Specific endurance testing in tennis
1  Aspects of work load demands in tennis ✓
2  Test description and life presentation
3  Test validity and reliability
4  Norm values and test interpretation
Energy metabolism and oxygen kinetics differ extremely between running and tennis

Oxygen consumption of maximal stroke activities is considerably high.

- BH Standing max (112 km/h)  
  82 % VO₂max

- FH Standing max (121 km/h)  
  86 % VO₂max

The closest correlation was found between the Tennis Ballmachine Test and the Multistage Shuttle Run Test (Léger et al. 1988)
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Hit & Turn Tennis Test (HTT)

- Translation of the multistage 20 m shuttle run test (Léger et al. 1988) on tennis demands.
- The Hit and Turn Tennis test is an acoustically controlled and progressive Fitness Test.
- The test is carried out with a racket on a tennis court by one or more players at the same time.
- The object of the test is to follow as long as possible the audio signals and to hold up the required footwork.
- The player has to run along the base line and to simulate a shot in the respective corners in time with the signals.
- The maximal achieved test level or a LA threshold related sub maximal test level is assessed.

developed by Ruhr-University Bochum (2008)
under support of ITF and DTB

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1. Aspects of work load demands in tennis ✓
2. Test description and life presentation ✓
3. Test validity and reliability ✓
4. Norm values and test interpretation
<table>
<thead>
<tr>
<th></th>
<th>( \text{VO}_2 \text{ peak} )</th>
<th>( L_4 \text{ mmol} )</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reliability</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carpet/Carpet</td>
<td>0.942**</td>
<td>0.848**</td>
</tr>
<tr>
<td>Carpet/Clay</td>
<td>0.713**</td>
<td>0.880**</td>
</tr>
<tr>
<td><strong>Validity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HTT/Ballmachine Test</td>
<td>0.961**</td>
<td>0.756**</td>
</tr>
<tr>
<td>HTT/Treadmill Test</td>
<td>0.619 *</td>
<td>0.617 *</td>
</tr>
</tbody>
</table>

R. Federer (SUI) – R. Nadal (ESP)
<table>
<thead>
<tr>
<th></th>
<th>Aspects of work load demands in tennis</th>
<th>✓</th>
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</thead>
<tbody>
<tr>
<td>2</td>
<td>Test description and life presentation</td>
<td>✓</td>
</tr>
<tr>
<td>3</td>
<td>Test validity and reliability</td>
<td>✓</td>
</tr>
<tr>
<td>4</td>
<td>Norm values and test interpretation</td>
<td>✓</td>
</tr>
</tbody>
</table>
VO$_2$ [mmol·min$^{-1}$·kg$^{-1}$]

- **NR (n=14)**
  - $f(x)=2.0x + 30.0$  
  - $\{8,16\}$

- **RR (n=13)**
  - $f(x)=1.2x + 40.0$  
  - $\{8,12\}$

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**Level**

- 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16
VO₂ [mmol·min⁻¹·kg⁻¹]

- f14 (n=17) \( f(x)=1.21x + 35.0 \) \{6,11\}
- f16 (n=13) \( f(x)=1.25x + 32.0 \) \{6,11\}

- m12 (n=8) \( f(x)=1.80x + 33.0 \) \{6,11\}
- m14 (n=20) \( f(x)=1.66x + 33.0 \) \{6,14\}
- m16 (n=19) \( f(x)=1.68x + 31.0 \) \{6,14\}
## Norm Values for Male Tournament Players

<table>
<thead>
<tr>
<th>VO₂\text{est} [ml/min/kg]</th>
<th>Strokes</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Level</td>
<td>Intervall [s]</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>4.9</td>
<td>46.0</td>
</tr>
<tr>
<td>2</td>
<td>4.8</td>
<td>48.0</td>
</tr>
<tr>
<td>3</td>
<td>4.7</td>
<td>50.0</td>
</tr>
<tr>
<td>4</td>
<td>4.6</td>
<td>52.0</td>
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<tr>
<td>5</td>
<td>4.5</td>
<td>54.0</td>
</tr>
<tr>
<td>6</td>
<td>4.4</td>
<td>56.0</td>
</tr>
<tr>
<td>7</td>
<td>4.3</td>
<td>58.0</td>
</tr>
<tr>
<td>8</td>
<td>4.2</td>
<td>60.0</td>
</tr>
<tr>
<td>9</td>
<td>4.1</td>
<td>62.0</td>
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<tr>
<td>10</td>
<td>4.0</td>
<td>64.0</td>
</tr>
<tr>
<td>11</td>
<td>3.9</td>
<td>66.0</td>
</tr>
<tr>
<td>12</td>
<td>3.8</td>
<td>68.0</td>
</tr>
</tbody>
</table>

**Notes:**
- **VO₂\text{est}** denotes the estimated oxygen consumption during physical activity.
- The table categorizes players into different levels of performance based on their VO₂\text{est} values and the number of strokes they can maintain within a given interval.
HTT individual discussion

Player R.G. (ATP 576)
Test break-off: Level 17.0
VO₂max: 67.0 ml/min/kg
4 mmol/l: Level 14.2
Evaluation: excellent

Player R.Z. (4th division)
Test break-off: Level 12.0
VO₂max: 51.0 ml/min/kg
4 mmol/l: Level 10.3
Evaluation: reasonable
Specific diagnostic for athletic development

The biannual nationwide DTB-Test
Specific endurance testing in tennis