S&C for Fast Bowling in Cricket

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Introduction

Importance of fast bowling in cricket

Biomechanics of fast bowling

Physiology of fast bowling

Needs analysis & training for fast bowling
A batsman takes approximately 600 ms to decide on trajectory of the ball and play an appropriate stroke.

Jeff Thomson was recorded bowling at 159.3 km/hr\(^{-1}\), with the ball reaching the batsman in 438 ms.
Benefits of Fast Bowling

• ↓ Decision making time and movement time available to the batsman
  • May ↑ difficulty for batsman (more errors) and ↑ chance of getting them “out”

• Hostility towards batsman
  • Bowler wants either blood or wickets
Gaps in S&C Cricket Literature

• Limited data examining the relationship between physical capacities and fast bowling performance
  • A majority of physical tests have not been postural specific (i.e., isokinetic seated knee extensions)

• A lack of training studies on bowling performance

• No research investigating the correlations between physical capacities and bowling kinematics
• Due to a lack of research in S&C for fast bowling in cricket, S&C coaches prescribe training programmes based on intuition and perhaps unpublished research.

• Therefore, examining the biomechanics and physiology of fast bowling would provide the S&C coach with ways to better train bowlers to enhance performance.
Model of Bowling Performance

Physical Capacities
(Strength, Power, Speed)

Bowling Technique
(Biomechanics)

Fast Bowling Performance
(Speed & Accuracy)
Biomechanics of Fast Bowling Performance
Phases of Fast Bowling

- **Run Up**
- **Back Foot Impact**
- **Delivery Stride**
- **Front Foot Impact**
- **Ball Release**
- **Follow-Through**

[Image of a cricket bowler in action]

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Learn to succeed
1. Run-up velocity at back foot impact (+)
2. Deceleration between back foot impact and front foot impact (+)

Positive relationship between 1) and 2). Run-up velocity tends to increase stride length

3. Front foot horizontal impulse from front foot impact to ball release (+)

↑ run-up velocity at back foot impact assists in the rapid deceleration of the body, = ↑ force to the ball
  • only if the bowler has the strength to withstand the ↑ forces from the run-up
4) Front knee extension angle at front foot impact and ball release (+)

Ideal knee technique is > 10° knee flexion and extension between these two phases
Ideal Front Knee Technique

• Implications?
  • Force absorption / force application
  • $\uparrow$ magnitude and transmission of force from the legs to the bowling arm
  • Via stretch-shortening cycle
    • $= \uparrow$ bowling speed

• Reactive strength an important quality?
• Similar to javelin?
Javelin – Extended Knee
Shaun Tait (Collapsed Front Leg)

Brett Lee (Extended Front Leg)

Both bowl at same speed (~160 km.hr\(^{-1}\))

Imagine if Shaun Tait had the reactive strength in front leg to extend upon ball release....

He might be faster providing all else being equal!
Front Leg Collapsed
Front Leg Extended
5) Maximum difference between the hips and the shoulder segments occurring closer to ball release (+) difference measured in transverse plane (bird’s eye view)

Core power for rapid trunk rotation, flexion, lateral flexion?

Portus et al. (2004).
6) Angular velocity of bowling and non-bowling arm humerus (+)

Fast bowlers typically have 120 ms to apply impulse to the cricket ball, but this depends on the amount of displacement of the bowling arm humerus (more = greater impulse)

Upper body strength vs. upper body power?
Physiology of Fast Bowling Performance
<table>
<thead>
<tr>
<th>Activity</th>
<th>Twenty20</th>
<th>One Day</th>
<th>Multi-Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking (0-2.0 m/s)</td>
<td>2,634 ± 268</td>
<td>2,520 ± 362</td>
<td>2,512 ± 258</td>
</tr>
<tr>
<td>Jogging (2.01-3.5 m/s)</td>
<td>718 ± 276</td>
<td>618 ± 217</td>
<td>614 ± 173</td>
</tr>
<tr>
<td>Running (3.51-4 m/s)</td>
<td>164 ± 76</td>
<td>157 ± 58</td>
<td>185 ± 89</td>
</tr>
<tr>
<td>Striding (4.01-5.0 m/s)</td>
<td>249 ± 121</td>
<td>220 ± 81</td>
<td>233 ± 133</td>
</tr>
<tr>
<td>Sprinting (&gt;5.01 m/s)</td>
<td>406 ± 230</td>
<td>316 ± 121</td>
<td>230 ± 149</td>
</tr>
</tbody>
</table>

Petersen et al. (2010).
<table>
<thead>
<tr>
<th></th>
<th>Twenty20</th>
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<th>Multi-Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number per hour (#)</td>
<td>23 ± 10</td>
<td>18 ± 5</td>
<td>17 ± 11</td>
</tr>
<tr>
<td>Mean sprint distance (m)</td>
<td>17 ± 4</td>
<td>18 ± 3</td>
<td>13 ± 1</td>
</tr>
<tr>
<td>Maximum sprint distance (m)</td>
<td>35 ± 13</td>
<td>46 ± 12</td>
<td>28 ± 5</td>
</tr>
</tbody>
</table>

Petersen et al. (2010).
Repeated Sprint Ability

- Defined as a cluster of 3 or more sprints above 5.01 m.s\(^{-1}\) with less than 60 s recovery between each sprint

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</tr>
</thead>
<tbody>
<tr>
<td>Clusters (#)</td>
<td>3.3 ± 1.5</td>
<td>6.2 ± 2.9</td>
<td>5.5 ± 4.0</td>
</tr>
<tr>
<td>Sprints per cluster (#)</td>
<td>4.8 ± 1.4</td>
<td>5.0 ± 1.4</td>
<td>4.9 ± 0.7</td>
</tr>
</tbody>
</table>

Petersen et al. (2010).
Other Physiological Data

• **VO$_{2\text{max}}$**
  • 55-60 ml.kg$^{-1}$.min$^{-1}$

• **Heart rates**
  • During 12 overs of bowling:
    • ~160 bpm

• **Lactates:**
  • During 12 overs of bowling:
    • ~5 mmol.L$^{-1}$
S&C for Fast Bowling Performance
<table>
<thead>
<tr>
<th>Physical Capacity</th>
<th>Low</th>
<th>Mod</th>
<th>High</th>
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</thead>
<tbody>
<tr>
<td><strong>Muscular Strength</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Upper Body</td>
<td></td>
<td></td>
<td>Y</td>
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<tr>
<td>- Lower Body</td>
<td></td>
<td></td>
<td>Y</td>
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<tr>
<td>- Core</td>
<td></td>
<td></td>
<td>Y</td>
</tr>
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<td><strong>Muscular Power</strong></td>
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</tr>
<tr>
<td>- Core</td>
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<td></td>
<td>Y</td>
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<tr>
<td><strong>Reactive Strength</strong></td>
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<td></td>
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<tr>
<td>- Lower Body</td>
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<td></td>
<td>Y</td>
</tr>
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<td>Physical Capacity</td>
<td>Low</td>
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<tr>
<td><strong>Speed</strong></td>
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<tr>
<td>- Acceleration</td>
<td></td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>- Maximum</td>
<td>Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Repeated Sprint Ability</td>
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<tr>
<td><strong>Energy Systems</strong></td>
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<td></td>
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<tr>
<td>- ATP-PC</td>
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<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>- Anaerobic Glycolysis</td>
<td></td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>- Oxidative Metabolism</td>
<td></td>
<td></td>
<td>Y</td>
</tr>
</tbody>
</table>
Training Ideas

- **Lower body strength:**
  - Squats
  - RDL’s
  - Deadlifts
  - Lunges

- **Lower body power:**
  - Hang cleans
  - Hang snatch
  - Split jerk
Training Ideas

• **Core strength & power:**
  • Pilates based exercises for strength
  • Medicine ball slams and rotations for power

• **Upper body strength:**
  • Bench press / pull

• **Upper body power:**
  • Overhead medicine ball throws
  • Bench press throws
Training Ideas

- **Reactive Strength (for lead leg):**
  - Bungee cord attached from pole to waist, athlete faces pole and places bungee cord in tension
  - Five steps in total
    - Start and finish with lead leg used in bowling
    - Final step in lunge position – copying ideal front knee technique of >10° knee flexion and extension in a rapid SSC.
    - Still in a state of tension upon lunge

- Other options are:
  - Depth jumps (emphasise jump height and low contact time)
  - Double leg horizontal jump with single leg landing
• **Repeated Sprint Ability:**
  - 10 x 20 m (on every 15 s), maximal effort, standing start
  - No more than 10% decrement allowed in first sprint when compared to best 20 m sprint time
  - Active recovery between sets (walk / jog back)
  - Assessing time to complete each sprint and compare
  - Specific to run-up distance
• **Acceleration & Deceleration Ability:**
  • 20 m sprint, from standing start
  • Try to slow down before final cone
    • Adopt lunge position on front leg (mimic bowling)
  • Progress by reducing the end distance of 5 m to enable faster deceleration
• Development of gluteus medius / minimus muscles to assist in stabilisation of pelvis throughout bowling action
  • Minimise medio-lateral forces and redirect forces towards batsman

• Eccentric external rotator cuff strength
  • Assist in deceleration of the glenohumeral joint

• Strengthening non-dominant side musculature
  • Muscle development on both sides of the body
  • Minimise scoliosis
Thanks!

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