m	Strength		Conditioning			
	5m	10m		ISO Pull	Back Sq	Bench Press	Wide Pull Ups	Mean RSA	30-15iIFT
Elite & 2012	0.99	1.75	5.4	3.75	2	1.05	12	7.2	21
Green	1.04	1.8	5.65	3	1.75	0.9	9	7.45	20
Amber	1.1	1.87	5.85	2.4	1.5	0.75	6	7.7	19.5
Red	1.15	1.93	6	2	1.25	0.6	3	7.9	19

Oct 09

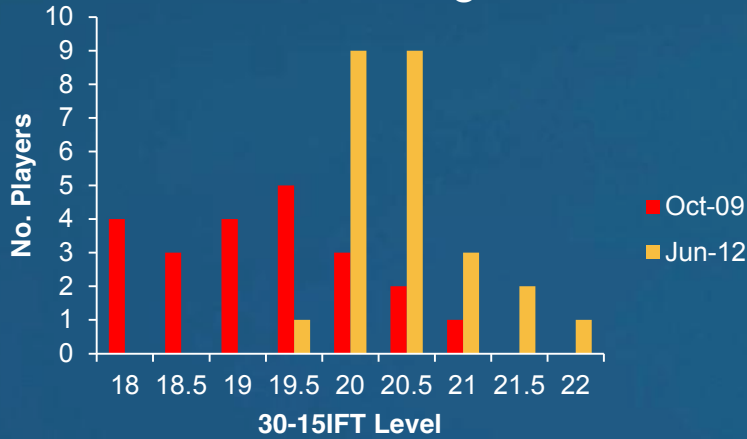


June 12

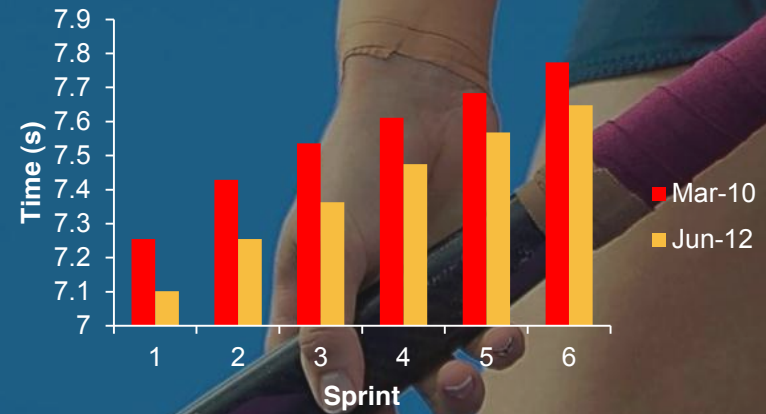




## Aerobic Conditioning



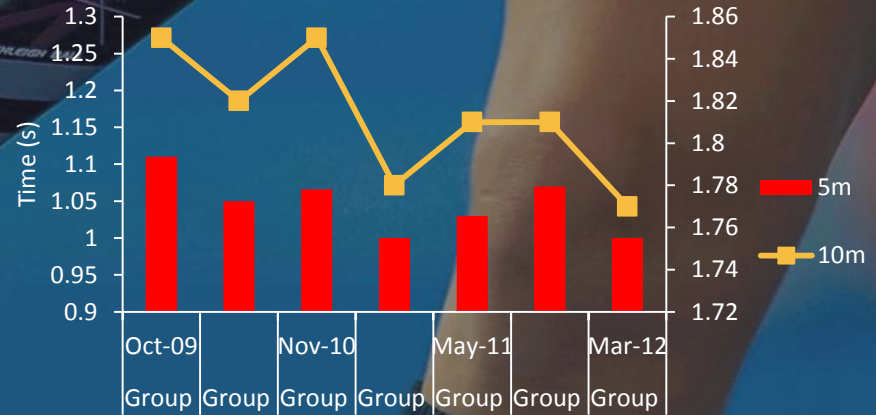
## Anaerobic Shuttle 6x40m



## Strength Tests

	Oct 2009	June 2012
Back Squat (kg)	82 (17)	109 (11)
Rel. Back Squat	1.21	1.74
Bench Press (kg)	42 (8)	62 (7)
Rel. Bench Press	0.65	0.97
Wide Chins	1.5	12

## Speed



# Performance?

## GPS: Performance Changes

	*2008 Team 6 <sup>th</sup> Beijing	2012 Team 3 <sup>rd</sup> London
Ave Distance (m)	5541	6604
Percentage Time % covered in each activity (Distance, m)		
Standing/Walking	56	30
Jogging	25	27.4
Running	12.5 (1226)	23.4 (1591)
Fast Running	5 (620)	13.6 (912)
Sprinting	1.5 (232)	5.6 (378)

\*Macutkiewicz, D and Sunderland, C (2011)

Players	Ave. Distance (m)	% time (Fast running/Sprinting)	Minutes Played	30-15IFT Score	Ave RSA (s)
Senior GB 20.5+	6698	20.8	45.4	20.8	7.26
Senior 20-	6508	17.4	44.8	19.98	7.48
U21's	5807	14.9	45.9	19.05	8.05



# Year 1

*Develop Understanding of Program Demands*



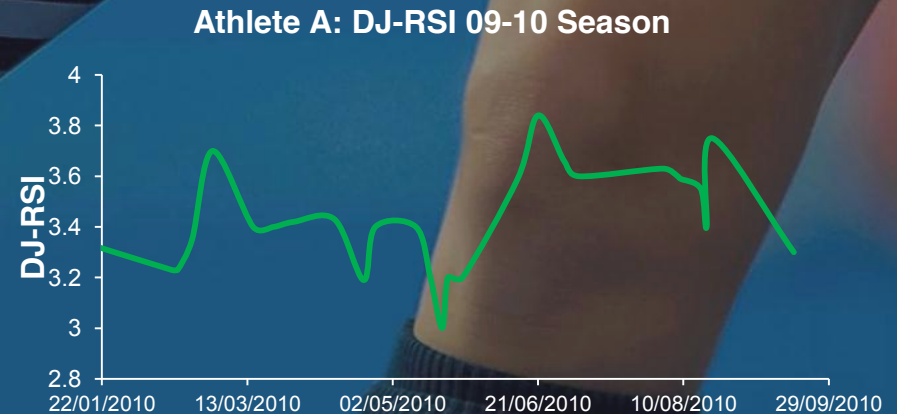
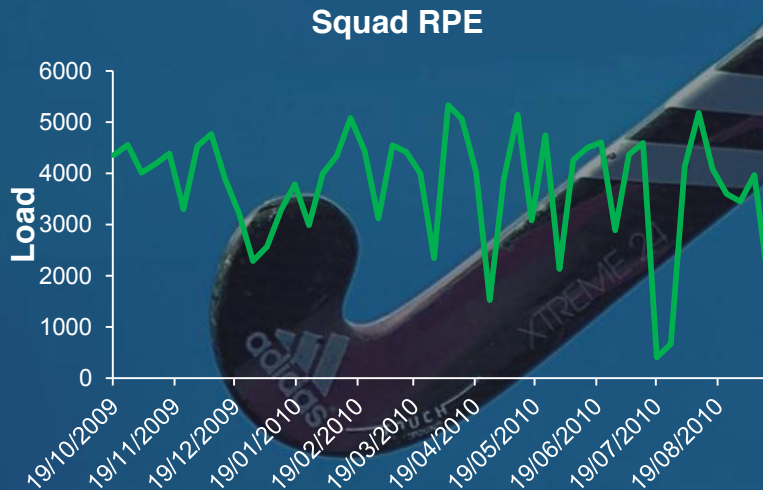
# Develop Understanding of Program

Need to know:-

- How hard do they think they are working?
- What is the impact of this work on their performance and readiness level?

Tools

1. Rate of Perceived Exertion
2. Drop Jumps – Reactive Strength Index



**ENGLISH  
INSTITUTE OF  
SPORT**

# Why RPE?

- Quantify individual and team training load
- Able to Quantify multiple training modalities
- Easy to use, reliable and consistent with physiological indices for exercise intensity

$$\text{RPE (1-10)} \times \text{Session Duration (min)} = \text{Load}$$

## A New Approach to Monitoring Exercise Training

CARL FOSTER, JESSICA A. FLORHAUG, JODI FRANKLIN, ORI GOTTSCHALL, LAURI A. HROVATIN, SUZANNE PARKER, AM

Journal of Strength and Conditioning Research, 2004, 18(2), 333-338  
© 2004 National Strength & Conditioning Association

### MONITORING EXERCISE INTENSITY DURING RESISTANCE TRAINING USING THE SESSION RPE SCALE

MEGHAN L. DAY, MICHAEL R. MCGUGGAN, GLENN BRICE, AND CARL FOSTER

Journal of Strength and Conditioning Research, 2004, 18(4), 796-802  
© 2004 National Strength & Conditioning Association

### QUANTIFICATION OF RESISTANCE TRAINING USING THE SESSION RATING OF PERCEIVED EXERTION METHOD

TRAVIS W. SWOFFORD, CARL FOSTER, MICHAEL R. MCGUGGAN, AND GLENN BRICE  
Department of Exercise Science, University of Cape Town, South Africa

## A Theoretical Basis of Monitoring Fatigue: A Practical Approach for Coaches

Michael Lambert and Jill Borresen  
MRC/UCT Research Unit for Exercise Science and Sports Medicine,  
Department of Human Biology, Faculty of Health Sciences,  
University of Cape Town, PO Box 115, Newlands, 7725,  
Cape Town, South Africa  
E-mail: Mike.Lambert@uct.ac.za

#### ABSTRACT

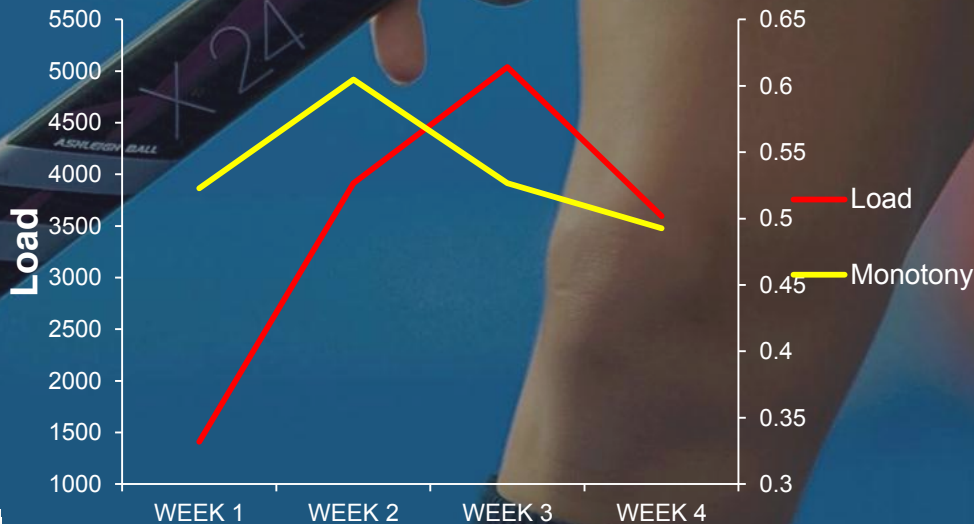
Training can be described as a process that induces biological adaptations. The basic principle of training is that training (breakdown) is followed by rest (recovery) which results in an improvement in performance. An imbalance in the training load and recovery time can result in symptoms of fatigue. If the imbalance between training and rest persists, the athlete may develop serious symptoms of fatigue that will affect the ability to sustain a high training volume and will have a negative effect on performance. While it is important for a coach to have a training plan, it is also important to be able to adjust the plan based on how the athlete is adapting. A coach needs to be able to answer a series of questions in order to make decisions about training prescription. Information from various measurements including perception of effort, session RPE, recovery scales (DALDA), assessment of muscle soreness and recovery heart rate. This information can guide decision-making about training and reduce the risk of under or overtraining.

**Key words:** Daily Analysis of Life Demands for Athletes (DALDA), Muscle Soreness, Profile of Mood States (POMS), Recovery Heart Rate, Rating of Perceived Exertion (RPE), Training Impulse (TRIMP).

#### INTRODUCTION

Training used to be mostly instinctive, with training programmes evolving through trial and error. About fifty years ago there was an attempt to apply a scientific approach to exercise training with the goal of reaching peak performances [1]. Knowledge has accumulated and it is now known that exercise training can be explained according to the principles of biological adaptation. In accordance with this explanation, each training session imposes a physiological stress [2] that results in transient physiological and metabolic changes [3]. The nature of these changes depends on the type, duration and intensity of exercise [4]. Examples of these transient physiological and metabolic changes are [2]:

Reviewers: Karin van Someren (English Institute of Sport, UK)  
Mehis Viru (University of Tartu, Estonia)



ENGLISH INSTITUTE OF SPORT



# Why DJ-RSI?

International Journal of Sports Physical  
© 2008 Human Kinetics, Inc.

## Neuromuscular of Elite Play

**Purpose:** a single 5 consecutive to a view to  
**Methods:** formed a (48pre, pt (96post), a point comp  
**Results:** A ratio of CM 1.06) and T

## Tect Low-I Fi

A recent review by *ences Reviews* (200) neuromuscular fatig applied versus redu recommendations scientist or practi highlight the inbr and to provide pr type of fatigue, c applied sport sc report identifi test of LFF for lead to a better unoc---

**Key Words:** electrical stimulation, force, fitness testing, etc---

It is well understood that elite athletes are required to train aggressively to perform at a high level. These athletes are in a cyclic state of training-fatigue adaptation, and this cycle is often imperfect (ie, athletes often train fatigued). Monitoring fatigue is important because effective monitoring leads to maximize performance. Recommendations from a recent review<sup>1</sup> indicated that future work in fatigue and helps determine appropriate training loads in competitive sport, (2) evaluating the role of perceived exertion in limiting performance, (3) assessing power output rather than force, (4) moderate rather than severe force fatigue, (5) protocols with dynamic (and stretch-shortening cycle) contractions rather than static contractions, and (6) protocols with submaximal rather than maximal contractions. These recommendations suggest that additional research in the applied sport setting is required to further our understanding of fatigue.

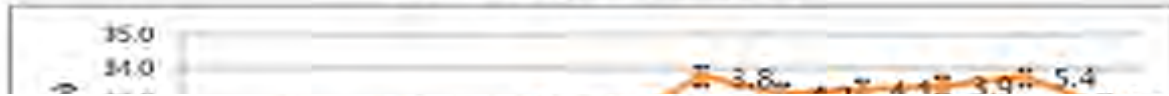
Low-frequency fatigue (LFF) is a multifactorial fatigue resulting from high-intensity, moderate- to high-force, repetitive eccentric or stretch-shortening cycle

The author is with the School of Recreation Management and Kinesiology, Acadia University, Wolfville, NS, Canada B4P 2R6.

ith Queen's Universi-  
Australia; Robert  
Health Sciences,  
School of Human  
Australia.

Journal of Australian Strength and Conditioning  
... Succession & Transition Science J Aust Strength Cond 17(2)-10

## Pre and Post CMJ- Games 1-6



## Journal of Australian Strength and Conditioning

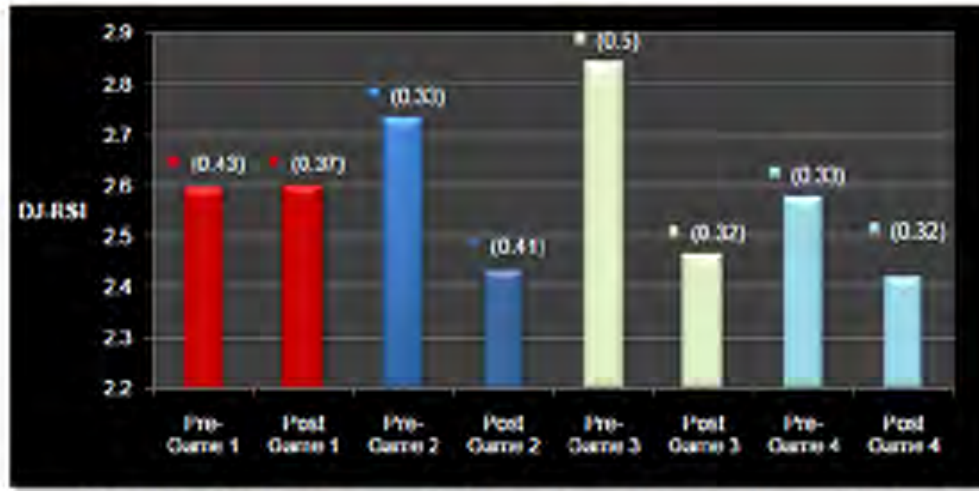


Figure 3 - Pre and Post Match (following morning) Drop Jump -Reactive Strength Index data & (SD) (Only subjects who completed full game)

endurance as key determinants for...  
and non-elite athletes (4, 21, 20). Therefore developing a physical performance test capable of assessing neuromuscular fatigue is warranted.

The countermovement jump (CMJ) is one method of assessment thought to offer an insight into neuromuscular function and power performance. However, despite the multitude of studies performed across a range of sports and athletic levels (1, 6, 7, 12, 14, 18, 20, 24, 27, 28, 29, and 30) discrepancy still exists with exactly how effective CMJ performance is as an indicator of neuromuscular fatigue.

performance...  
CMJ ratio Flight Time: Contraction Time...  
recent crucial variable for monitoring neuromuscular status in elite AFL players due to its high sensitivity and the substantial changes observed following AFL match play. In a recent study by Hamilton (12) which found no significant difference in CMJ height performance before and following soccer match play in youth soccer players it was suggested that drop jumps (DJ) may offer a more valuable insight into the neuromuscular changes associated with fatigue, due to the comparable muscle qualities required for success in a drop jump, agility tasks and maximal running speed (3, 10, 33).



ENGLISH INSTITUTE OF SPORT



# DJ-RSI

Why?

1. Simple, reliable, repeatable
2. Can be performed anywhere – KMS



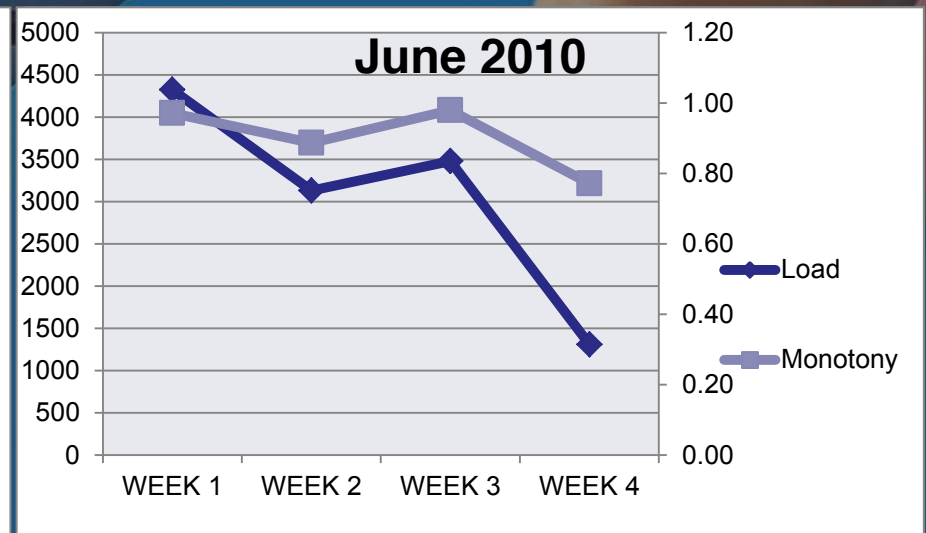
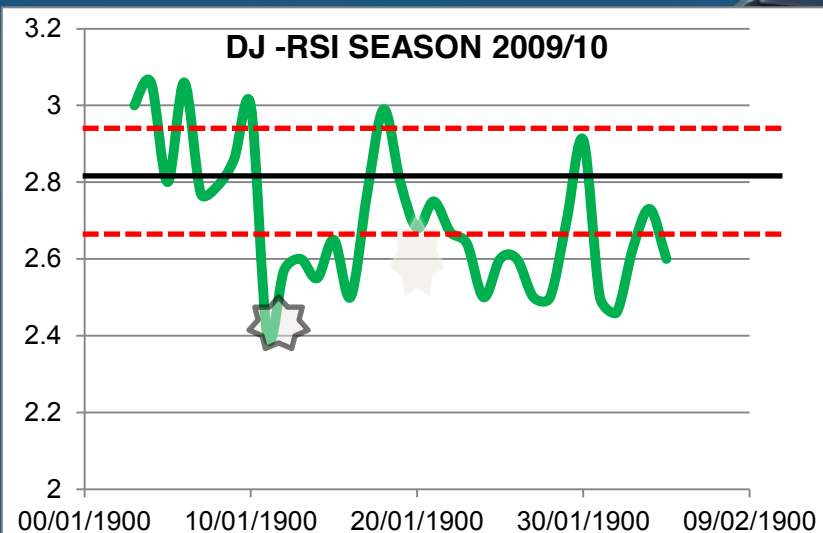
Drop Jump – Reactive  
Strength Index

CV	SWC
4%	0.1

# Findings – Year 1 Acute

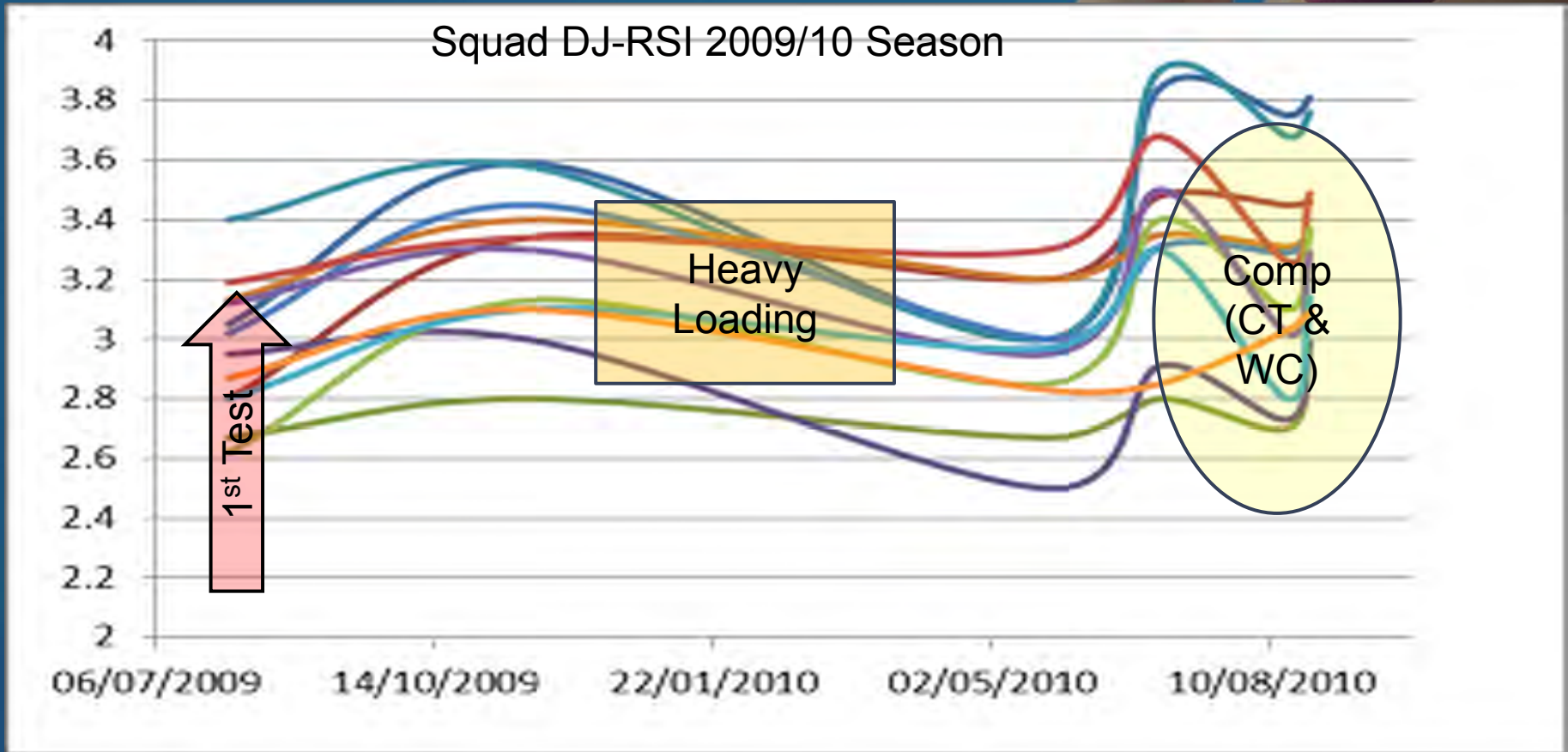
## 2 Cases - Over-Training?

	Athlete 1	Athlete 2
Date	Mar-April 2010	June-July 2010
'Coaches Eye'	Poor Form	Sluggish
Field Testing Results	Decline	No Change
Session RPE	Load High	Monotony Score High
DJ-RSI	Low	Low
Decision	3 wks. @ 25% reduced load	2 wks. @ 25% reduced loading – no change



# Findings – Year 1 Chronic

Trend: Squad DJ-RSI

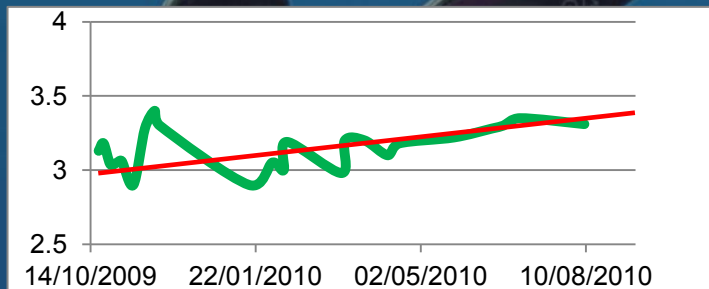
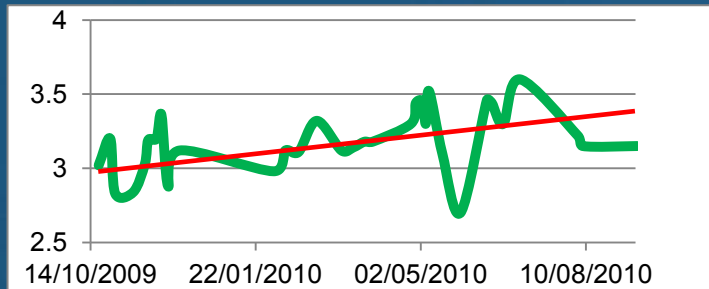
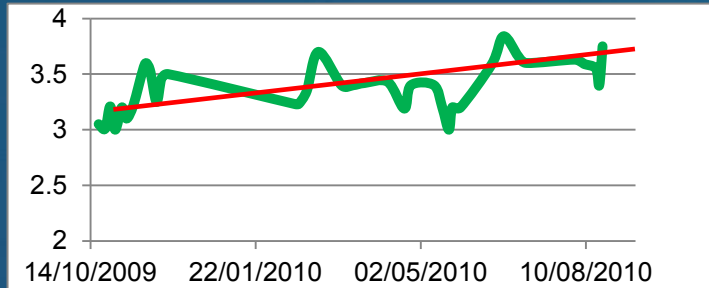




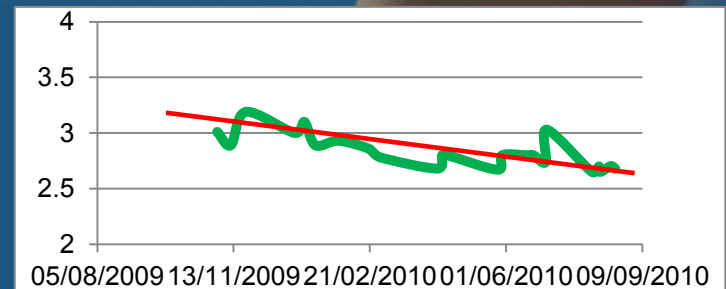
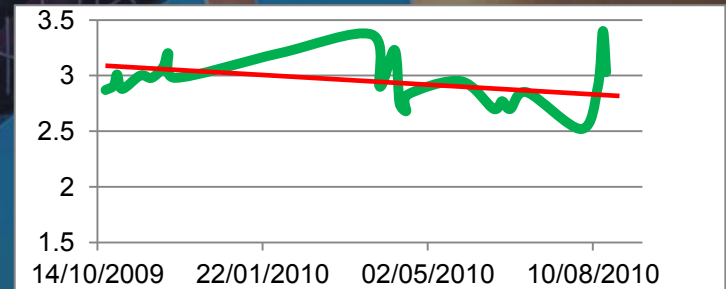
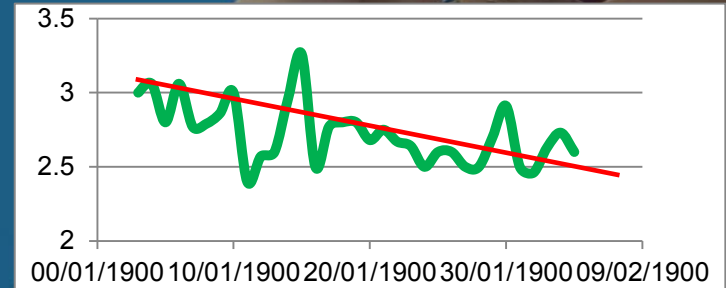
# Findings – Year 1 Chronic

## Individual DJ Trends

### Older (Training Age)

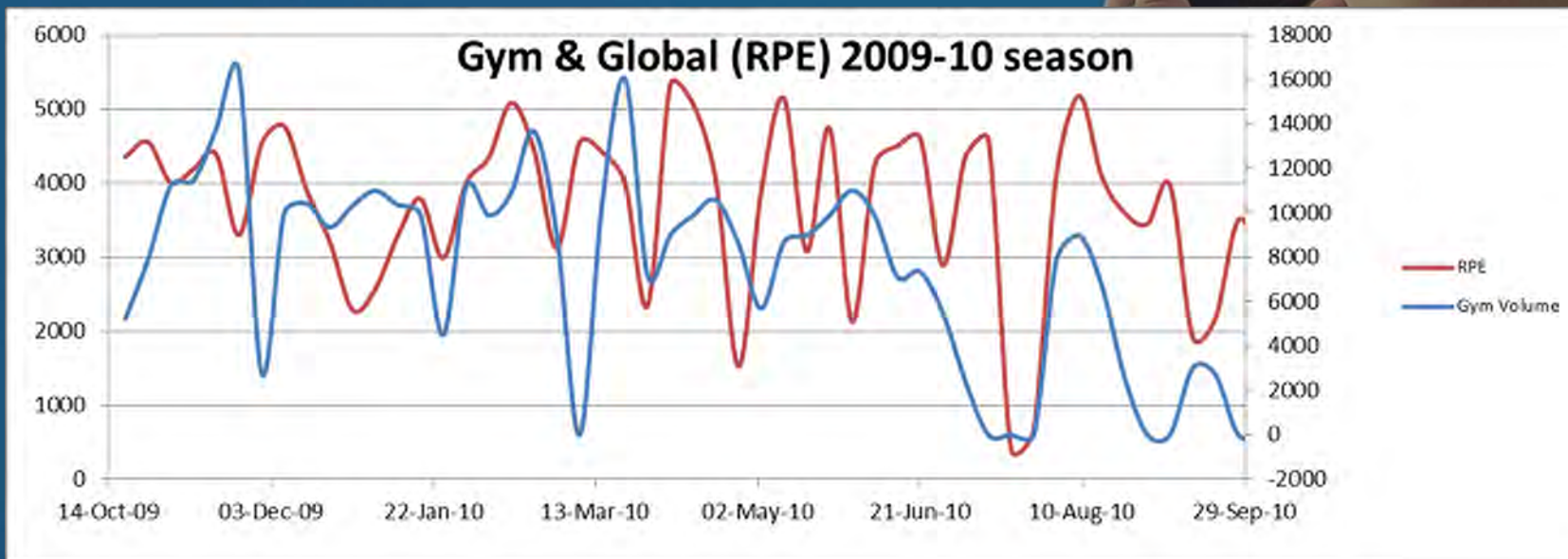


### Younger (Training Age)



# Summary

- DJ-RSI Useful Marker - NM fatigue in Hockey Players
- Session RPE + DJ-RSI – Over-training Gauge (more cognitive, somatic markers needed)
- Session RPE - Gym Loading = Hockey Demands





# Year 2

*Finalise Monitoring Model for  
Olympic Year 2012*



# Finalise Monitoring Model

Additions: Monitoring Model V.2

1. Hormone Profiling (UKSPORT – R&I)
2. Menstrual Data
3. Online Monitoring (Restwise)
4. DJ-RSI in Competitions

Constants

1. Session RPE
2. DJ-RSI (3 x wk.)



ENGLISH  
INSTITUTE OF  
SPORT

# Hormone Profiling

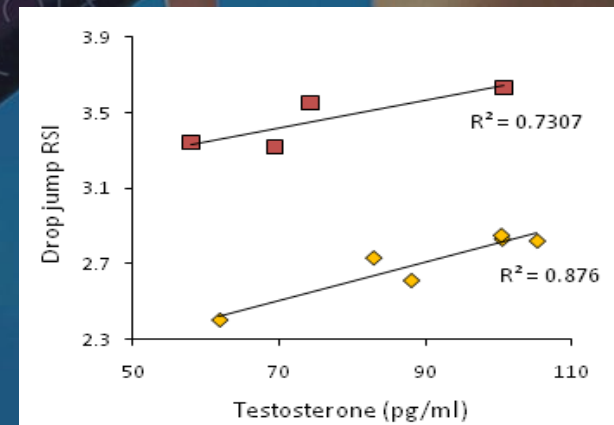
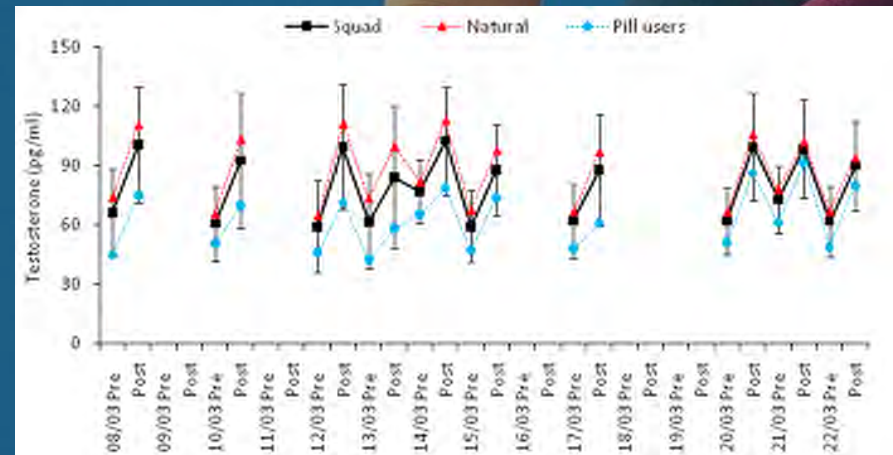
March 2010 – UKSport R&I

Measured: Testosterone & Cortisol

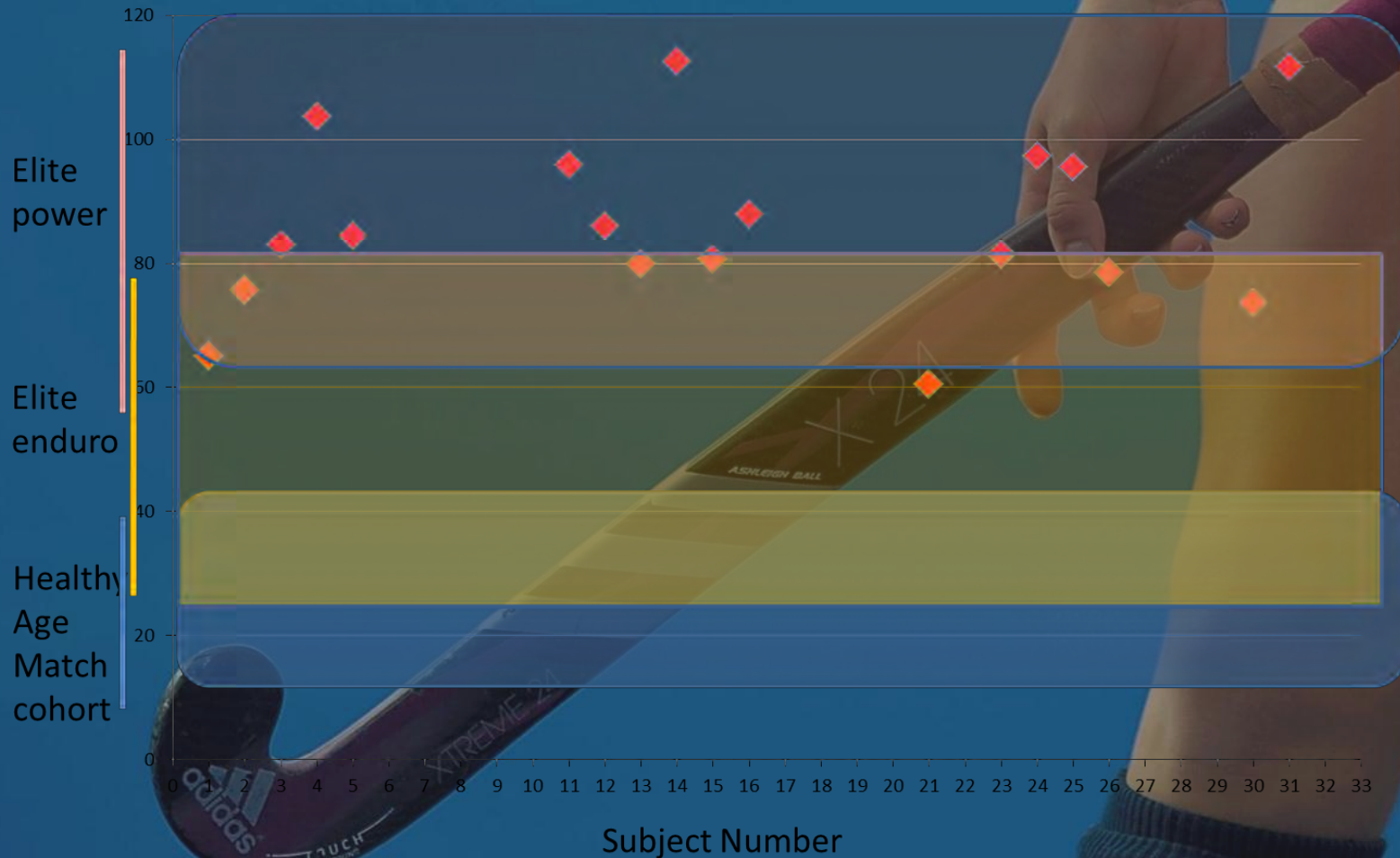
## 4 key Outcomes

1. High T and Good Responders
2. Load Tolerant
3. T good relationship with DJ-RSI
4. Difference OC and Naturals

Impact Areas – Competition, Physical Development, Recovery



# Hormonal Profiling (T): Naturals





# Hormonal Profiling (T): OC

*Am J Hum Biol.* 2012 Aug 22. doi: 10.1002/ajhb.22302. [Epub ahead of print]

## Comparison of baseline free testosterone and cortisol concentrations between elite and non-elite female athletes.

Cook CJ, Crewther BT, Smith AA.

United Kingdom Sports Council, London, United Kingdom; Sport, Health and Exercise Science, Department for Health, University of Bath, Bath, United Kingdom; Hamlyn Centre, Imperial College, London, United Kingdom; Health and Sport Portfolio, College of Engineering, Swansea University, Swansea, United Kingdom.

### Abstract

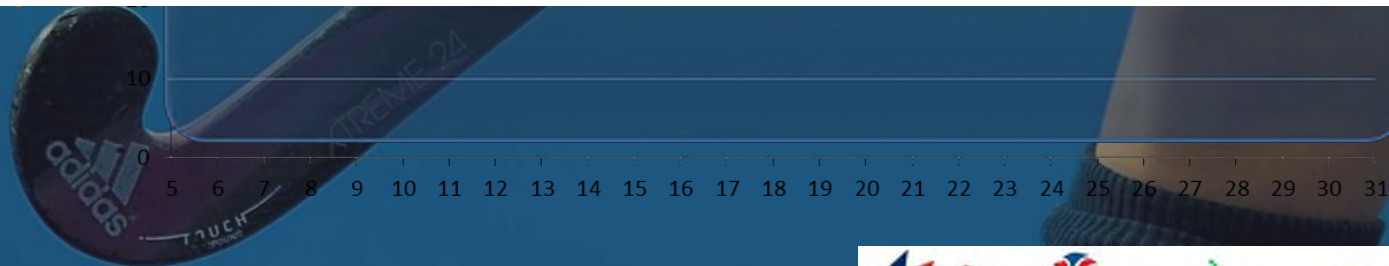
**OBJECTIVES:** To compare the baseline free testosterone (T) and cortisol (C) concentrations of elite and non-elite female athletes.

**METHODS:** Eighteen females from different sports (track and field, netball, cycling, swimming, bob skeleton) were monitored over a 12-week period. Baseline measures of salivary free T and C concentrations were taken weekly prior to any training. The elites (n = 9) and non-elites (n = 9) were classified as international and national level competitors, respectively, with both groups matched by sport.

**RESULTS:** The pooled free T concentrations of the elites (87 pg/ml) were significantly higher than the non-elites (41 pg/ml) and consistently so across all weekly time points ( $P < 0.001$ ). Pooled free C concentrations were also greater in the elite group (2.90 ng/ml) than the non-elites (2.32 ng/ml) ( $P < 0.01$ ).

**CONCLUSIONS:** The pooled baseline T and C measures were higher in elite female athletes than non-elites. Higher free T and C concentrations could indicate a greater capacity for physical performance at higher work rates, which is commensurate with the demands of elite sport. Speculatively, the T differences observed could influence female behavior and thereby help to regulate sporting potential. *Am. J. Hum. Biol.*, 2012. © 2012 Wiley Periodicals, Inc.

Match  
cohort



ENGLISH  
INSTITUTE OF  
SPORT

# Menstrual Data

Menstrual	Phase	Hormone Level	Physiological and Psychological Changes	Effect on Training	S&C Periodisation Thoughts				
					Weeks	Focus	Intensity	Priority Session	Simple Terms
1	Early Follicular (Menses)	Oestrogen, Progesterone & Testosterone Low	Changes in mood resulting in increased stress, accidents, poor reaction times and perception of exertion. Immune depression	Eliminate skill and precision training, reduce stress and training volume	1	Regen	Light	Mixed Early Light Conditioning & Start loading gym	↓
2									↓
3									↓
4									↓
5									↓
6	Mid Follicular	Oestrogen Rising, Progesterone Low		Include high intensity, low volume, complex tasks, anaerobic and power based activity, lactic acid based work and strength training	2	Metabolic & Strength	Medium	Speed	↓
7									↓
8									↓
9	Late Follicular	Oestrogen Peak	Increased glycogen storage, fat and protein and water and electrolyte stores	Include low intensity and high volume aerobic work. Emphasize nonweight bearing activities and prolonged exercise	3	Aerobic & Injury Prevention	Medium Heavy	Conditioning	↓
10									↓
11									↓
12									↓
13									↓
14	Ovulation	Testosterone Peak		Strength & Power Training					↑
15	Early Luteal	Progesterone Rising	Increased glycogen stores in liver and muscle tissue. Decreased glycogen stores in blood glucose. Increase in total energy and fat intake. Depression of blood lactate concentration. Greatest retention of water, sodium, chloride and potassium	Include High intensity, low volume, complex task. Anaerobic and power based activity, lactic acid based work and strength training	4	Maximal Strength * Power	Very Heavy	Gym & Speed	↑
16									↑
17									↑
18									↓
19									↓
20									↓
21	Mid Luteal	Oestrogen and Progesterone Peak	Greater protein breakdown. Muscular endurance low. Increased glycogen storage, increased fat and protein. Increased water and electrolyte stores	Include low intensity and high volume aerobic work. Emphasize nonweight bearing activities and prolonged exercise. Ability to cope with heat stress	5	Aerobic & Injury Prevention	Medium	Conditioning Heavy	↓
22									↓
23									↓
24									↓
25	Late Luteal	Oestrogen, Progesterone & Testosterone Low	Changes in mood resulting in increased stress, accidents, poor reaction times and perception of exertion. Immune depression	Recovery week. Eliminate skill and precision training. Include Simple tasks and low stress. Reduce stress and training volume and include strength training	5.00	Recovery	Light	Light Mixed	↓
26									↓
27									↓
28									↓
29									↓
30									↓
31									↓

Days



ENGLISH INSTITUTE OF SPORT



# Menstrual: Physical Development

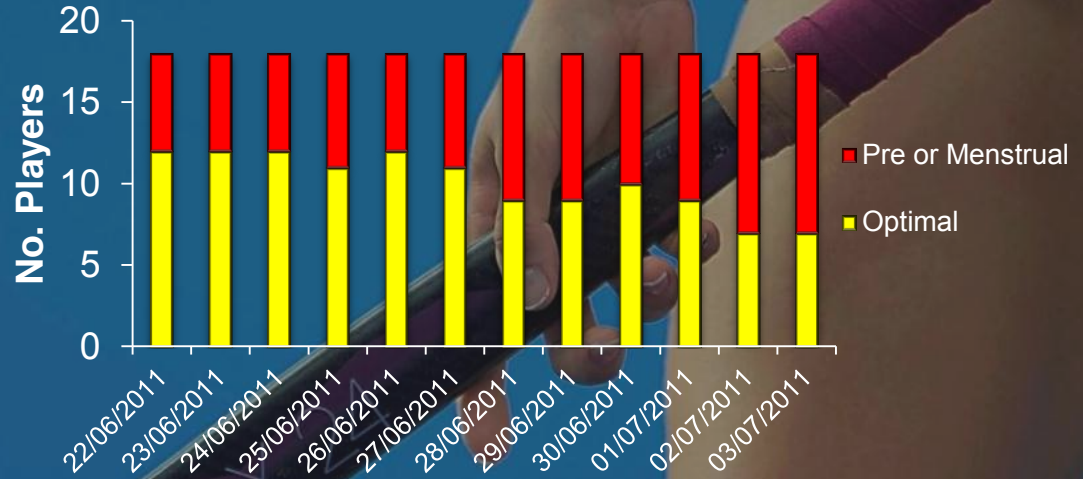
How did it work?

1. Collect data (Oct 2010)
2. Prescriptive changes (S&C)
3. Competition
4. Then What?

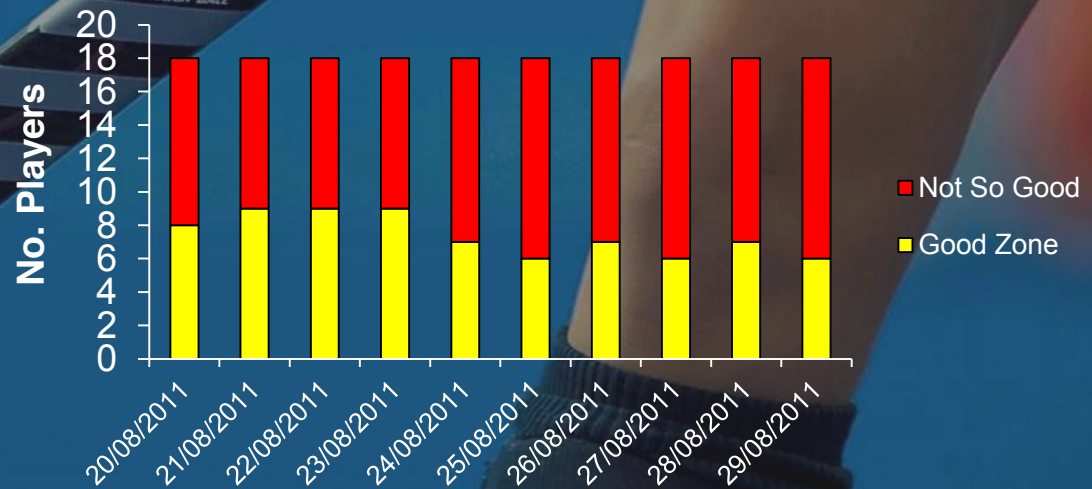
Interventions?

Management?

Menstrual Data – Champions Trophy 2011



Menstrual Data - Europeans 2011





# Restwise

## What is it?

- Online – Monitoring Tool
- Simple & Easy
- Recovery score
- Nice add-on: Player

## Understanding

- Apps



Resting heart rate  bpm

SP0<sub>2</sub>  %

Weight  lbs / kg [Synchronize with Wearings](#)

Hours slept, including naps  hrs

How well did you sleep?  worse than normal normal better than normal

Describe your energy level today  worse than normal normal better than normal

Describe your mood state today  worse than normal normal better than normal

Describe yesterday's training performance  worse than normal normal better than normal rest day

Describe your appetite  less than normal  normal

Do you have sore throat, headache, nausea, diarrhea, menstrual cramping or other illness?  yes  no

Do you have any muscle soreness?  yes  no

Do you have an injury that is affecting your training?  yes  no

Is this the first day of your menstrual cycle?  yes  no

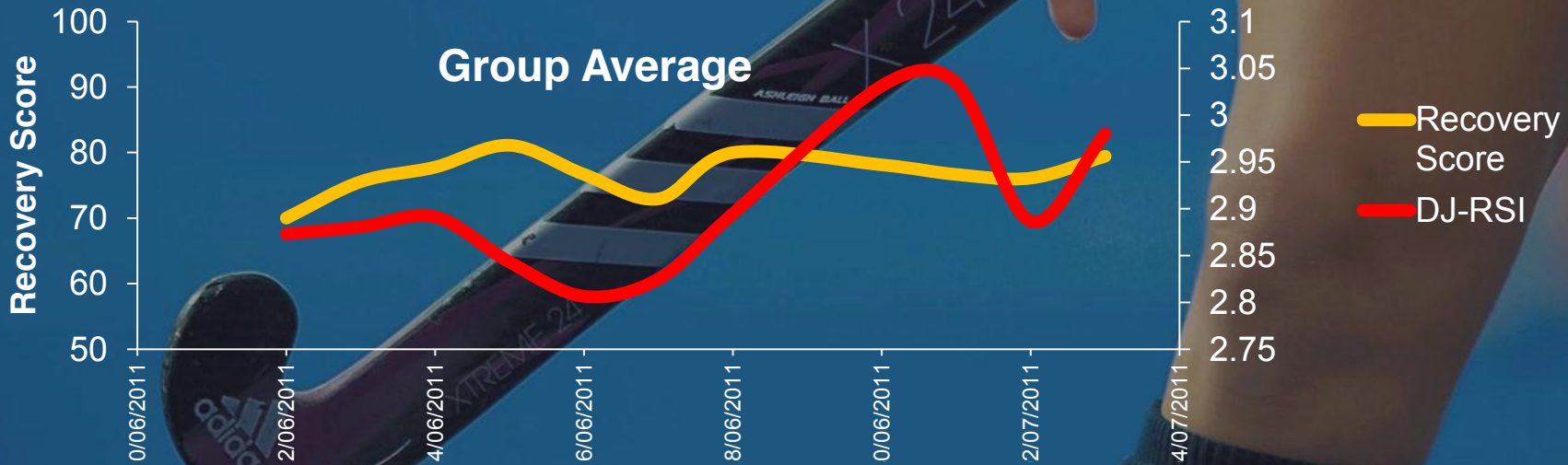
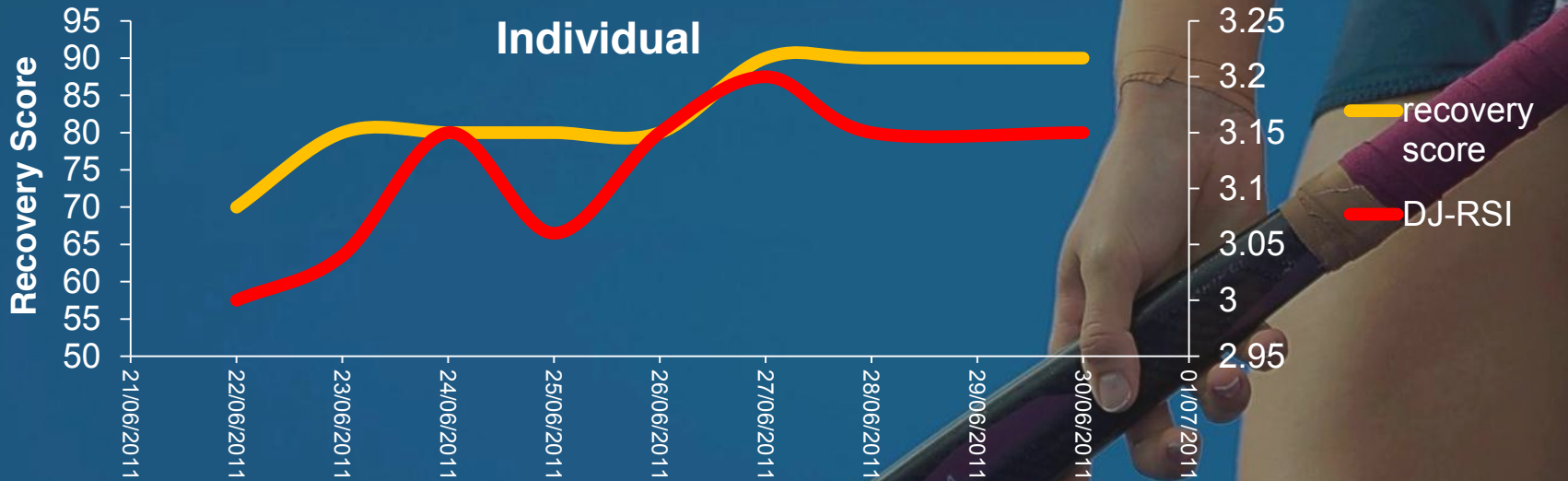
Urine shade  dark yellow yellow pale/clear yellow

Notes



ENGLISH  
INSTITUTE OF  
SPORT

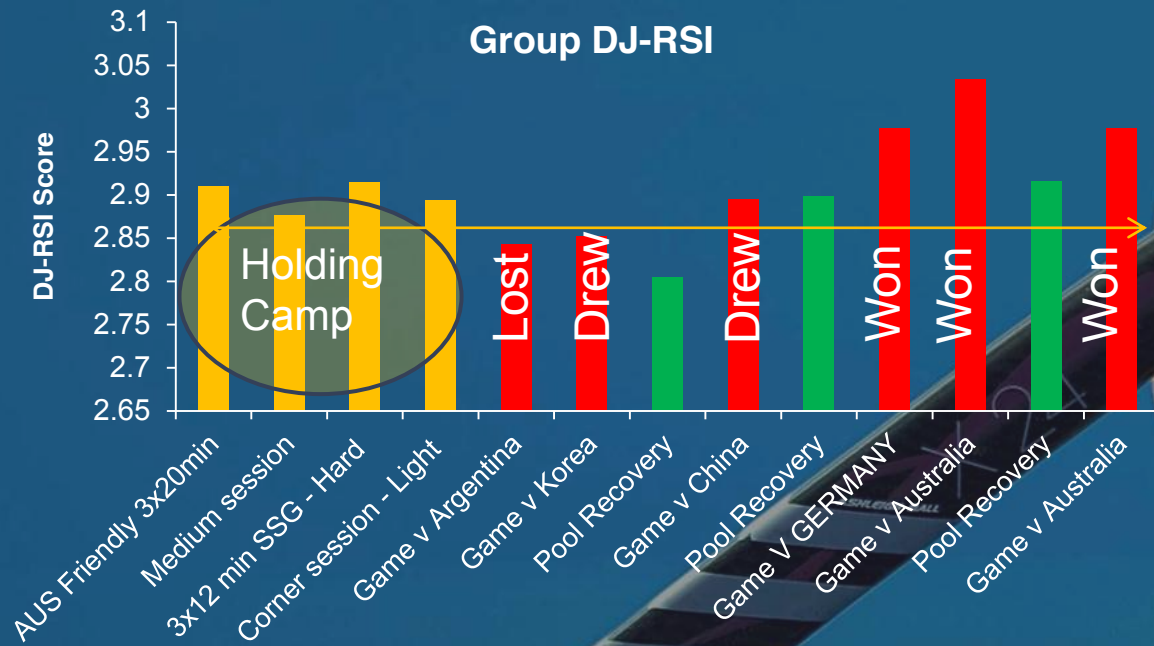
# Findings - DJ-RSI & Restwise



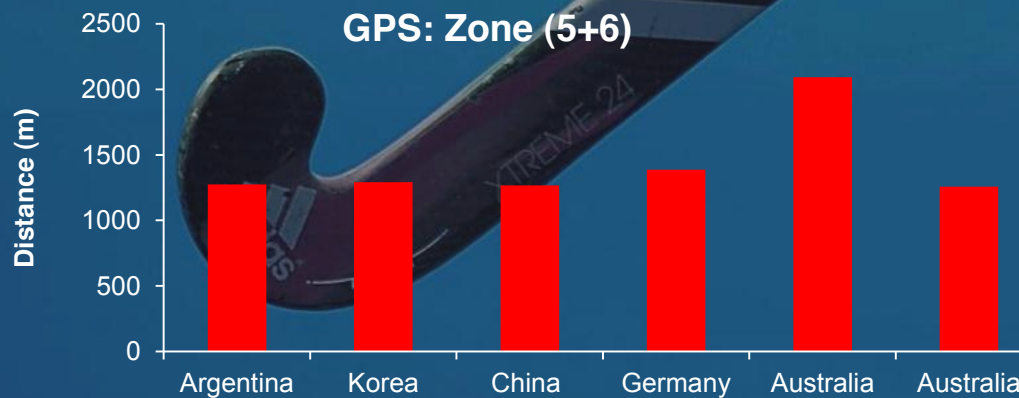
ENGLISH INSTITUTE OF SPORT

# DJ Competition: Case Study 1 - Holding Camp

## 1. Champion Trophy: June 2011 (Bad Example)



- DJ-RSI poor – Game 1: Why?
- Q? Taper Strategy



### Thoughts

- 6 hour travel + evening game
- 48 hours – training to hard

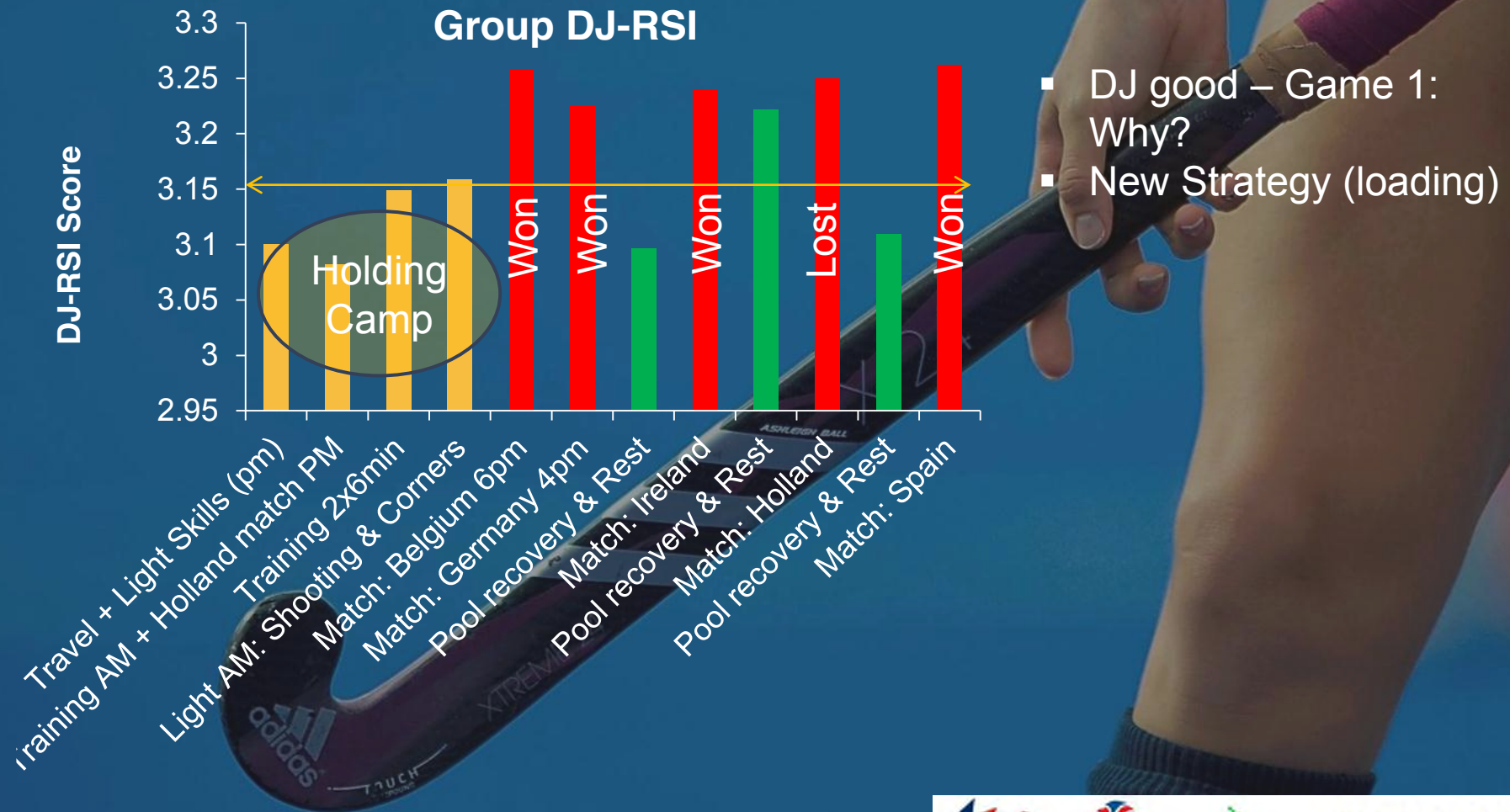


ENGLISH INSTITUTE OF SPORT



# Case Study 1 – Holding Camp

## 1. European Championship 2011 – August



# Ideal Holding Camp Strategy

Monday:	Tuesday:	Wednesday	Thursday	Friday	Saturday
Bisham	Arrived				
Hockey (M)	Flight (M)	Rest	Hockey 7v7 (2x6mins) (M)	Hockey: Shooting & Corners (L)	Rest
Gym Primer (L)	Hockey PM: Aerials & Corners	Game Vs Holland 3x20 (H)	Rest (L)	Rest	Game 1 Vs Belgium
Moderate	Moderate	Heavy	Moderate	Light	Heavy

Moderate Loading 2 Days

Practice  
Game

Unloading

Minimum 3 Days (72hrs)

Game 1



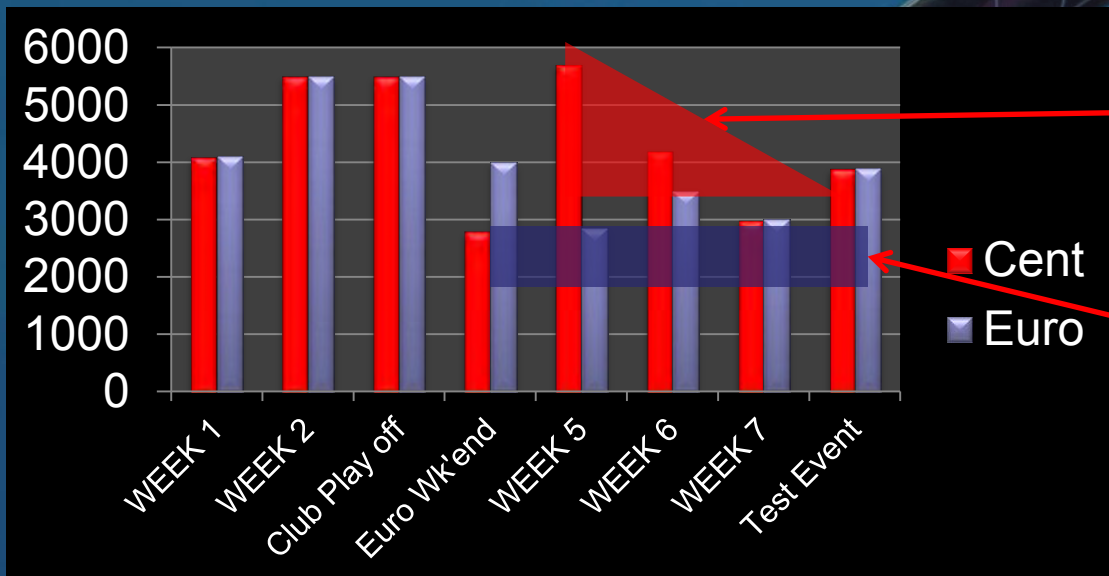
ENGLISH  
INSTITUTE OF  
SPORT

# Case Study 2: Player Management

## Champions Trophy 2011

- Two Player Groups (European Cup Finals & England Centralised)
- Two - Training regimes
- Two - Performance outcomes
- 'Management Vs Development'

Date	Week	Centralised	Euro-players
11/03/2012	1	Testing - MH	Testing
18/03/2012	2	Heavy - H	H
25/03/2012	3	Club Play off - VH	Club Play off - VH
01/04/2012	4	ML - Decentralised	Euro Play offs - H
08/04/2012	5	Overreach 1 - H	Recovery - L
15/04/2012	6	Taper 2 - MH	Rebuild - M
22/04/2012	7	Taper 1 - ML	Taper 1
29/04/2012	8	Test Event	Test Event



Player Development & Taper

Player Management

\*Based on actual RPE data collected 2010



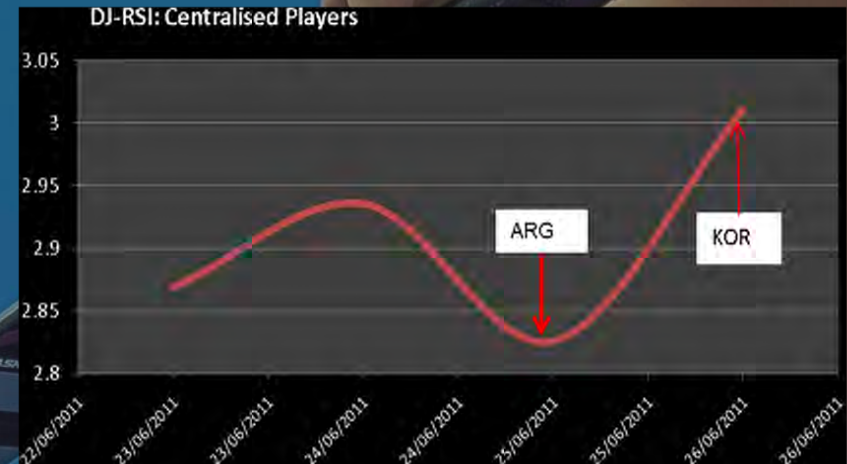
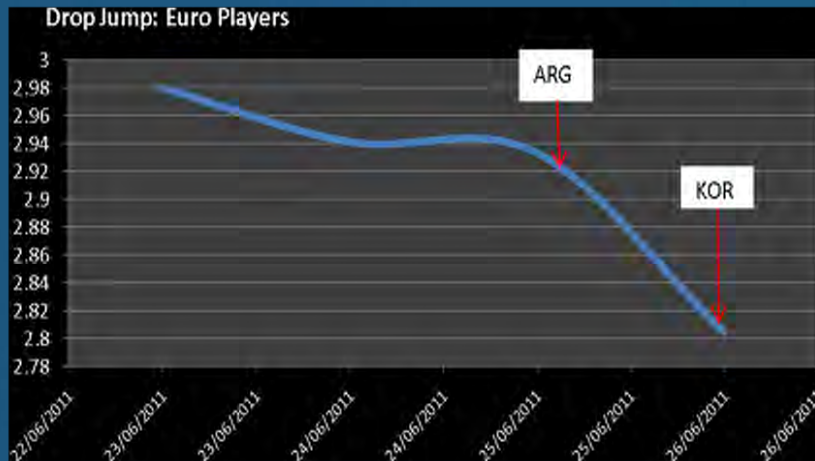
ENGLISH INSTITUTE OF SPORT



# Case Study 2: Player Management

## Performance Markers – CT2011

### 1. Drop Jump



- Suppressed NMS
- Lack of variance

- NMS Active
- High Variance

# Case Study 2: Player Management

## Performance Markers

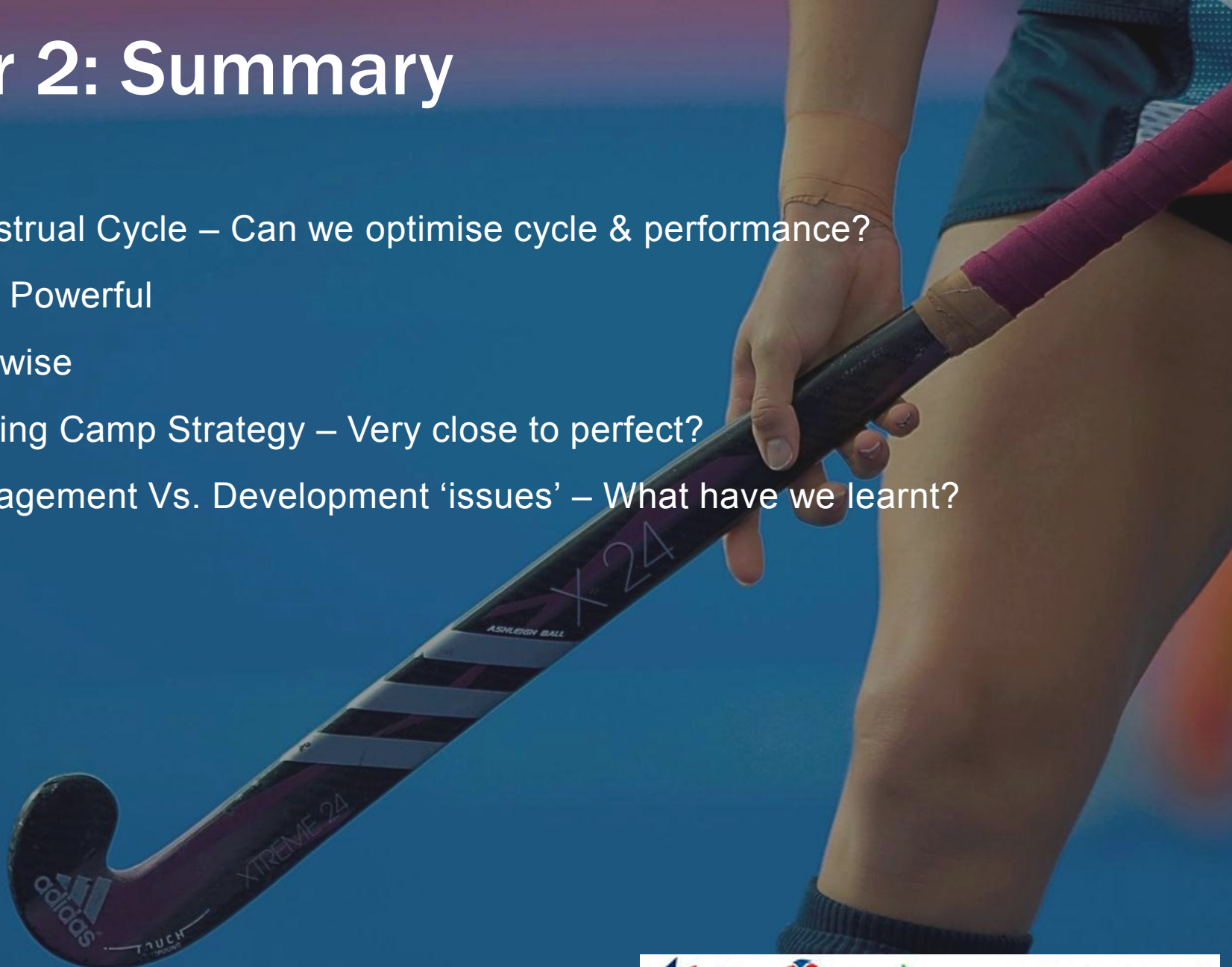
- GPS - Match Intensity (m.min<sup>-1</sup>)

### % Diff - Match Intensity: 1st - 2nd Half



# Year 2: Summary

1. Menstrual Cycle – Can we optimise cycle & performance?
2. DJ – Powerful
3. Restwise
4. Holding Camp Strategy – Very close to perfect?
5. Management Vs. Development ‘issues’ – What have we learnt?



ENGLISH  
INSTITUTE OF  
**SPORT**





# Year 3

*Actualisation Phase*

# Year 3: Actualisation Phase

- Happy with Monitoring Model?
  - Where else are the margins for change?
1. Post Match Recovery – How effective is it
  2. Hormone Priming –What, Where, When.
  3. Taper, DJ-RSI & Performance
  4. Olympic Outcome?



ENGLISH  
INSTITUTE OF  
**SPORT**

# Post Match Recovery

Recovery Package

Q. How can we make

Answer: Mind-body

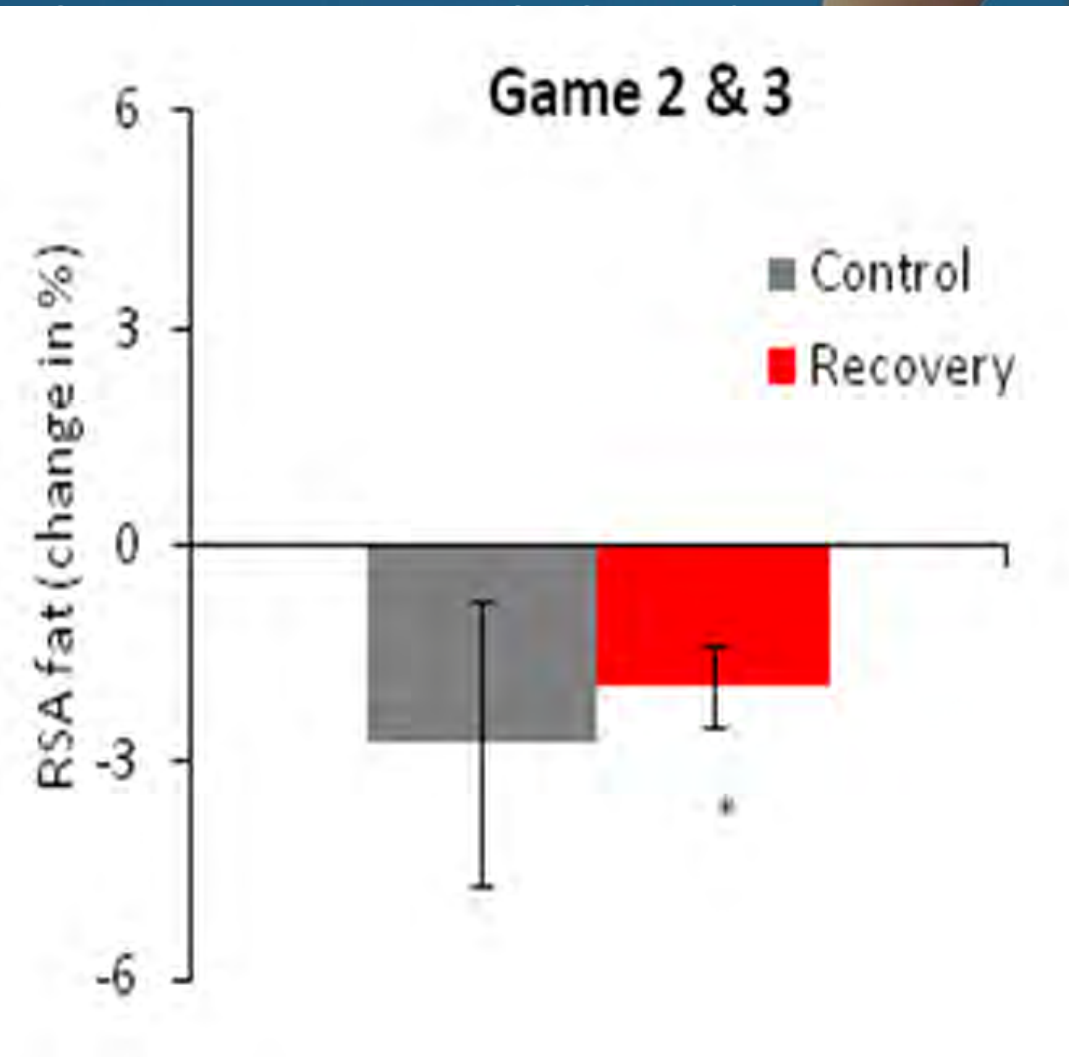
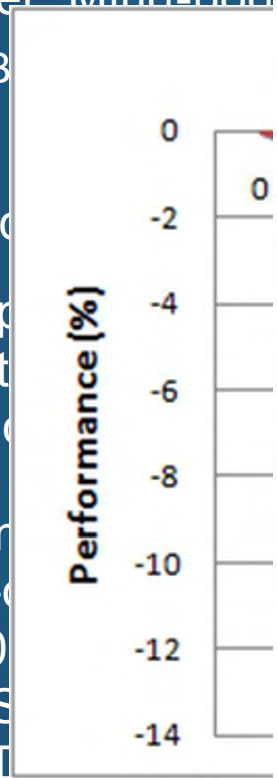
a. B

Immed

- Supp
- Bat
- sto

Testin

- X-c
- 30
- RS
- 4 D





## The effects of different pre-game motivational interventions on athlete free hormonal state and subsequent performance in professional rugby union matches.

[Cook CJ](#), [Crewther BT](#).

United Kingdom Sport Council, London, UK.

### Abstract

We examined the effect of different pre-match motivational interventions on athlete free testosterone (T) and cortisol (C) concentrations and subsequent match performance in professional rugby union. Male participants (n=12) playing at a senior or academy level in rugby union were recruited and each completed three interventions (15 min each) before a competitive game; 1) watching a video clip of successful skill execution by the player with positive coach feedback [VPCF1]; 2) watching a video clip of successful skill execution by an opposing player with cautionary coach feedback [VCCF], 3) the player left alone to self-motivate [SM1]. The first and last interventions were retested [VPCF2 and SM2]. Salivary free T and C measures were taken pre-intervention and pre-game. Within each game, players were rated by coaching staff on a key performance indicator (KPI) from identified skills and an overall performance indicator (OPI), where 1 = best performance to 5 = worst performance. The VPCF1 and VPCF2 interventions both promoted significant T responses (11.8% to 12.5%) before each game and more so than SM1, SM2 and VCCF. The VCCF approach produced the largest C response (17.6%) and this differed from all other treatments. The VPCF interventions were also associated with better game KPI (1.5 to 1.8) and OPI ratings (1.7 to 1.8) than SM1, SM2 and/or VCCF. Across all treatments, greater individual T responses and lower C responses were associated with better KPI and OPI outcomes. In conclusion, the pre-game presentation of motivational strategies to athletes involving specific video footage and coach feedback produced different outcomes on two indicators of match performance, which were also associated with changes in free hormonal state.

Copyright © 2012 Elsevier Inc. All rights reserved.

## Effects of different post-match recovery interventions on subsequent athlete hormonal state and game performance.

[Crewther BT](#), [Cook CJ](#).

Hamlyn Centre, Imperial College, London, UK. [bcrewther@imperial.ac.uk](mailto:bcrewther@imperial.ac.uk)

### Abstract

We tested the effects of different post-match recovery interventions on the subsequent hormonal responses to a physical stress-test and game performance in professional rugby union players. On four occasions, participants (n=12) completed a video session (1 h each) with accompanying coach feedback the day after a rugby union match. The interventions showed either video footage of player mistakes with negative coach feedback (NCF1) or player successes with positive feedback (PCF1). Both approaches were repeated (NCF2 and PCF2). In the following week, participants were assessed for their free testosterone (T) and cortisol (C) responses to a physical stress-test, pre-game T and game-ranked performance. The PCF1 and PCF2 approaches were both associated with significantly ( $p < 0.01$ ) greater free T (36% to 42%) responses to the stress-test when compared to NCF1 and NCF2 (16% to -3%), respectively. The PCF interventions were also associated with higher (28% to 51%) pre-game T concentrations and superior game-ranked performances than the NCF approaches ( $p < 0.01$ ). In conclusion, the post-game presentation of specific video footage combined with different coach feedbacks appeared to influence the free hormonal state of rugby players and game performance several days later. Therefore, within the sporting context, future behaviour and performance might be modified through the use of simple psychological strategies. These data are applicable to generalised human stress responses and their modifiability by prior exposure to a stressor.

Copyright © 2012 Elsevier Inc. All rights reserved.

# Post Match Recovery – DJ-RSI

Training: USA (5 in 6)

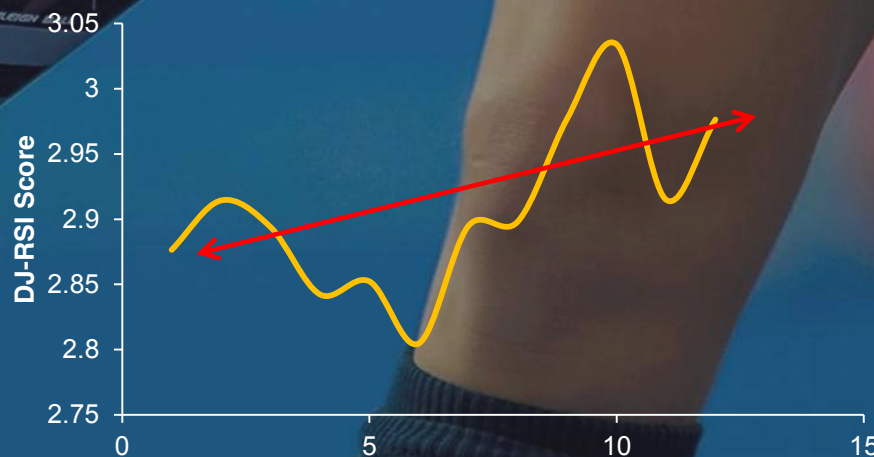
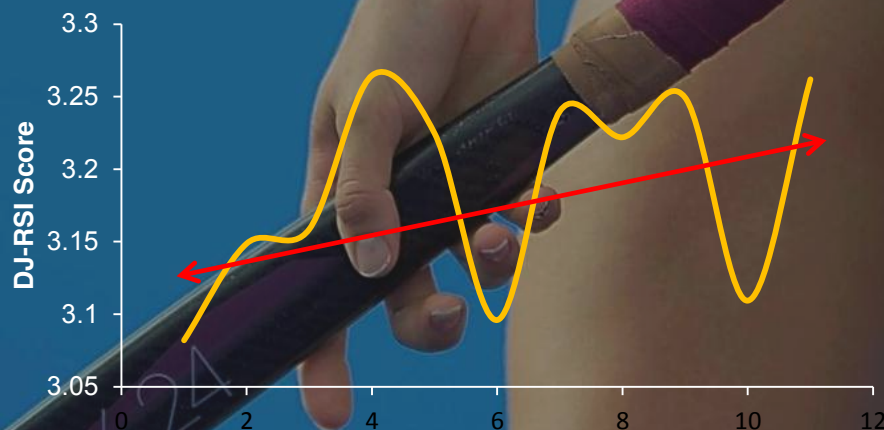
- No Recovery intervention

Date	Session	DJ-RSI
07/12/2011	Gym & Training	3.256
08/12/2011	Gym & Training	3.257
09/12/2011	Gym & Training	3.359
11/12/2011	Game v USA	3.188
12/12/2011	Pitch & Upper Body	3.320
13/12/2011	Speed Session (light)	3.201
15/12/2011	Game v USA	3.281
15/12/2011	Game v USA	3.281
17/12/2011	Game v USA	3.176
18/12/2011	Game v USA	3.220



Competitions (Euro 2011, CT 2011)

- Full Recovery package





# Priming

Rationale behind

EFFECTS OF LOW- VS. HIGH-INTENSITY TRAINING ON CYCLING PERFORMANCE  
*Physiol Behav.* 2012 Jul 16;106(5):683-8

The effects of different training intensities on subsequent performance

Cook CJ, Crewther BT.  
United Kingdom Sport Council, London, UK

**Abstract**  
We examined the effect of different training intensities on subsequent match performance in elite players recruited and each completed three trials: 1) the player with positive coach feedback [VCCF], 2) the player with neutral coach feedback [VPCF], 3) the player with negative coach feedback [VCCF]. Blood C measures were taken pre-intervention and post-intervention from identified skills and an overall performance score. Both interventions both promoted significant improvements in C measures. The VCCF approach produced the largest C improvements (1.5 to 1.8) and C improvements were associated with lower C responses were associated with specific video footage and changes in free hormonal state.

Copyright © 2012 Elsevier Inc. All rights reserved.

Research conducted at the Waikato Institute of Sport and Recreation, New Zealand.  
Address correspondence to Dr. Carl D. Paton, C/O  
2388/1758-1761  
Journal of Strength and Conditioning Research  
© 2009 National Strength and Conditioning Association  
1758 Journal of Strength and Conditioning Research

## REVIEW ARTICLE

Sports Med 2011; 41 (2): 103-123  
0112-1642/11/0002-0103/\$49.95/0

© 2011 Adis Data Information BV. All rights reserved.

# Two Emerging Concepts for Elite Athletes

## The Short-Term Effects of Testosterone and Cortisol on the Neuromuscular System and the Dose-Response Training Role of these Endogenous Hormones

Blair T. Crewther,<sup>1,2,3</sup> Christian Cook,<sup>3,4,5</sup> Marco Cardinale,<sup>6,7</sup> Robert P. Weatherby<sup>2</sup> and Tim Lowe<sup>8</sup>

- 1 The New Zealand Institute for Plant & Food Research Limited, Hamilton, New Zealand
- 2 Department of Exercise Science and Sport Management, Southern Cross University, Lismore, New South Wales, Australia
- 3 Hamlyn Centre, Institute of Global Health Innovation, Imperial College, London, UK
- 4 United Kingdom Sport Council, London, UK
- 5 Sport, Health and Exercise Science, Bath University, Bath, UK
- 6 British Olympic Medical Institute, London, UK
- 7 University College London, Division of Surgical and Interventional Science, London, UK
- 8 School of Applied Sciences, Bay of Plenty Polytechnic, Tauranga, New Zealand

### Contents

Abstract	104
1. Introduction	104
2. Literature Search Methods	105
3. Hormonal Effects on the Neuromuscular System	105
3.1 Long-Term Effects of Exogenous Hormones	106
3.1.1 Muscle Development	106
3.1.2 Neural Development	106
3.2 Short-Term Effects of Exogenous Hormones	106
3.2.1 Steroid Receptors	106
3.2.2 Second Messengers and Lipid/Protein Pathways	107
3.2.3 Behaviour and Cognition	107
3.2.4 Motor System	107
3.2.5 Muscle Properties	107
3.2.6 Energy Metabolism	108
3.3 Summary	108
4. Hormonal Contribution to Resistance Training	109
4.1 Acute Modifications in Endogenous Hormones	109
4.1.1 Workout Design	109
4.1.2 Nutrition	110
4.1.3 Training Status and Type	110
4.1.4 Genetic Variation	111
4.2 Chronic Modifications in Endogenous Hormones	111
4.2.1 Training Status	111
4.2.2 Training Type	112
4.3 Acute and Chronic Modifications in Steroid Receptors	113
4.3.1 Androgen Receptors	113

hormonal state and

sol (C) concentrations and  
amy level in rugby union were  
lip of successful skill execution by  
losing player with cautionary coach  
PCF2 and SM2]. Salivary free T and  
on a key performance indicator (KPI)  
ance. The VPCF1 and VPCF2  
SM2 and VCCF. The VCCF  
itions were also associated with  
eater individual T responses and  
of motivational strategies to athletes  
rmance, which were also associated



# Priming

What is it?

Training stimulus used to promote a positive change in Testosterone

How?

1. Individual (hormone profile) – identify key Exercise/intensity  
=  $\uparrow$  NM function & testosterone

2. Mind-Body Link

3. Reinforce with feedback

When?

- Rest days – decline in NM Function
- Late Games – Potentiation/activation of NM System

Performance Marker – DJ-RSI



ENGLISH  
INSTITUTE OF  
SPORT

# Priming Format



## Great Britain Women's Hockey Primer Session

Name

10 minute Warm Up

This should involve activities which best suit your session content and is player led. You may chose classic dynamic exercises, mobility work, foam roller or activation activities

Examples

Foam Roller Work (gluts, ITB) – Hip mobility Circuit – Body Weight Squats

Profile Type: **Elite Power (Force)**

	Option 1	Option 2	Option 3	Option 4	Option 5
Exercise	(2 x WU sets) 2x2 @ 85% Back Squat or Leg Press	Squat Jumps 3x3 @ 20% 1RM	(2 WU sets) Power Cleans @ 75% 2x2	Max Load Cycle (high load) 4x7s - 1min rest easy	Cycle: 5x7s sprint 30s between (moderate resistance)
Rest (s)	120	120	120	1 set	1 set

Supplementary:

This is secondary to the primer activities and is optional. You may choose to do some upper body exercises, activation work or core. I will be available should you need guidance with your exercise selection here.

Examples

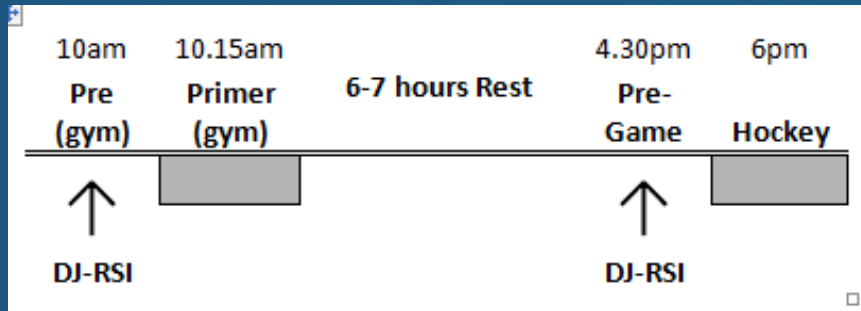
DB Curl & Press – Supine Pulls 3x12 – Bench Press – Glut Shuffles – BOSU Stability

*Your primer session should last no longer than 30 minutes and this should include warm up and any extra supplementary work you should choose to do.*

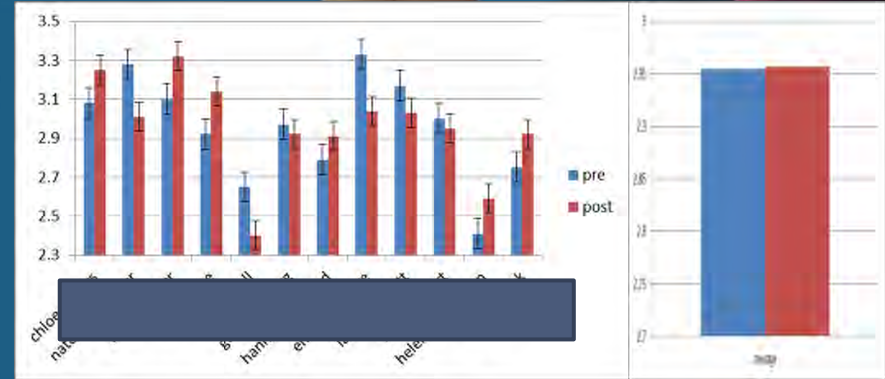
# Priming Study

Investec Cup 2012

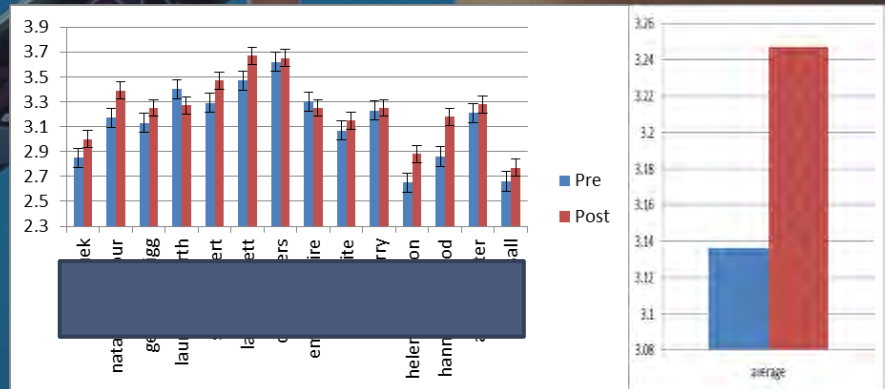
- 3 opportunities (2 primer, 1 control) – Evening Games



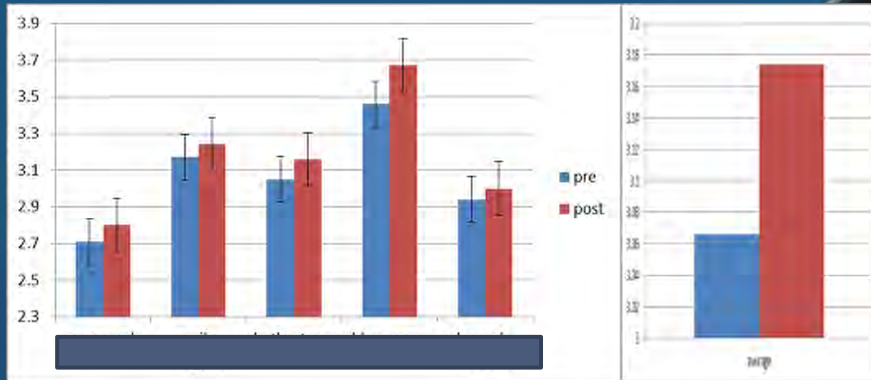
Normal: Game 2 v GER (15 Players)



Primed: Game 3 v IRE



Primed: Game 1 v SA (5 players)

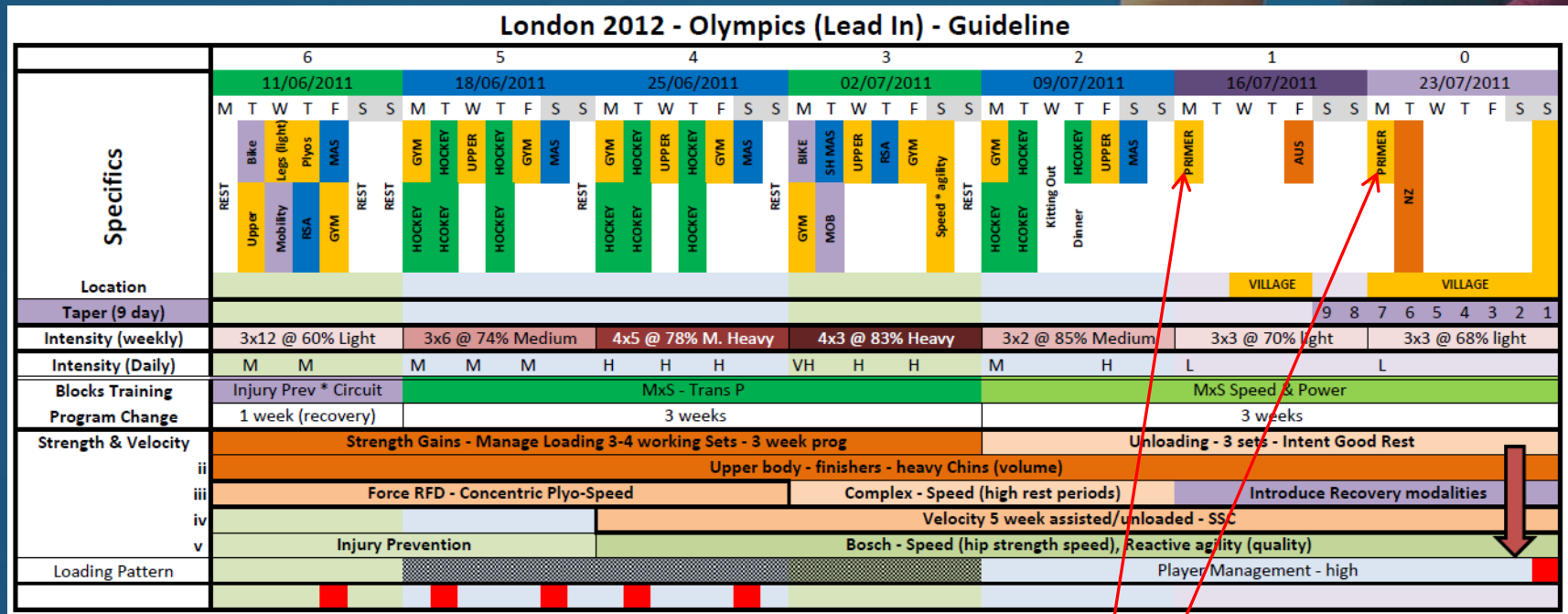


Conclusion:

- There is something there



# Olympic: Lead-In, Taper, DJ & Performance



- Traditional Periodisation (Block)
- Taper (14 day)
- DJ-RSI Score: Mean = Ok +/- SD = Good or Bad

# DJ-RSI

- DJ-RSI: Taper (Primer 1&2)
  - Continue
  - Remove Plyometric/Reduce Volume

Decision: DJ-RSI Score  
 Mean = Ok  
 +/- SD = Good or Bad

Name	DJ-RSI
A [redacted] ll	2.76
L [redacted] ett	3.05
G [redacted] gg	3.20
A [redacted] n	3.80
C [redacted] rs	3.48
H [redacted] eod	2.94
E [redacted] re	3.36
A [redacted] er	3.50
H [redacted] lson	2.82
N [redacted] our	3.46
[redacted] y	3.37
L [redacted] rth	3.30
[redacted] n	3.06
S [redacted] n	2.54
[redacted]	3.10
[redacted]	3.19

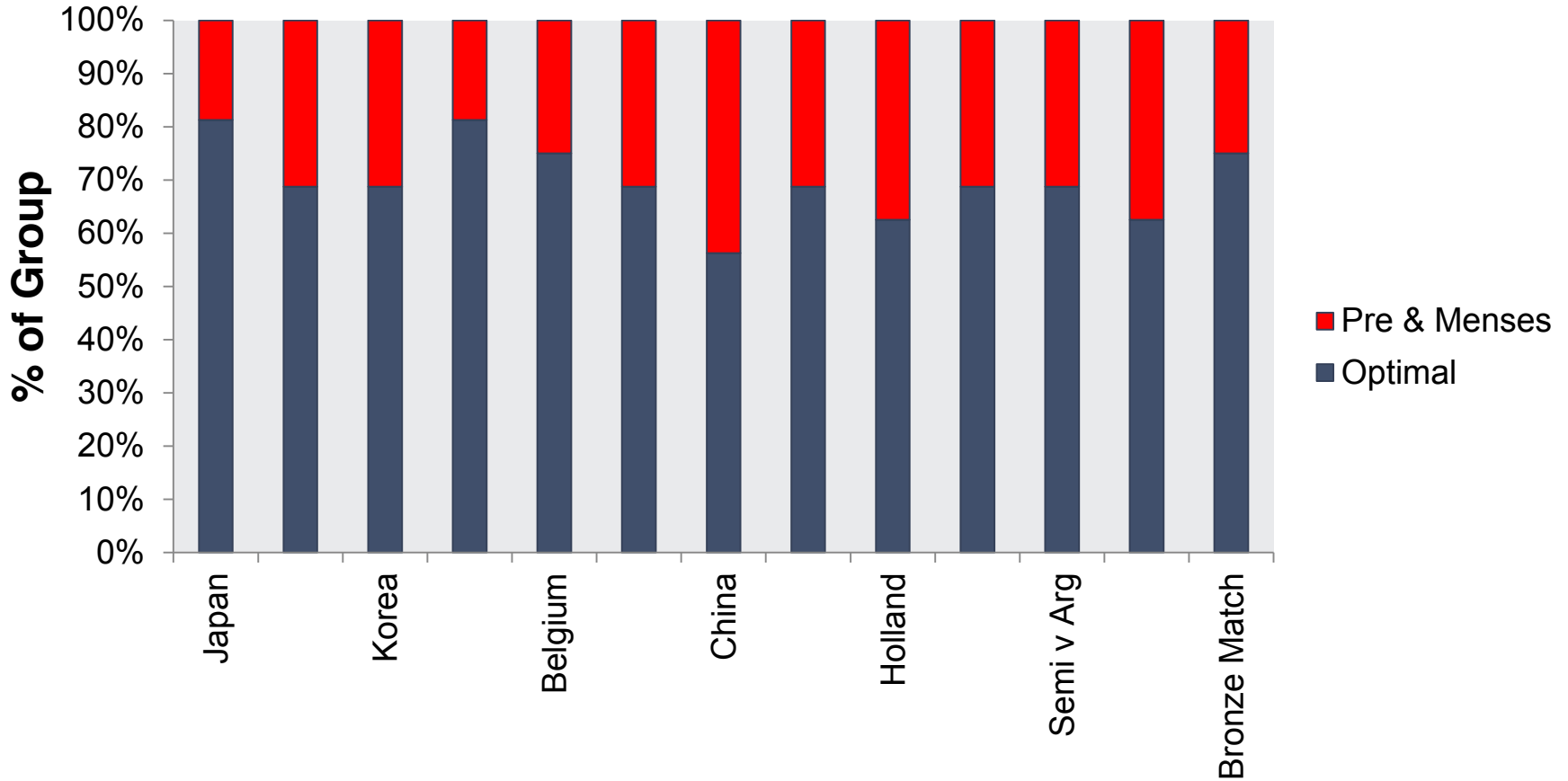
If you do not achieve your drop jump score, please leave the 15m accelerations and replace with 20m build ups 90%

Name	Average	Date	STD	Status	
A [redacted] ll	2.783811	23/07/2012	2.65	0.15719	ok
L [redacted] ett	3.086794	3.23	0.22753	ok	
G [redacted] vigg	3.195481	3.13	0.183519	ok	
A [redacted] on	3.816422	4.06	0.182577	good	
C [redacted] ers	3.477521	3.46	0.237073	ok	
E [redacted] uire	3.34689	3.17	0.16252	bad	
A [redacted] ter	3.491836	3.68	0.154414	good	
H [redacted] dson	2.821716	3.06	0.187415	good	
N [redacted] our	3.4526	3.32	0.123743	bad	
[redacted] ry	3.39677	3.5	0.166464	ok	
L [redacted] orth	3.316409	3.59	0.234276	good	
[redacted] e	3.092069	3.21	0.149025	ok	
[redacted]	3.221002	3.32307692	0.094911	good	

# Olympic Games:

Competition	Mean DJ-RSI *Games
Champions Trophy 2011	2.02*

## Menstrual Status OG Team



ENGLISH  
INSTITUTE OF  
SPORT



# Summary: Learning's



1. Get to know the individuals within Team
2. Choose simple monitoring tools
3. Be Patient





# Acknowledgements

- Team GB Hockey S&C: Matt Bramhall, Shaun Joffe
- UKSPORT R&I: Dr. Christian Cook, Dr. Scott Drawer, Pete Atkinson

