Managing the overuse injury; a delicate balance between load and recovery

STEVEN DOEVEN:
Researcher/Lecturer
(adapted from Kenttä and Hassmén, 1998)

Conceptual model

Hard to distinguish adaptation and maladaptation
(adapted from Kenttä and Hassmén, 1998)
RELEVANCE

“Imbalance between training and recovery will have mild to severe negative consequences on performance” (Kuipers and Keizer, 1988)

Overuse Injuries

✓ General principles and introduction (overuse) injuries in elite (young) athletes

✓ Overtraining

✓ Application of a SportsFieldLab in overtraining
What's the definition of an injury?

Definition **INJURY** (FIFA): “Any physical complaint sustained by a player that results from a football match or football training, irrespective of the need for **medical attention** or **time loss** from football activities”.

*Fuller, 2006*

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**Monitoring injuries and illnesses**

✓ FIFA registration system (Fuller et al, 2006)
  - Time loss injury (being unable to take a full part in future training or match play)
  - Medical attention injury (receiving medical attention for more than 1 day)
  - Injury location, type, severity, mechanism
  - Illness (a circumstance in which the player felt limited or unable to perform in training or match play)
What are overuse injuries?

(Various) definition(s): “caused by repeated micro-trauma without a single, identifiable event responsible for the injury”

Bahr, 2009

A qualitative study on overuse injuries: The beliefs of athletes and coaches

C.P. van Wilgen a, b, E.A.L.M. Verhagen b

Original research

“Physical, psychological and social factors are of importance and should be incorporated in the definition of overuse injuries” (Athletes and coaches)

Conclusions: Athletes and coaches have a holistic view on the definition of overuse injuries, and the intrinsic and extrinsic risk factors for overuse injuries. If preventive approaches for overuse injuries are developed and implemented, they should incorporate physical factors, as well as incorporate psychological and social factors. Based on the input of coaches and athletes, the latter are important risk factors for overuse injuries.

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Coaches’ and Athletes’ description of overuse injuries:

“making too much damage while training/playing which your body cannot repair”

“overuse injuries are caused by a misbalance between training and rest”

“not being alert enough (not listen to body signals such as pain) at the onset of an injury”

Wilgen and Verhagen, 2012

How do overuse injuries occur?

Stress on the bone, muscle, tendon or ligament due exercise or activity.

Too much breakdown in comparison to build-up of tissue

Result: inflammation of these structures
Methods

Please answer all questions regardless of whether or not you have experienced health problems in the past week. Select the alternative that is most appropriate for you, and in the case that you are unsure, try to give an answer as best you can anyway.

**Question 1**
Have you had any difficulties participating in normal training and competition due to injury, illness or other health problems during the past week?
- [ ] Full participation without health problems
- [ ] Full participation, but with injury/illness
- [ ] Reduced participation due to injury/illness
- [ ] Cannot participate due to injury/illness

**Question 2**
To what extent have you reduced your training volume due to injury, illness or other health problems during the past week?
- [ ] No reduction
- [ ] To a minor extent
- [ ] To a moderate extent
- [ ] To a major extent
- [ ] Cannot participate at all

**Question 3**
To what extent has injury, illness or other health problems affected your performance during the past week?
- [ ] No effect
- [ ] To a minor extent
- [ ] To a moderate extent
- [ ] To a major extent
- [ ] Cannot participate at all

**Question 4**
To what extent have you experienced symptoms/health complaints during the past week?
- [ ] No symptoms/health complaints
- [ ] To a mild extent
- [ ] To a moderate extent
- [ ] To a severe extent

![Figure 2](image1.png)
The four key questions asked at the beginning of the weekly online Oslo Sports Trauma Research Center (OSTRC) Questionnaire on Health Problems. If the athlete answered the minimum value in each of the four questions, the questionnaire was finished for that week.

Clarsen et al, 2013

![Figure 3](image2.png)
Diagram of questionnaire logic showing how the length of the questionnaire varied according to the number of health problems the athlete reported. Up to four health problems could be reported per week.

Clarsen et al, 2013
Injury mechanism and severity in young elite soccer players

**Figure 3** Venn diagram of the number of overuse problems identified by the standard injury registration method and the new method. All injuries registered using the standard method was classified as substantial overuse problems by the new method.

Clarsen et al, 2013

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Brink et al, 2010
Overuse Injuries

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Overtraining (terminology)

Functional Overreaching (FO)
✓ Mild symptoms, days to weeks

Non-Functional Overreaching (NFO)
✓ Moderate symptoms, weeks to months

Overtraining syndrome (OTS)
✓ Severe symptoms, months up to years

(Meeusen et al. 2006, Nederhof et al. 2006)
<table>
<thead>
<tr>
<th>✓ Functional overreaching (FO)</th>
<th>✓ Non-functional overreaching (NFO)</th>
<th>✓ Overtraining Syndrome (OTS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>performance decrements and fatigue</td>
<td>performance does not improve and feelings of fatigue do not disappear (several weeks)</td>
<td>poorer performance, severe fatigue, muscle soreness, overuse injuries, reduced appetite, major depression, disturbed sleep patterns, immune system deficits, concentration difficulties (months till years)</td>
</tr>
<tr>
<td>temporarily and potential positive effects on the long term</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
20-60% experience negative effects of overtraining once in their career

Hooper, 1995
Lehmann, 1997
Kentta and Hassmen, 2001

Treatment
- rest

Epidemiology

Overtraining continuum

Supercompensation FOR NFOR OTS

Duration and severity of performance decrement and symptoms
- Days to week: Mild
- Week to months: Moderate
- Months to years: Severe

Area of interest for prevention of OTS

Brink et al, 2012
What should we do about it?

Do not **overtrain** (proper training and common sense)

Design a well-balanced training program

Special attention for incorporation strength training, increasing flexibility, improving core stability!

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At**thletes differ in susceptibility to overtraining**!

![Diagram showing the process of overtraining and recovery](image)

*Fig. 2. An overview of the whole overtraining and recovery process* (adapted from Kenttä and Hassmén, 1998)
SUPPORTING ELITE BASKETBALL PLAYERS BY MONITORING

How and When? After

GAMES
## How and When? Before

### Total Quality of Recovery (TQR)

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Very, very poor recovery</td>
</tr>
<tr>
<td>7</td>
<td>Very poor recovery</td>
</tr>
<tr>
<td>8</td>
<td>Poor recovery</td>
</tr>
<tr>
<td>9</td>
<td>Reasonable recovery</td>
</tr>
<tr>
<td>10</td>
<td>Good recovery</td>
</tr>
<tr>
<td>11</td>
<td>Very good recovery</td>
</tr>
<tr>
<td>12</td>
<td>Very, very good recovery</td>
</tr>
</tbody>
</table>

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### How and When? Before

**Name:**

**Date:**

**Week nr.:**

<table>
<thead>
<tr>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FATIGUE</strong></td>
<td>Very fresh</td>
<td><strong>Feel</strong></td>
<td>Normal</td>
<td>More tired than usual</td>
</tr>
<tr>
<td><strong>SLEEP QUALITY</strong></td>
<td>Very restful</td>
<td><strong>Good</strong></td>
<td>Difficulty falling asleep</td>
<td>Restless sleep</td>
</tr>
<tr>
<td><strong>GENERAL MUSCLE SORENESS</strong></td>
<td>Feeling great</td>
<td>Feeling good</td>
<td>Normal</td>
<td>Increased in soreness</td>
</tr>
<tr>
<td><strong>STRESS LEVELS</strong></td>
<td>Very relaxed</td>
<td><strong>Relaxed</strong></td>
<td>Normal</td>
<td>Feeling stressed</td>
</tr>
<tr>
<td><strong>MOOD</strong></td>
<td>Very positive mood</td>
<td>A generally good mood</td>
<td>Less frustrated in other activities than usual</td>
<td>Experiences all normal emotions,imer</td>
</tr>
</tbody>
</table>

**Total:**
Total load and average total quality of recovery over an 8-week period. Injured in week 41.

No illness during this period. No data available for illness and injury for week 48.

Recovery (in sum)

Focus on psychophysiological recovery:

✓ nutrition and hydration - binding carbohydrates requires water

✓ sleep and rest - passive recovery during daytime and sufficient sleep at night

✓ relaxation and emotional support (i.e., mental training)

✓ active rest - low volume and low intensity training
Overuse Injuries

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Focus on CAPACITIES

✓ Modern facilities to measure and analyse (sports and clinical setting)

✓ Diverse populations - elite athletes, chronic patients, children, elderly, adolescents.

✓ Educational and research purposes.

✓ In relation to health (i.e. OTS) or performance!

✓ Focus on measuring capacities (Monitoring Athletic Performance Study MAPS and Recovery Rules)

What is it?

*Injuries
*Illnesses
*Over-training

(Brink, 2010) adapted from conceptual model Konita & Harmsen (1999)
✓ **Cardio pulmonary (clinical) exercise testing (lab 1)**
✓ Biomechanical analysis (lab 2)
✓ Match analysis and monitoring behaviour (lab 3)
✓ Neuropsychological analysis (lab 4)
✓ Cardio pulmonary (clinical) exercise testing (lab 1)
✓ Biomechanical analysis (lab 2)
✓ **Match analysis and monitoring behaviour (lab 3)**
✓ Neuropsychological analysis (lab 4)
Cardio Pulmonary Exercise Testing (Lab 1)

FOCUS ON:

(Elite) Athletes - i.e. riders, rowers, runners, speed skaters, team sport athletes - WINGATE TESTS and VO2max TESTS

Applications in clinical setting:

Cardiovascular disease (coronary heart disease, decompensatio cordis), Chronic Obstructive Pulmonary Disease (COPD), Obesity, Diabetes
Physiological tests

*Gives information about the physiological profile (aerobic or/and anaerobic) of different types of sport*

Contribution of energy systems over time

- ATP-PC system
- Glycolysis
- Aerobic metabolism

% Contribution of energy system vs. Time (seconds) of maximal effort
What about yourself?

Which energy system is dominant in your own sport?
Tests that will be performed (1)

✓ Wingate test (power)
   At a cycle ergometer
   30 seconds all out exercise
   To measure power (peak power + mean power)

Wingate tests (junior basketball players)
Repeated Wingate Tests (6x10s)

Preliminary results
Tests that will be performed (2)

✓ Maximal oxygen uptake test (VO2max)

On a treadmill with a masque on the face to measure oxygen uptake
8 – 12 minutes
With increasing slope
Until exhaustion

VO2max
Biomechanical analysis (lab 2)
APPLICATIONS

Landing strategies - i.e. elite volleyball players, runners
Gait patterns
Angles / moments during sport specific movements
Monitoring injury specific markers/predictors in i.e. ACL ruptures
Match analyses /Motion analyses (lab 3)

What kind of behaviour in specific decision making situations?
Performance monitoring in ball team sports

Cameras (pan, tilt, zoom)
Neuropsychological lab (4)

✓ Tests at the pc (psychological testing)
  • Reaction time (during stress) test
  • Stress tolerance test
  • Attention test
  • Peripheral vision
  • Personality tests
  • Etc.
Ongoing projects

✓ Identifying performance indicators in (elite) athletes - e.g. riders, rowers, runners, speed skaters, team sport athletes (lab 1).

✓ Relation between training load and performance in elite athletes (lab 1,2,3, 4) - e.g. volleyball players, basketball players, soccer players.

✓ Relation between a prevention program and ACL ruptures (lab 2) e.g. volleyball players, basketball players, soccer players.

✓ Identifying relations between field tests, lab tests and match/motion analyses (lab 1 and 3)

✓ Relation between neuropsychological parameters and injuries (lab 4)

Conceptual model

(adopted from Kenttä and Hassmén, 1998)
Thank you!