Match running performance and physical capacity in youth football (soccer)

Martin Buchheit, Alberto Mendez-Villanueva, Ben Simpson and Pitre Bourdon

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Determinants of football performance

- Football is first a **tactical/technical** game
- Knowledge of the physical demands of a match is however of interest for the implementation of physical training strategies
Match running performance in Football

Mohr et al. 2003

Mohr et al. 2003
Match running performance and **PHYSICAL CAPACITIES**

Krustrup et al. 2005

$$y = 12.9x - 289$$

$$r = 0.555, \ r^2 = 0.308$$
Match running performance and PHYSICAL CAPACITIES

$r = 0.64$ [CI 95%: 0.25; 0.85]; $R^2 = 0.41$; $p < 0.01$

*Rampinini et al. 2007*
Match running performance and PHYSICAL CAPACITIES

\[ r = -0.60 \text{ [CI95\%: -0.83; -0.18]}; \quad R^2 = 0.36; \quad p < 0.01 \]

\[ \text{Very high-intensity running distance (m)} \]

\[ \text{RSA}_{\text{mean}} (s) \]

Rampinini et al. 2007
Match running performance and PHYSICAL CAPACITIES

Castagna et al. 2009

$r=0.77$, $p<0.0001$

$y=273.92 + 0.82x$
Match running performance and physical capacities

• **Simplistic view**: the **FITTER** the players, the **GREATER** the distance covered at high-intensities !?

• Game constraints?
• Opponent?
• Individual standard?
• Tactical ploy?
• Playing position?
Match running performance and
PLAYING POSITION

Di Salvo et al. 2009
Match running performance and PHYSICAL CAPACITIES

• If individual match running performance was simply dictated by a player’s physical capacities,
  • Central defenders would have consistently the lowest physical capacities
  • Midfielders would display the greatest physical capacities
• BUT such between-position differences in physical capacities are not always apparent (Impellizzeri 2008) or even absent (Taskin 2008)
Purpose

- Examine match running performance in highly-trained young players as a function of age and playing positions.
- Examine, as a function of playing positions, the relationships between match running performance and physical capacities.
Methods
Testing

- Anthropometry
- Peak Height Velocity (PHV)
- Counter movement jump (CMJ)
- 40-m sprint with 10-m split times
  - Acceleration (1st 10 m) / PV (best split)
- Repeated-sprint ability (RSA_{mean})
- Incremental track test (V_{Vam-eval})
Match analyses

• GPS (1Hz, SPI Elite, GPSports, Canberra, Australia)

• 635 player-matches from 99 different players during 42 international games (4 months period), 1-9 games / players.

→ Final \( n = 186 \) files from 77 different players (full games)
Match analyses

- **4-4-1-1 formation**
- **Playing positions**
  - fullbacks (FB, \(n = 15\) players ↔ 36 files)
  - centre-backs (CB, \(n = 16\) players ↔ 54 files)
  - midfielders (MD, \(n = 13\) players ↔ 40 files)
  - wide midfielders (W, \(n = 13\) players ↔ 16 files)
  - second strikers (\(2^{nd}S\), \(n = 9\) players ↔ 19 files)
  - strikers (S, \(n = 11\) players ↔ 21 files)
Match analyses

- Match running categories
  - total distance covered (TD)
  - low-intensity running (LIR; < 13.0 km·h⁻¹)
  - high-intensity running (HIR; 13.1 to 16 km·h⁻¹)
  - very high-intensity running (VHIR; 16.1 to 19 km·h⁻¹)
  - sprinting distance (Sprinting; > 19.1 km·h⁻¹)
  - very high-intensity activities (VHIA, VHIR + Sprinting)
  - peak game running speed

Castagna et al. 2009
Results
Physical capacities / AGE

- **Peak Velocity (km.h\(^{-1}\))**
  - U13: 15
  - U14: 20
  - U15: 25
  - U16: 30
  - U17: 35
  - U18: 40

- **V\textsubscript{vam-Eval} (km.h\(^{-1}\))**
  - U13: 8
  - U14: 10
  - U15: 12
  - U16: 14
  - U17: 16
  - U18: 18

**Significance Notes**
- **a:** significant difference vs. U14 \((P<0.05)\)
- **b:** vs. U15
- **c:** vs. U16
- **d:** vs. U17
- **e:** vs. U18
Match running performance / AGE

**ANCOVA (adjusted on playing time)**

- **LIR**
- **HIR**
- **VHIR**
- **Sprinting**

Distance covered (m)

<table>
<thead>
<tr>
<th>Age</th>
<th>Distance</th>
<th>U13</th>
<th>U14</th>
<th>U15</th>
<th>U16</th>
<th>U17</th>
<th>U18</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>7497±196</td>
<td>7956±128</td>
<td>8026±143</td>
<td>8436±156</td>
<td>8448±135</td>
<td>8254±118</td>
</tr>
<tr>
<td></td>
<td>c,d,e</td>
<td></td>
<td></td>
<td>e</td>
<td>e</td>
<td>e</td>
<td>e</td>
</tr>
<tr>
<td></td>
<td>a: significant difference vs. U14 (P&lt;0.05), b: vs. U15, c: vs. U16, d: vs. U17, e: vs. U18.</td>
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</tr>
</tbody>
</table>
Physical capacities / Playing position

ANOVA (adjusted on age)

<table>
<thead>
<tr>
<th>Position</th>
<th>Peak Velocity (km.h⁻¹)</th>
<th>V_vam-Eval (km.h⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FB</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>CB</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>MD</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>2ndS</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>

a: significant difference vs. CB ($P<0.05$), b: vs. MD, c: vs. W, d: vs. 2ndS, e: vs. S.
Match running performance and PLAYING POSITION

**ANCOVA (adjusted on age playing time)**

- **LIR**
- **HIR**
- **VHIR**
- **Sprinting**

Distance covered (m)

- **FB**
- **CB**
- **MD**
- **W**
- **2rS**
- **S**

- **a**: significant difference vs. **CB** ($P<0.05$), **b**: vs. **MD**, **c**: vs. **W**, **d**: vs. **2rS**, **e**: vs. **S**.
Match running performance and physical capacities

• Age-related differences in physical capacities NOT reflected in match running performance

• Great position-related differences in match running performance despite poor disparities in physical capacities
Match running performance vs. field test results
Match running performance vs. field test results

- All players pooled together:
  - TD was only significantly related to $V_{Vam\text{-}eval}$
  - VH1A was related to CMJ, PV, $RSA_{\text{mean}}$ and $V_{Vam\text{-}eval}$
  - However, these correlations were only small to moderate (e.g., $r$ = ranging from 0.17 for VH1A vs. PV to 0.41 for VH1A vs. $V_{Vam\text{-}eval}$)

Partial correlations (adjusted on age playing time)
Match running performance vs. field test results

• The relationships between match running performance and physical capacities were more clearly position-dependent:
  
  • trivial and non-significant correlations in FB, CB, MD and W: e.g., VHIA vs. $V_{Vam\text{-eval}}$:
    
    \[ r = 0.06 \text{ and } 0.022 \text{ in FB and CB} \]
  
  • Large associations in 2ndS and S:
    
    e.g., VHIA vs. $V_{Vam\text{-eval}}$: \( r = 0.70 \) and \( 0.64 \)
    
    or VHIA vs. RSA_{mean}: \( r = 0.66 \) in 2ndS.
Conclusions
CONCLUSIONS

• Although this requires further tactical/technical analysis, present results suggest that the older/fitter players’ ability to use their physical potential might be restricted during games.
• “The fitter, the better” is therefore likely too simplistic
• The beneficial impact of high physical fitness on game running performance is likely position-dependent, with attackers (i.e., 2\textsuperscript{nd}S and S) likely to benefit the most from their physical capacities
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[OP-TC06] Training and Coaching 6 - Running and Sprinting Performance
25.06.2010, Start: 10:20, Lecture room: "Hall 8"

DOES ON-FIELD SPRINTING PERFORMANCE IN YOUNG SOCCER PLAYERS DEPEND ON HOW FAST THEY CAN RUN OR HOW FAST THEY DO RUN?

Mendez-Villanueva, A., Buchheit, M., Simpson, B., Peltola, E., Bourdon, P.