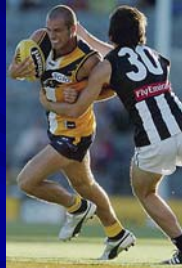


Physiological demands of team sports - needs analysis

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A 5 step process for physical preparation for Rugby (Duthie, 2006)

1. ID physical demands of the sport, and positions (needs analysis)



Needs analysis

- Relative importance of physical qualities for sport & individual
- Observation & experience suggests what qualities are important for success, but should be evidence-based
- Guides **emphasis** in training & selection of tests
 - Rate importance of physical qualities for:
 - your **sport** eg. Rugby v Australian Rules
 - playing **positions**
 - a particular **team** eg. style/tactics, playing group
 - the **individual**
- eg. score out of 10

Basic needs analysis for elite 100m sprinter eg. 10 point scale
(modified from Young, *Better Coaching*, 2001)

Speed		
Acceleration speed		10
Maximum speed		10
Speed-endurance		5
Strength		
	Lower body	Upper body
Maximum absolute strength	5	5
Maximum relative strength	7	5
Power		
General	10	8
Reactive strength	8	1
Power-endurance	4	2

10 = very important 5 = some importance 1 = minor importance

• Team sports harder !

Challenges for needs analysis

- Many *specific* physical qualities to consider:
- Endurance
 - Aerobic power
 - AT/LT
- Speed
 - Acceleration
 - Maximum
 - Speed-endurance
 - Sustained sprints eg. 80m +
 - Repeated sprints with inadequate recoveries (RSA)



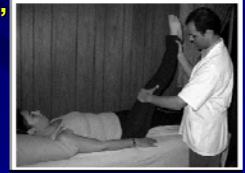
Physical qualities cont'

- Agility
- Strength
 - Maximum eg. 1RM
 - Absolute & relative to body mass
 - Strength-endurance
 - Speed-strength
 - General power eg. CMJ
 - Reactive strength eg. DJ with short GCC
 - Lower and upper body
 - Specific muscles eg. glutes



Physical qualities cont'

- Flexibility
 - Specific muscles
- Core stability
- Muscle balance (eg. predisposition to injury)
- Body composition
 - Lean body mass
 - Trade-off with power/weight (jumping, running endurance)
 - Skinfolds
- Difficult decisions



Ways to determine importance of physical qualities for sport (evidence) eg. Australian Rules football

1. Descriptive info on game demands

- Eg. HR monitoring (Buttivant, 1999)

	% game time > 85% max HR
Forwards & backs	28 %
Mid-field	44 % (sig. greater)

2. Time-motion analysis

eg. Dawson et al. (2004). *JSMS*, 7(3): 278-291.



- Video analysis of 22 AFL games
- Midfielders covered 16.9 km
 - 11.5 km was jogging or faster
 - 24 sprints per game
 - 41s between high intensity efforts
 - 119 game activities per game (1 every 63 s)

Does training match game demands? Dawson et al. (2004). *JSMS*, 7(3): 292-301.

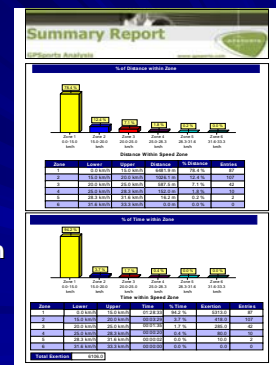
- Compared to games, training contained:
 - Similar short (<6s) intensity sprints
 - Similar changes of direction (<90°)
 - Longer recoveries between efforts
 - Longer periods of standing
 - Less contests



Time-motion analysis cont'



- GPS
 - Restricted to path covered over time (no vision)
 - Data acquisition rate
 - Can be integrated with HR & acceleration
 - Eg. Wisbey & Montgomery (2005)...



Selected variables for AFL game analysis (means) (Wisbey & Montgomery, 2005)

Total distance (km)	12.45
Average speed (km.hr ⁻¹)	6.76
Total time (min)	111:01
Average work to rest	1:2.2
Exertion index (EI)	120.98
Exertion index/min	1.1
Efficiency (EI per possession)	8.23
Maximum speed (km.hr ⁻¹)	30.25

- EI correlated with possessions ($r=0.30$, $p<0.01$)
- What fitness measures correlate with EI?

Time-motion analysis cont' Maximum speed

- Traditionally thought max speed not important
- However many sprints performed from running start in rugby (Duthie et al., 2006) & AFL (Benton, 2001)
 - Near max speed often reached eg. Super 12 rugby 53% of sprints reached 90-99% max
- 2006 GPS study to determine % max speed reached in TAC Cup & AFL competition



Needs analysis cont'

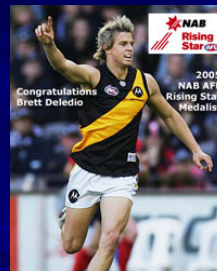
3. Qualities that distinguish higher and lower levels of playing performance.

- If better players are superior in a fitness measure, that quality may be seen as more important
- Elite v sub-elite
 - Selected v non-selected to enter AFL (Pyne et al, 2005)
 - Selected v non-selected for a team (Young et al, 2005)
- Senior v junior (Marchant & Austin, 1996)



Pyne et al. (2005). Fitness testing & career progression in AFL football. JSMS, 8(3): 321-332.

- AFL draft camp fitness test results 1999-2001
- Career progression:
 - Drafted to an AFL club
 - Played senior game
 - # games played
 - Subjective rating of career potential



Pyne et al.(2005) cont'

- Generally better fitness scores were related to indicators of career progression eg...

	Drafted	Not drafted	% diff
Sprint 5m (s)	1.08	1.10	1.9
Sprint 10m (s)	1.80	1.82	1.1
Sprint 20m (s)	3.03	3.06	1.0
Agility (s)	8.55	8.61	0.7
Est. VO ₂ max (mL/min/kg)	58.0	57.2	1.4


- Concluded speed & endurance were best predictors of being drafted
- Presumably drafted players are better players, not just recruited on fitness
- Conclusions difficult because of different outcome variables of playing success

Young, Newton, Doyle, Chapman, Cormack, Stewart, Dawson (2005). JSMS, 8(3): 333-345.

Anthrop & fitness measure	Selected players significantly better ($p<0.05$) and E.S.>0.8
Height	X
Weight	X
Sum skinfolds	X
Isokinetic quad strength	X
Isokinetic hamstring strength	X
3RM leg press	X
3RM chin-ups	X
3RM bench press	X but close



Young et al. (2005) cont'



Fitness measure	Selected significantly better (p<0.05) & E.S >0.8
Squat jump (concentric leg power)	Close
CMJ (SSC power)	✓
DJ (reactive strength)	Close
10m t (acceleration)	✓
Flying 30m (Max speed)	✓
Vertical jump	X
Beep test	X
Yo Yo test	✓ (correlation with beep = 0.56)

AFL senior v juniors (Marchant & Austin, 1996)

	U-18	Senior AFL
Height (m)	185.6	184.4
Weight (kg)	78.9	84.7
Sum of skinfolds (mm)	64.2	65.3
Bench press 1 RM (kg)	78.4	112.5 (43%)
5m (s)	1.10	1.12
10m		1.85
20m	3.07	3.09
40m	5.37	5.44
VJ (cm)	60.3	59.1
Beep test level	12.35	13.08 (6%)





4. Correlations with:

- Specific skills eg. kicking
 - Saliba & Hrysomallis (2001)
 - Correlation between kicking performance and isokinetic knee extension & flexion non-significant (r=0.42, p>0.05)
- On-field performance indicators (TAC Cup competition, 2005)...

School of HMSS contracted to test 12 TAC Cup teams March 2005 & 2006



TAC CUP

- Data supplied as service to:
 - TAC Cup clubs (profiling & monitoring)
 - AFL clubs (talent ID)
 - Football Victoria prescribed test battery (modified from AFL draft camp)

Young & Pryor. Relationship between pre-season anthropometric and fitness measures and indicators of playing performance in elite junior Australian Rules football. JSMS. In Press. p<0.05 & ES>0.5

Anthrop	Selected Rd 1	High possessions	Games earning votes	Marks	Hit-outs	Top 4 teams
Height	X	✓ shorter	X	X	✓ taller	X
Mass	X	✓ lighter	X	✓ heavier	X	✓ heavier
Hand span	X	X	X	X	X	X
Arm length	X	✓ less	X	X	X	X
Stand reach	X	✓ Less	X	X	X	✓ higher
Fitness						
VJ	X	X	X	X	X	✓ worse
5m	X	✓ faster	✓ faster	X	X	X
20m	X	X	✓ faster	X	X	X
AFL agility	X	X	X	X	X	X
Pred VO ₂ max	X	✓ better	X	X	X	X
Sit & reach	X	X	X	X	X	X

	Forwards & backs			Mid-fielders		
Endurance		✓			✓	
Acceleration		✓			✓	
Max speed						
Speed-end. (RSA)						
Agility						
	Lower	Upper	Specific muscles	Lower	Upper	Specific muscles
Max strength (absolute)						
Max strength (relative)						
Strength-endurance						
General power	✓			✓		
Reactive strength						
Flexibility						
Muscle mass						
Skinfolds						

Conclusion & future directions

- Needs analysis important first step in training prescription
 - Challenging with many factors to consider
 - Little published evidence in ARF
 - Fitness qualities
- ↓
- Game stats
- ↓
- Game result
- Eg. sprinting <1% of game time but what influence on the game?
- What are effects of training eg. endurance, agility, speed etc on game stats?
 - *Individual* needs analysis eg. Aaron Davey (speed vs endurance)



Needs for a goal keeper?

