The physical development of Australian footballers

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Talent Identification, Development and Skill Acquisition in Junior Australian Football

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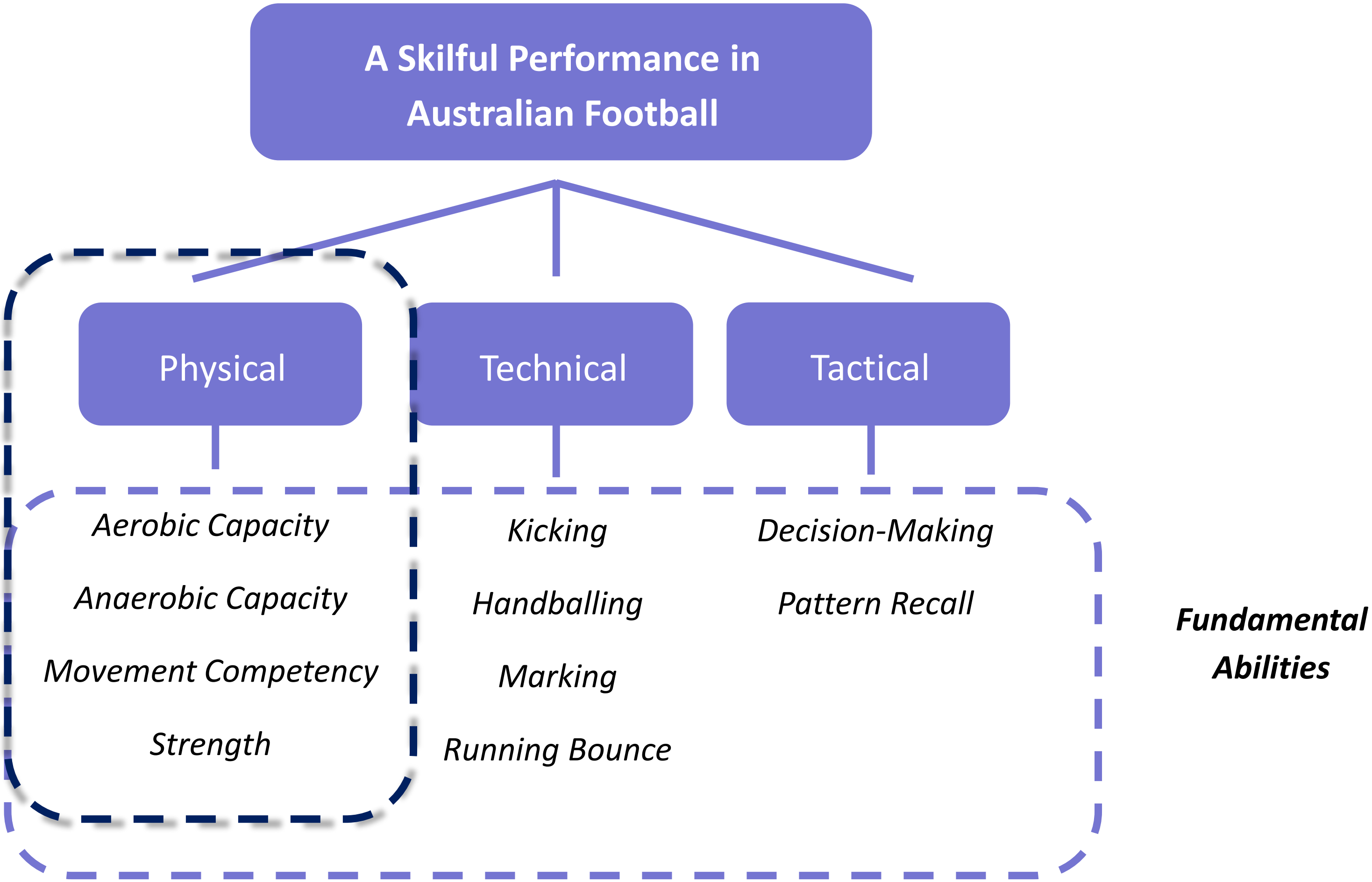
Presentation Overview

- The physical abilities needed in Australian football
- Preparing players for the rigours of a season
  - Aerobic ability
  - Anaerobic ability
  - Movement competency – Junior Athlete Specific
- Monitoring player workloads and fatigue
  - The use of global positioning – external
  - The use of muscle soreness questionnaires – internal

Australian Football – The constituents of a skilful performance



A Skilful Performance in Australian Football

Physical

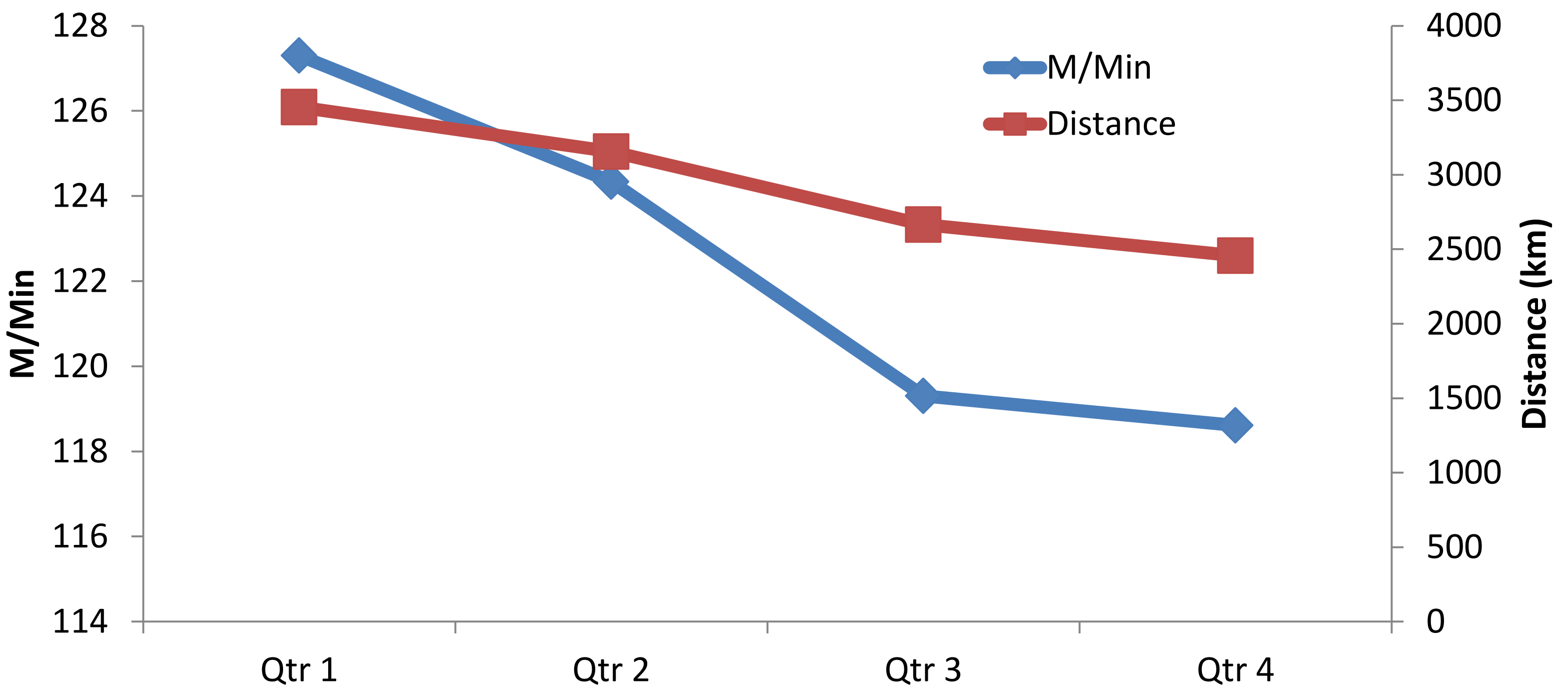
Aerobic Capacity

Anaerobic Capacity

Movement Competency

Strength

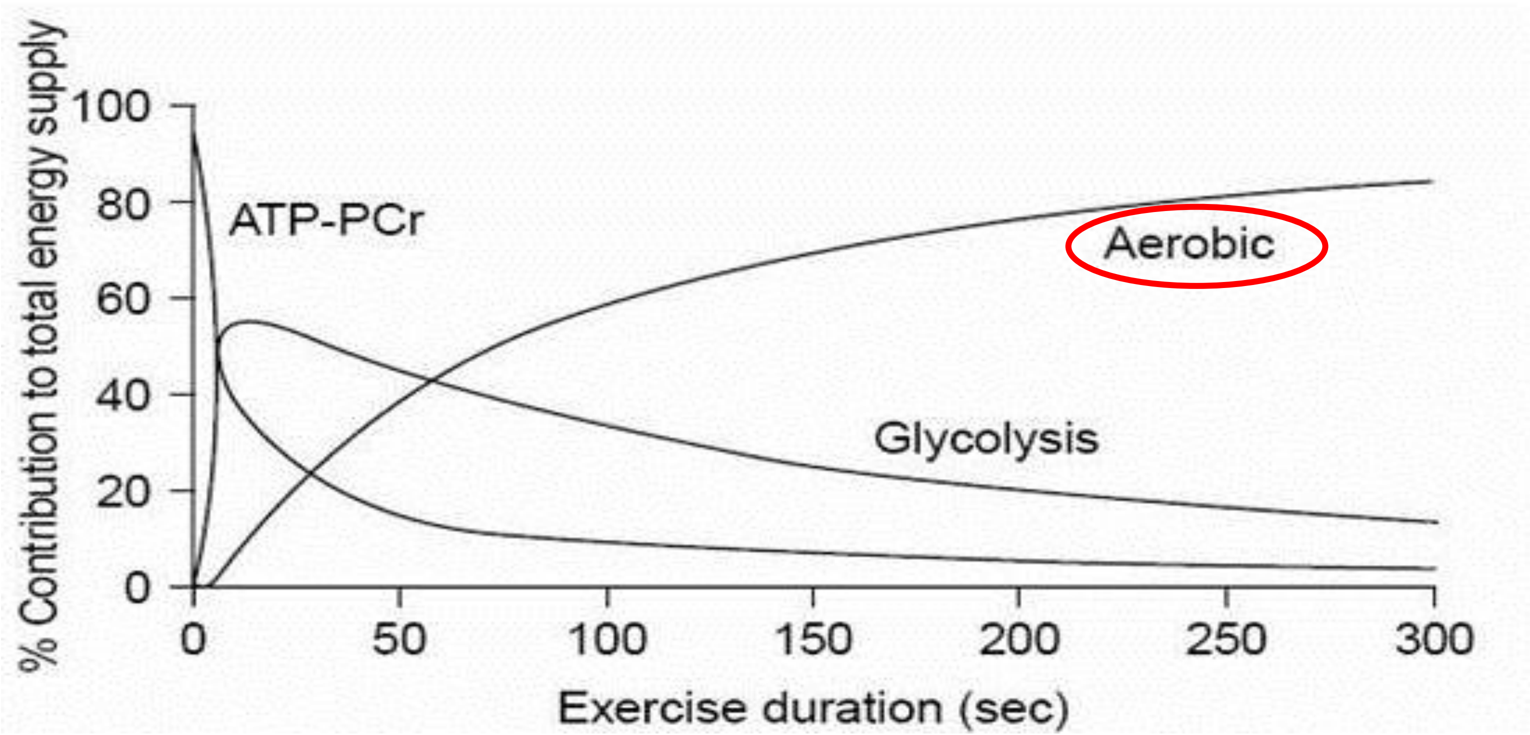
Aerobic Capacity – An important ability in Australian football



Total Distance (km)	12.45 ± 1.65
M/Min	120.98 ± 20.44
WR Ratio	1:2

Wisbey, Rattray & Pyne (2008)

Aerobic Ability – How do we train it?



What do we know?

- Aerobic training improves an athletes ability to efficiently deliver O2 to the working muscles
- **Frequency** – Minimum of twice / week
- **Intensity** – 90-95% Vo2Max (RPE of 9-9.5 using Borgs CR10 scale) or intermittently supramaximally
- **Duration** – > 4 minutes

Aerobic Ability – How do we train it? Generic Methods

Study	Aerobic protocol	Results
Helgerud et al. (2001)	▪ 4 x 4 min at 90 - 95% HR max with 3 min active recovery ▪ Twice/week x8 weeks	▪ Vo2 Max improved ~ 10% ▪ Lactate threshold improved ~ 14% ▪ Distance covered in match improved ~20%
Hoff & Helgerud (2004)	▪ Compared 60-80% intensity to 90-95% HR max twice per week over 8-12 weeks	▪ 90-95% saw improvements in Vo2 Max of 10-30% whilst 60-80% only saw 5-10% improvements

Aerobic Ability – How do we train it? Small-Sided Games

Study	Aerobic protocol	Results
Hoff et al. (2002)	▪ 5 x 5 SSG ▪ 2 x 4 minute intervals	▪ SSG elicited an average HR of 91.3% HR max ▪ Deemed as acceptable to train aerobic ability
Katis & Kellis (2009)	▪ Compared a 3 x 3 (15 x 25 m) SSG with a 6 x 6 (30 x 40 m) SSG	▪ Found a higher HR intensity with the 3 x 3 and thus greater aerobic training stimulus
Hill-Haas et al. (2011)	▪ Compared generic aerobic with SSG	▪ Found statistically similar responses when comparing techniques

Synthesis of Literature

- Choice of aerobic can come down to coach perceptions and philosophies
- However, SSG's do develop the **technical** and **tactical** requirements of the game under fatigue
  - Multidimensional benefits?

Farrow, Pyne & Gabbett (2008)

A Skilful Performance in Australian Football

Physical

Aerobic Capacity

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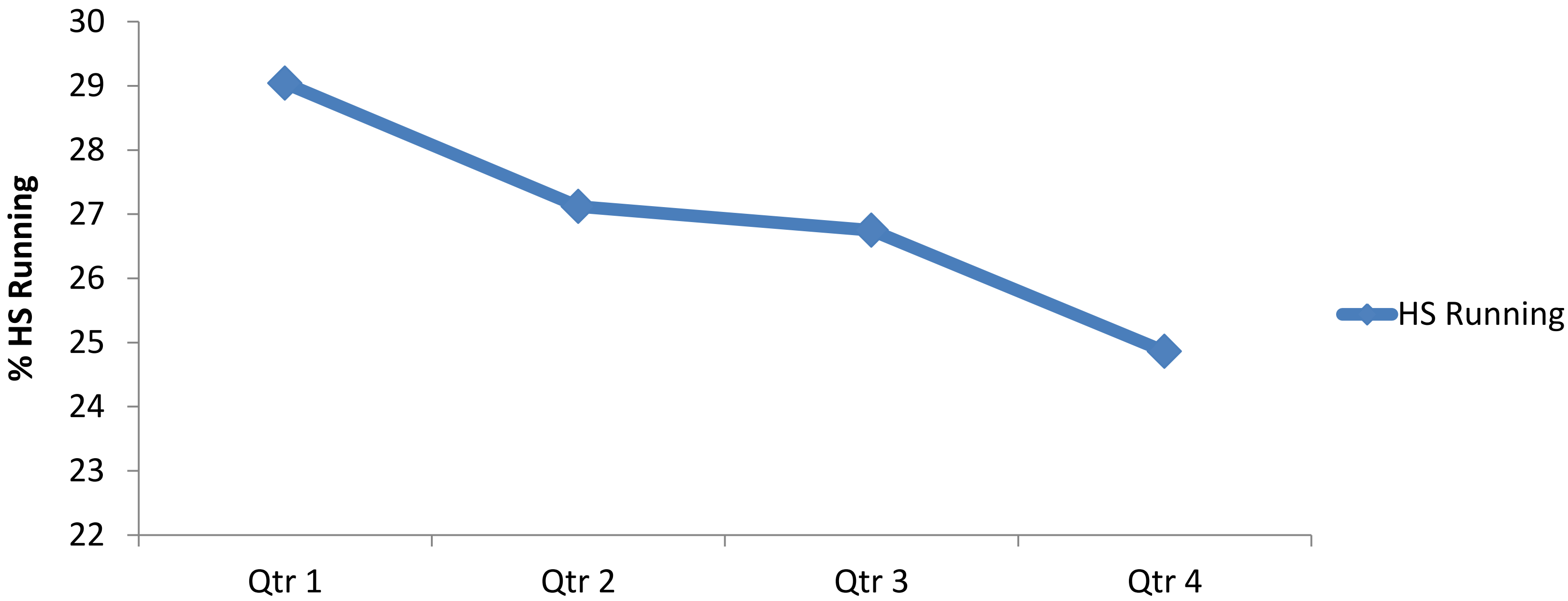
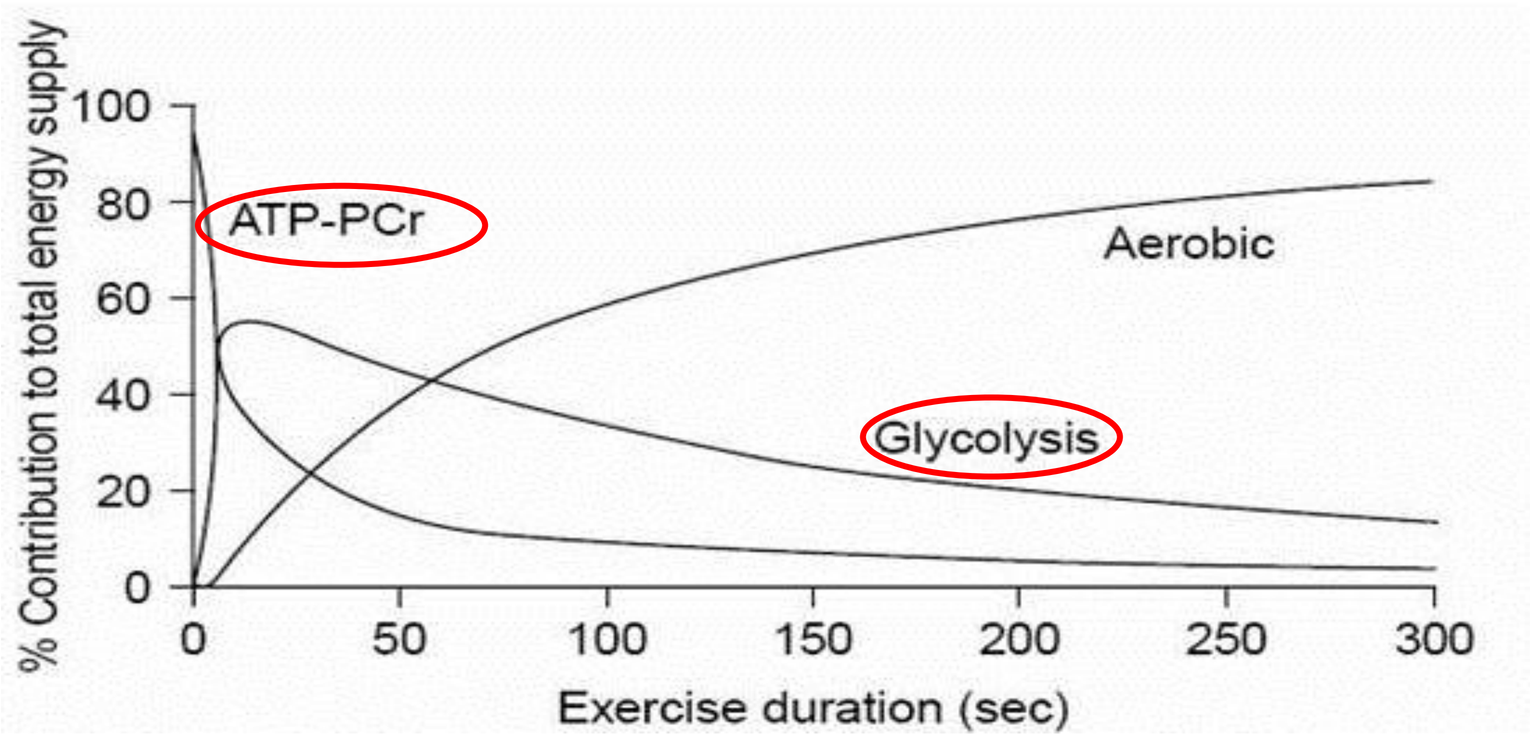
Anaerobic Capacity – An important ability in Australian football



Measurement	
Time 14-16 km/hr. (min)	4:32 ± 1:05
Time 16-18 km/hr. (min)	2:50 ± 0:43
Time >18 km/hr. (min)	5:24 ± 1:31
Time >25 km/hr. (s)	35:53 ± 17:12

Wisbey, Rattray & Pyne (2008)

Anaerobic Ability – How do we train it?



What do we know?

- Anaerobic training improves an athletes ability to utlise anaerobic glycolysis
  - Greater efficiency results in a greater ability to perform exercise at a high intensity
- **Frequency** – Minimum of twice / week
- **Intensity** – Need to work maximally (100%) or supramaximally (120%)
- **Duration** – 10-120 seconds

Anaerobic Ability – How do we train it?

Study	Anaerobic protocol	Results
Bucheitt et al., (2010)	▪ 2-3 sets of 5-6 20m RS with 14 s passive recovery x 1/week over 10 weeks	▪ Minor improvements in RS ability
Dupont et al., (2004)	▪ 12-15 40 m max sprints with 30 s rest ▪ Twice/week for 10 weeks	▪ 40 m sprint time significantly decrease following the intervention in comparison to a control

A Skilful Performance in Australian Football

Physical

Aerobic Capacity

Anaerobic Capacity

Movement Competency

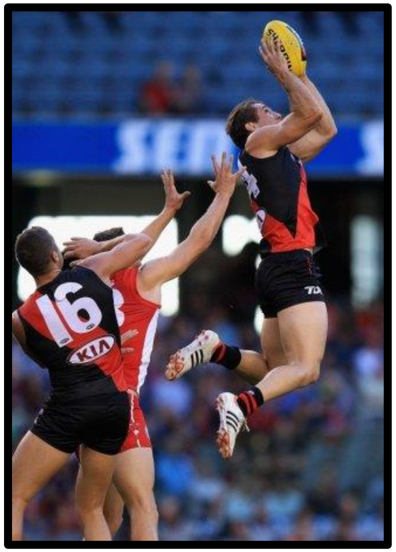
Strength

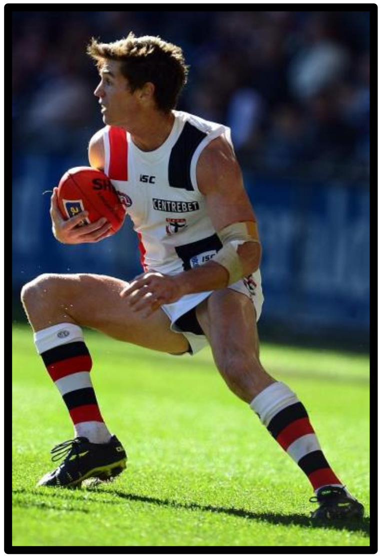
Movement Competency in Australian football – What is it?

Movement Competency

The ability to perform foundational movements that typically underpin the highly sports-specific movements needed to successfully compete within sport.

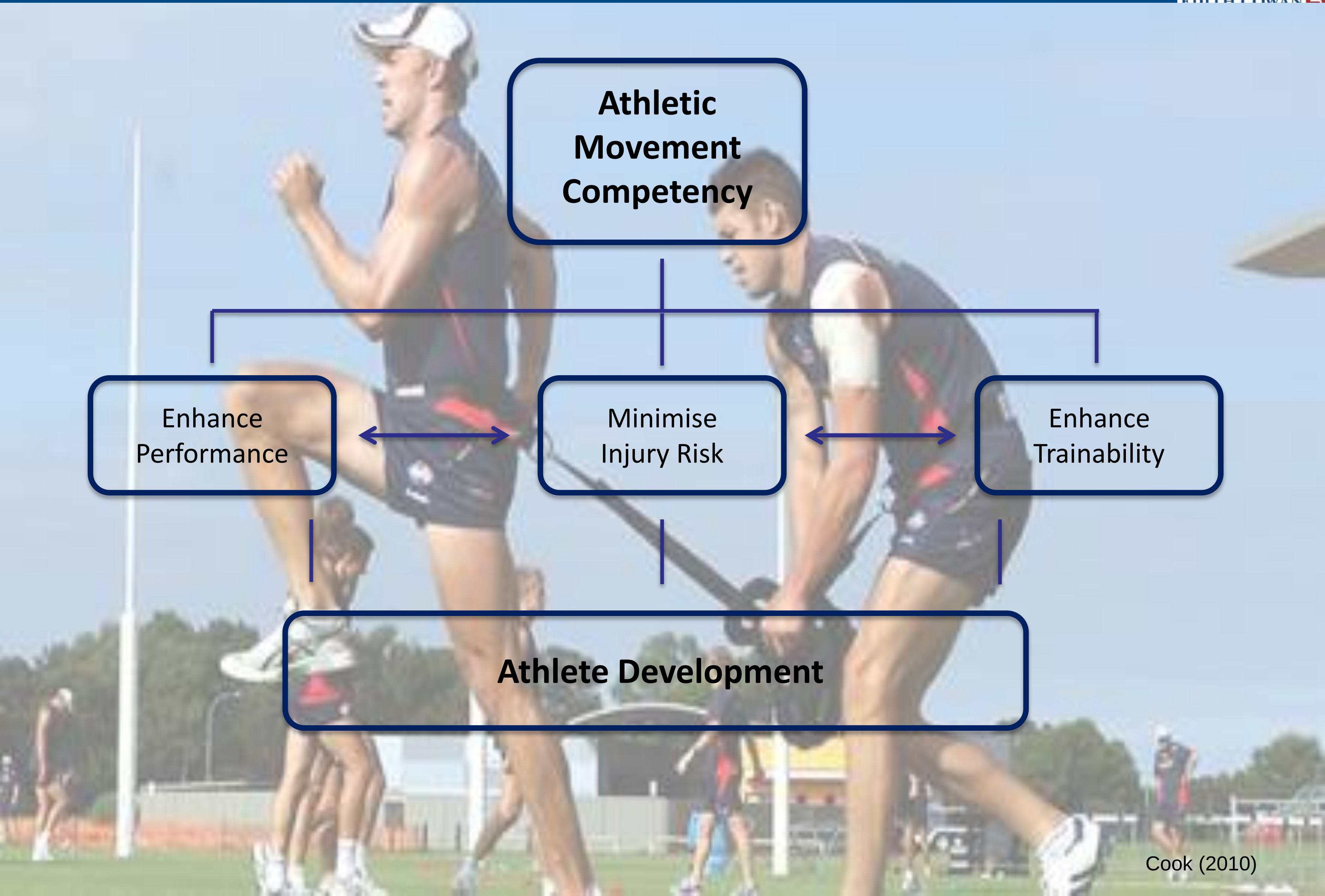
- Given the range of highly explosive physical movements required in an Australian football game, a solidified athletic movement competency is crucial





Movement Competency in Australian football – What is it?

Movement Competency in Australian Football – Why is it important?



Athletic Movement Competency

Enhance Performance

Minimise Injury Risk

Enhance Trainability

Athlete Development

Cook (2010)

Movement Competency – How to measure and train it?

- Assess a pre-planned set of un-weighted athletic fundamental movements.
- No "gold standard battery" – hinge upon the sport, but:
- **Functional Movement Screen (FMS)**
- **Netball Movement Screening Tool (NMST) - Netball**
- **Conditioning Specific Movement Tasks (CSMT) - Rugby**
- **Athletic Ability Assessment (AAA)**
- **Modified sports-specific AAA – Australian football**

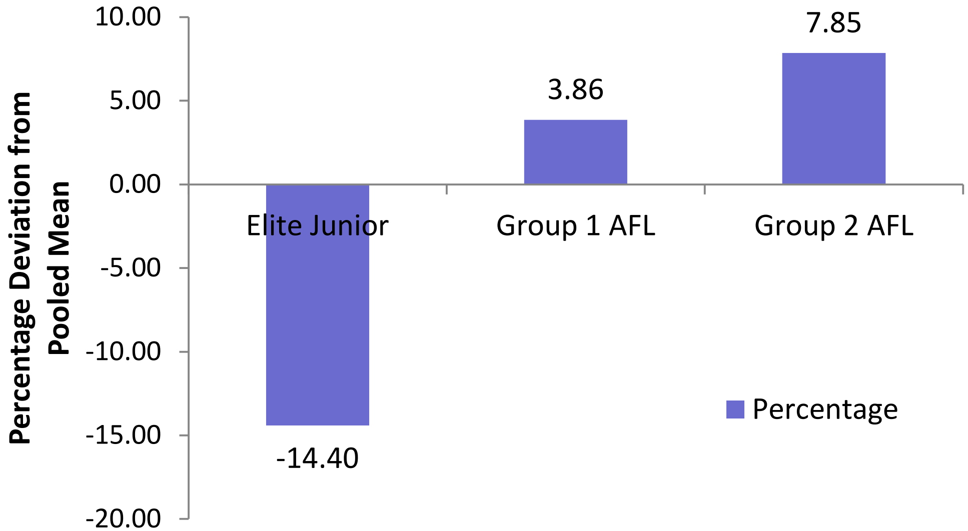
Modified AAA To Monitor Athlete Progression in junior Australian football

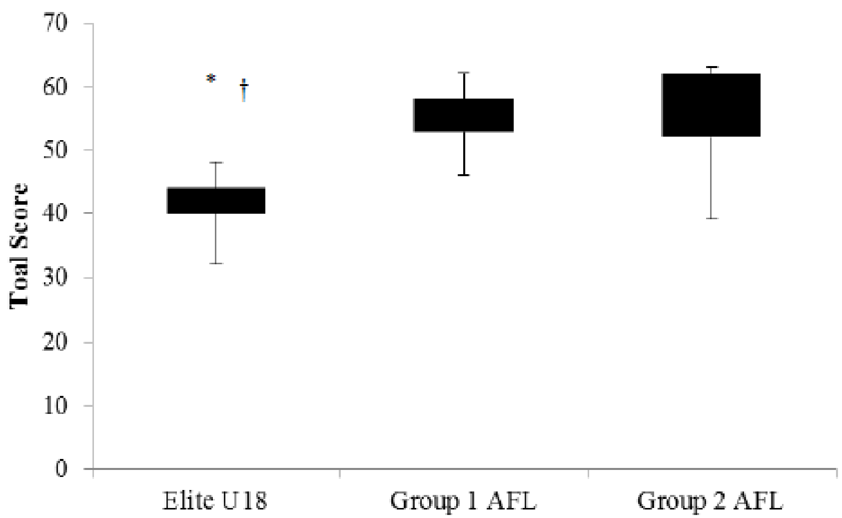
- Athletic movement competency screen inclusive of:

Exercise	Coaching Element	3	2	1
OH SQT	Upper Quadrant	*Perfect hands above head/feet*	*Hands above head/feet*	*Unable to achieve position*
	Triple Flexion	*Perfect SQT to parallel*	*SQT to parallel (compensatory)*	*Unable to achieve position*
	Hip Control	*Neutral spine throughout*	*Loss of control at end of range*	*Excessive deviation*
DL	Hip, Knee, Ankle	*Alignment during movement*	*Slight deviation*	*Poor alignment*
	Hip Control	*Neutral hip position*	*Slight deviation*	*Excessive flex/ext.*
	Take off Control	*Control*	*Jerking*	*Excessive deviation*
Push Up	TB control	*Perfect control/alignment*	*Perfect control/alignment for some*	*Poor body control for all reps*
	Upper Quadrant	*Perfect form/symmetry*	*Inconsistent*	*Poor scap positioning for every rep*
	x30 reps	*Hits target count*		*< x 30*
Chin Up	Scap rhythm	*Perfect form/symmetry*	*Inconsistent - some perfect*	*Unable to achieve position*
	TB control	*Perfect control/alignment*	*Perfect control/alignment for some*	*Poor body control for all reps*
	x10 reps	*Hits target count*		*< x 10*
SL RDL	Hip Control - Frontal	*Maintain neutral spine*	*Slight flex/ext through hips*	*Excessive flex/ext. on SL stance*
	Hip Control - Sagittal	*No rotation*	*Slight rotation at end of range*	*Excessive rotation*
	Hinge range	*Achieves parallel*	*Can dissociate but not reach parallel*	*Cannot dissociate hips from trunk*

Woods et al. (2014) – under review

The Importance for Establishing Athletic Movement Competency in Junior Australian Football





ASSESSMENT OF CONDITIONING-SPECIFIC MOVEMENT TASKS AND PHYSICAL FITNESS MEASURES IN TALENT IDENTIFIED UNDER 16-YEAR-OLD RUGBY UNION PLAYERS

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ABSTRACT

Parsonage, JR, Williams, RS, Rainer, P, McKeown, I, and Williams, MD. Assessment of conditioning-specific movement tasks and physical fitness measures in talent identified under 16-year-old rugby union players. *J Strength Cond Res* 28(6): 1497–1506, 2014—Preparedness to train was assessed using a battery of conditioning-specific movement tasks (CSMTs) on a group of talent identified rugby union players ($n = 156$; age = 15 ± 7 years; stature = 176 ± 7 cm; and mass = 74 ± 14 kg). In addition to explore the link between movement competency and performance, a series of standard fitness tests was conducted. Overall the group's CSMTs competency ratings were low, but task dependent. The proportion of competent players ranged from 14% for a single leg squat to 70% for a double to single leg landing. Players were subsequently grouped based on their CSMTs ratings using cluster analysis. This analysis classified players on features of the CSMT battery that distinguished between groups rather than an arbitrary score. Fitness test scores were then compared between the 3 groups identified. The "general low competency" group jumped 9.1 cm lower ($p = 0.0218$), sprinted slower across 10, 20 and 40 m (range, $p = 0.0126–0.0018$) and covered 389 m less ($p = 0.0105$) Yo-Yo intermittent recovery level 1 distance compared with the "squat competent group." In summary, at this important time before academy selection, most players could not competently perform the CSMTs that underpin rugby conditioning and may not be prepared for the transition into the "training to compete" stage of the suggested long-term athlete development model. For this sample of players, the athlete development process may therefore be unnecessarily inhibited. Moreover, our observations that competency in some CSMTs may explain better running and jumping performances in some players suggest that a focus on monitoring and addressing movement competencies during the training to train stage of player development should be considered.

KEY WORDS fitness testing, movement competency, long-term athlete development, movement skill, preparedness to train, cluster analysis

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Journal of Strength and Conditioning Research

INTRODUCTION

Since the professionalization of Rugby Union in 1995, one of the most prominent changes to the sport has been the increased physicality with players becoming bigger, faster, and stronger (17). In response to the reported increased physical demands, most national rugby union governing bodies have invested in development programs. Subsequently, developmental pathways have been mapped and documented with a focus to prepare youth players for the demands of professional Rugby Union and facilitate long-term player development through an academy-based system. Each academy is tasked with the identification and long-term nurturing of talented youth athletes. The program delivery takes an holistic theme that encompasses the combination of: technical, physical, tactical, social, and personal development with most players entering an academy at 16 years of age and which lasts up to 4 years before a decision is made to sign them as a professional player. At this important stage of a potential rugby player's career, those selected players are introduced to a new and challenging environment that involves a training schedule integrated with education and social activities. Preparation is important to make the most of this opportunity.

One potential benefit of an academy system is that the governing body can control the environment, their recruits are exposed to, ensuring the program is player-centered and it is developmentally appropriate. As a general guide, based on the long-term athlete development (LTAD) framework,

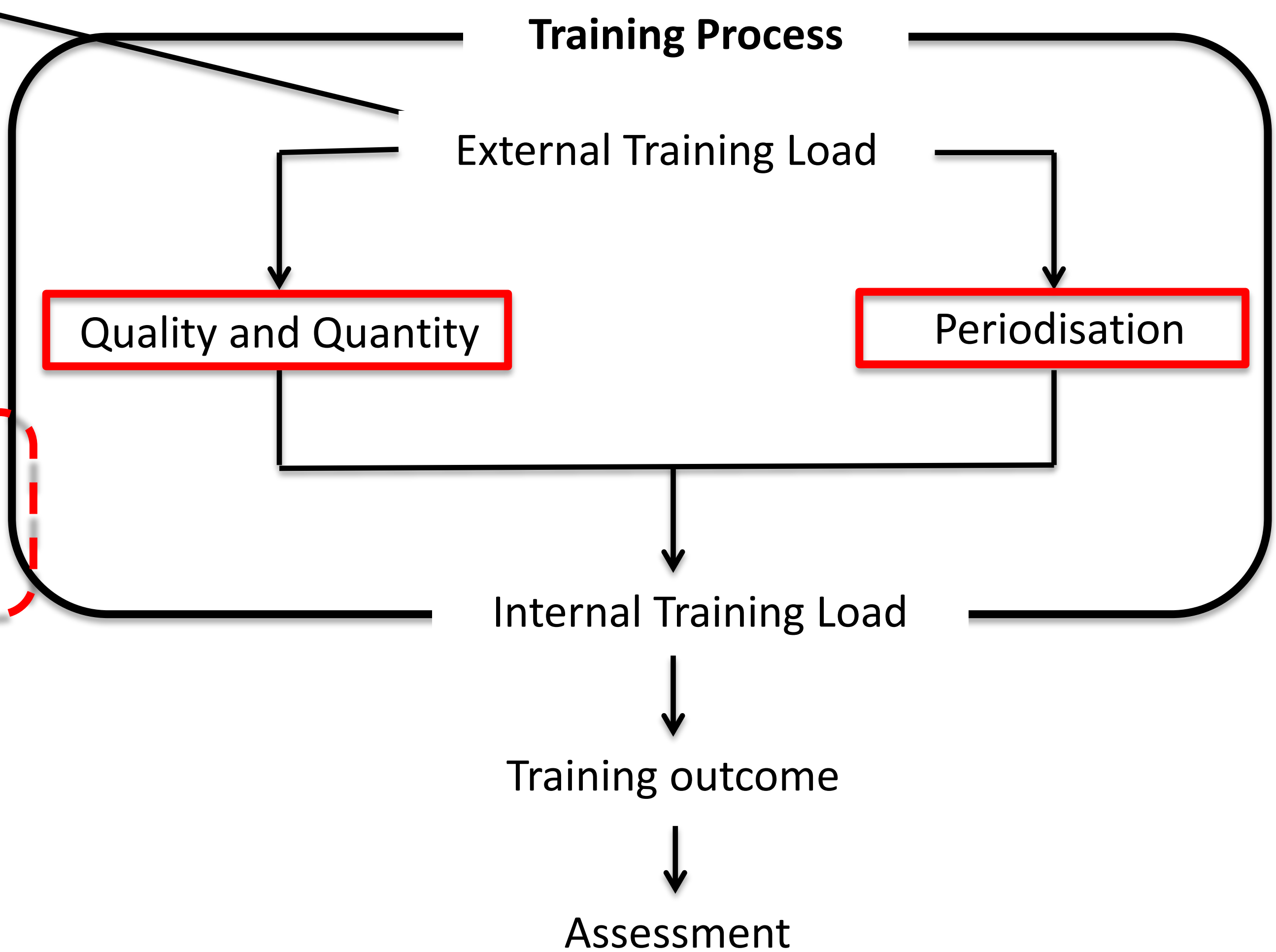
1. Jumped significantly higher
2. Run faster over 5, 10 and 20 meters
3. Covered greater distance on the Yo-Yo IR1 test

Woods et al. (2014) – under-review

Structuring The Development of These Abilities – The basics

How was training implemented?

1. Global Positioning Systems
2. Sessional Rate of Perceived Exertion



Impellizzeri et al. (2005)

Periodisation – The Use of Session Rate of Perceived Exertion

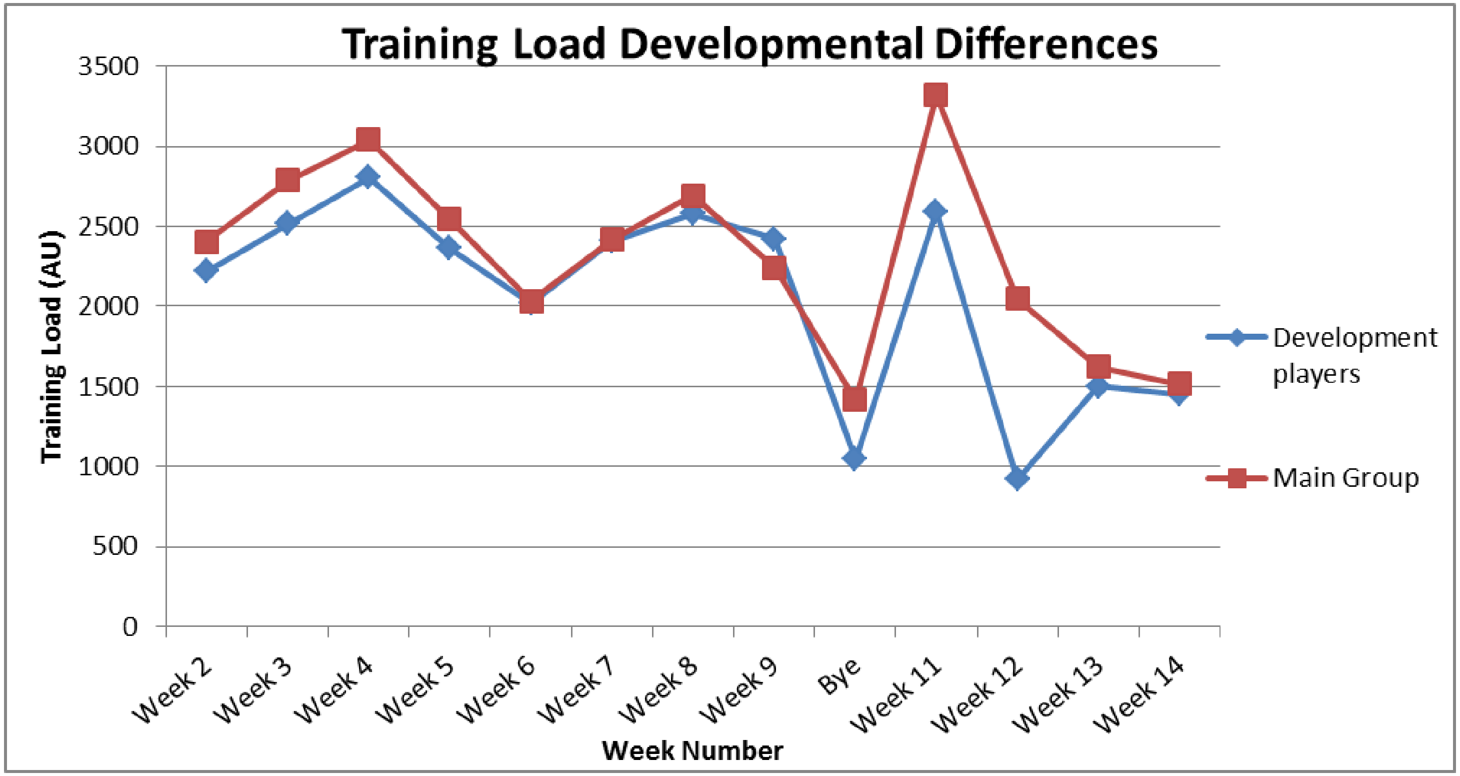
- **R**ate of **P**erceived **E**xertion is an easily administered method of planning and tracking (periodising) training load.

0	NOTHING AT ALL
0.5	VERY, VERY LIGHT
1	VERY LIGHT
2	FAIRLY LIGHT
3	MODERATE
4	SOMEWHAT HARD
5	HARD
6	
7	VERY HARD
8	
9	
10	VERY VERY HARD (MAXIMAL)

- Foster et al. (2001) scale is the most commonly used.
- Players selected their perceived exertion 30 minutes after exercise completion – why?
- This is then multiplied by the duration to get a training load.

Foster et al., (2001)

- Daily and then weekly loads can be analysed following the calculation of the daily load.



Foster et al., (2001)

Session-RPE – Individual Player Monitoring

- Useful when flagging potential non-functional overreaching

Q. Which player(s) is/are at risk of non-functional OR? Why?

Player	Week 2	Week 3	Week 4	Week 5
	Training Load	Training Load	Training Load	Training Load
Player 1	2900	3280	3365	2430
Player 2	2005	2355	2540	2595
Player 3	1995	2610	2805	2530
Player 4	1920	2075	3310	2405
Player 5	2220	2285	3110	2215
Player 6	2620	3235	2255	2370
Player 7	1631	2668	3205	1895
Player 8	2140	2705	3215	2850
Player 9	2560	2905	3190	2450
Player 10	3095	4000	3540	2931
Player 11	1775	1840	2470	2225
Player 12	3995	4448	3445	3600
Group Average	**2405**	**2867**	**3038**	**2541**
5% > Group Average	2525	3010	3189	2668
10% > Group Average	2645	3154	3341	2795

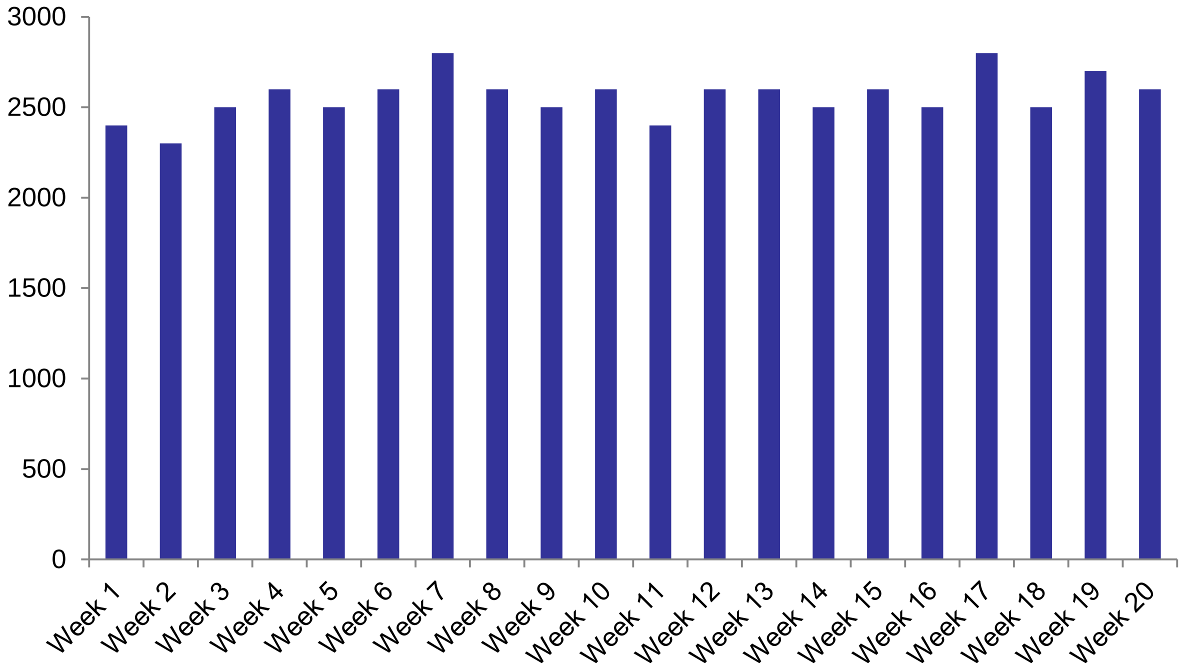
Training Program Design

- In an attempt to improve performance, coaches often prescribe large volumes of intensive (physical) training.
- This type of program should consist of intense bouts followed by an appropriate recovery phase.
- However, a rigorous program with limited recovery can be extremely problematic….

Performance ↓

Injury likelihood ↑

Physiological adaptation ↓



Coutts et al. (2007)

Looking for Signs of Fatigue

Sports Med
DOI 10.1007/s40279-014-0253-z

REVIEW ARTICLE

Monitoring Training Load to Understand Fatigue in Athletes

Shona L. Halson

Abstract Many athletes, coaches, and support staff are taking an increasingly scientific approach to both designing and monitoring training programs. Appropriate load monitoring can aid in determining whether an athlete is adapting to a training program and in minimizing the risk of developing non-functional overreaching, illness, and/or injury. In order to gain an understanding of the training load and its effect on the athlete, a number of potential markers are available for use. However, very few of these markers have strong scientific evidence supporting their use, and there is yet to be a single, definitive marker described in the literature. Research has investigated a number of external load quantifying and monitoring tools, such as power output measuring devices, time-motion analysis, as well as internal load unit measures, including perception of effort, heart rate, blood lactate, and training impulse. Dissociation between external and internal load units may reveal the state of fatigue of an athlete. Other monitoring tools used by high-performance programs include heart rate recovery, neuromuscular function, biochemical/hormonal/immunological assessments, questionnaires and diaries, psychomotor speed, and sleep quality and quantity. The monitoring approach taken with athletes may depend on whether the athlete is engaging in individual or team sport activity; however, the importance of individualization of load monitoring cannot be over emphasized. Detecting meaningful changes with scientific and statistical approaches can provide confidence and certainty when implementing change. Appropriate monitoring of training load can provide important information to athletes and coaches; however, monitoring systems should be intuitive, provide efficient data analysis and interpretation, and enable efficient reporting of simple, yet scientifically valid, feedback.

1 Background

As athletes strive to improve their performance, modifications in training load are required, particularly increases in frequency, duration, and intensity. Training loads are adjusted at various times during the training cycle to either increase or decrease fatigue depending on the phase of training (i.e. baseline or competition phase). Ensuring that fatigue is titrated appropriately is important for both adaptations to training as well as for competition performance [1].

Fatigue is a complex and multifaceted phenomenon that has a variety of possible mechanisms. Indeed, a number of different definitions of fatigue exist, often dependent upon the experimental model employed and/or the conditions under which they occur. One of the most common definitions of fatigue was proposed by Edwards [2], and states that fatigue is a "failure to maintain the required or expected force (or power output)." Fatigue can also be influenced by the type of stimulus (voluntary or electrical), type of contraction (isometric, isotonic, and intermittent or continual), duration, frequency and intensity of exercise, and type of muscle [3]. Further, the physiological and training status of the athlete and the environmental conditions may also significantly influence fatigue. The definitions and caveats mentioned above highlight both the multi-factorial nature of fatigue and the inherent complexities of trying to monitor or measure fatigue in the athlete. For the purpose of this review, and to reflect a

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Springer

- Questionnaires
- Heart Rate Recovery
- Neuromuscular Function
- Cycling Power Output
- Perception of Effort
- Blood Lactate
- Biochemical/Hormonal/Immunological Assessments

Halson (2014)

Questionnaires

- Simple and inexpensive means of **subjectively** quantifying fatigue.
- However, it is crucial that the frequency of the questionnaire administration and its' length are controlled.
- A range of questionnaires are reported in the literature:
- **Profile of Mood States (POMS)** – Morgan et al. (1987)
- **Recovery-Stress Questionnaire for athletes (REST-Q-Sport)** – Kellmann & Kallus (2000)
- **Total Recovery Scale (TRS)** – Rushall (1990)
- **Daily Analysis of Life Demands for Athletes (DALDA)** – Kentta & Hassmen (1998)

Daily Analysis of Life Demands for Athletes (DALDA)

DALDA Questionnaire
Monitors state of well being and mood state

(a = worse than normal, b = normal, c = better than normal)

Part A

1. a b c Diet
2. a b c Home Life
3. a b c School/college/work
4. a b c Friends
5. a b c Sports Training
6. a b c Climate
7. a b c Sleep
8. a b c Recreation
9. a b c Health

Part B

1. a b c Muscle Pains
2. a b c Techniques
3. a b c Tiredness
4. a b c Need for rest
5. a b c Supplementary Work
6. a b c Boredom
7. a b c Recovery Time
8. a b c Irritability
9. a b c Weight
10. a b c Throat
11. a b c Internal
12. a b c Unexplained aches
13. a b c Technique Strength
14. a b c Enough Sleep
15. a b c Between Session Recovery
16. a b c General Weakness
17. a b c Interest
18. a b c Arguments
19. a b c Skin Rashes
20. a b c Congestion
21. a b c Training Effort
22. a b c Temper
23. a b c Swelling
24. a b c Likability
25. a b c Runny Nose

Number of "a" Scores: ________

Increase in "a" scores suggests overreaching or overtraining.

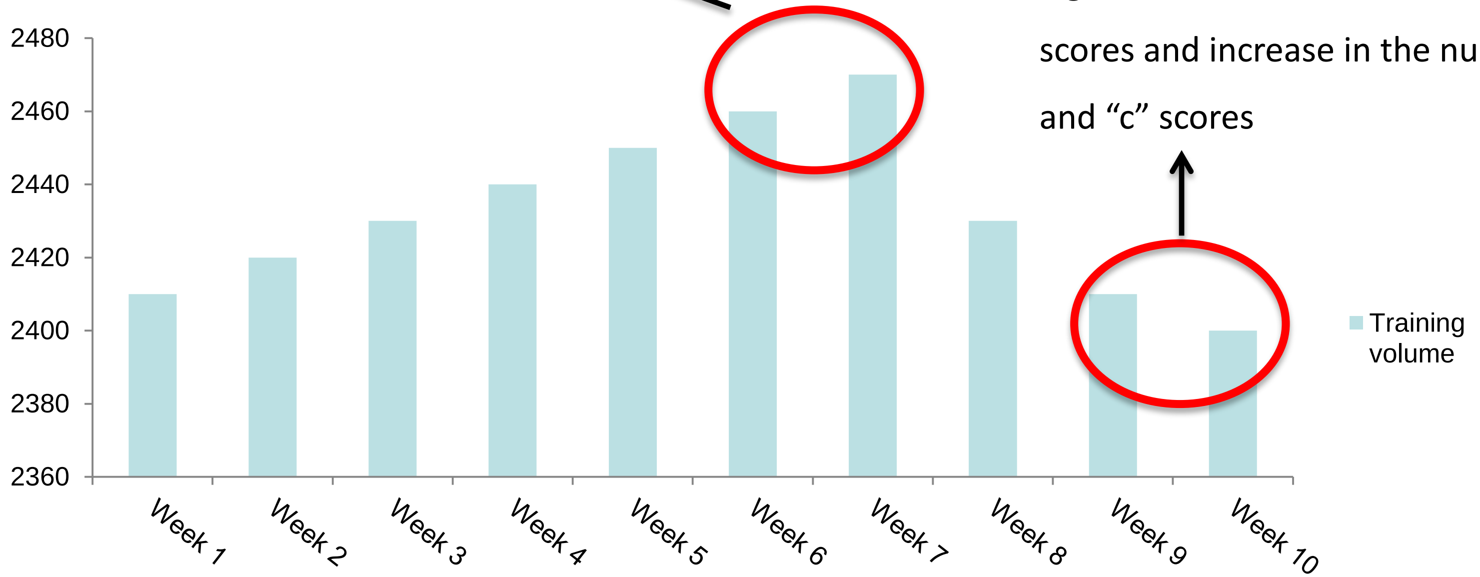
A significantly higher number of "a" scores in relation to "b" and "c" scores is thought to relate to potential signs of NFOR

Rushall (1990)

DALDA

Significantly abnormal number of “a” scores compared to “b” and “c”

Significant reduction in the number of “a” scores and increase in the number of “b” and “c” scores



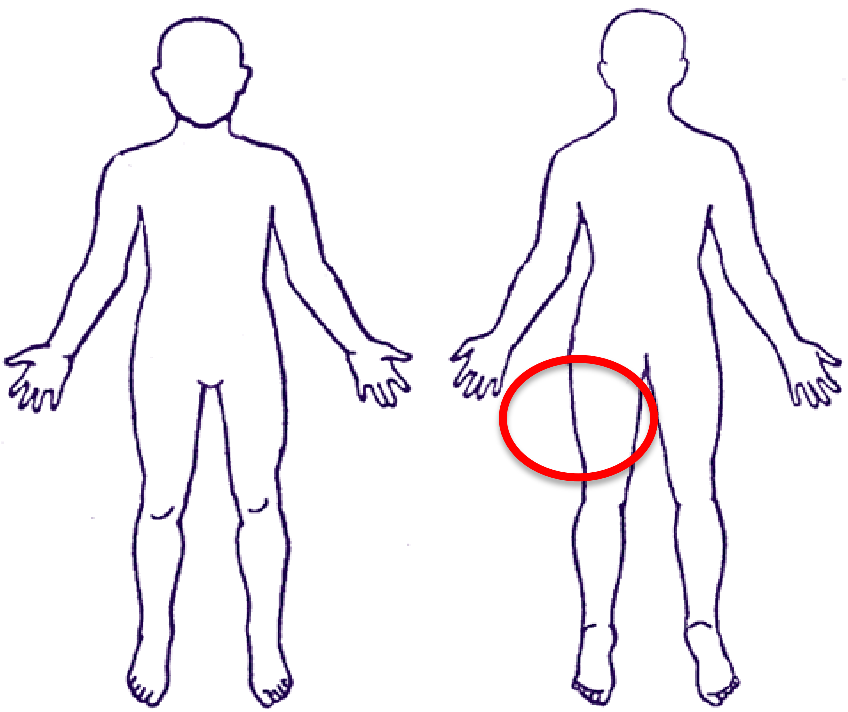
Muscle Soreness and Location Rating (MSLR)

1. On the scale below, circle your muscle soreness and if above a **5**, circle the regions on the body that are giving you the most soreness.

0 1 2 3 4 5 6 7 8 9 10

No soreness whatsoever — Immense muscle soreness

Anterior **Posterior**



Programming for Australian Football – An example

AUSTRALIAN FOOTBALL PERIODISATION PLAN																																																				
WEEK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
DATE	6-Jan-14	13-Jan-14	20-Jan-14	27-Jan-14	3-Feb-14	10-Feb-14	17-Feb-14	24-Feb-14	3-Mar-14	10-Mar-14	17-Mar-14	24-Mar-14	31-Mar-14	7-Apr-14	14-Apr-14	21-Apr-14	28-Apr-14	5-May-14	12-May-14	19-May-14	26-May-14	2-Jun-14	9-Jun-14	16-Jun-14	23-Jun-14	30-Jun-14	7-Jul-14	14-Jul-14	21-Jul-14	28-Jul-14	4-Aug-14	11-Aug-14	18-Aug-14	25-Aug-14	1-Sep-14	8-Sep-14	15-Sep-14	22-Sep-14	29-Sep-14	6-Oct-14	13-Oct-14	20-Oct-14	27-Oct-14	3-Nov-14	10-Nov-14	17-Nov-14	24-Nov-14	1-Dec-14	8-Dec-14	15-Dec-14	22-Dec-14	29-Dec-14
CYCLE	Pre-season												In-season																										Post-season						Off-season							
PHASE	Specific Preparation										T1		C1 Phase				C2 Phase				C3 Phase				C4 Phase						C5 Phase				C6 Phase				Transition 2						General Preparation						XMAS	
ROUND								NAB CUP					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	F1	F2	F3	GF														
MESO	4					5					6		7																		8				9				10						1				2		3	
SUB-PHASE	Strength and Aerobic Volume					Power and Anaerobic Development					Taper		Phases C1 to C4 will aim to progressively overload. Emphasis on recovery will be high												Increased training loads in readiness for finals						Tapering into finals				Emphasis is placed on recovery				Active Rest						Strength & Aerobic Volume						Active Rest	
TESTING																																																				

- Testing occurs at the beginning and completion of specific mesocycles to track athlete performance but to also assist with exercise prescription.
- Be cautious to not over test – remember, these tests are often maximal and may very well induce significant levels of fatigue.

Questions?