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I have no disclosures or conflicts of interest
Objectives

• Understand the concept of overtraining

• Identify potential causes of fatigue in the athlete

• Recognize potential therapeutic interventions for the fatigues athlete
The Problem

• Fatigue is common
  – Prevalence via survey 6.0 – 7.5%
  – 2-week period prevalence in US workers 38%
  – 21-33% patients seeking care at primary care clinics report fatigue as a symptom

And me…?
The problem, a broad differential diagnosis


<table>
<thead>
<tr>
<th>Table 1. Possible causes of fatigue in the athlete</th>
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<tbody>
<tr>
<td><strong>Cardiac</strong></td>
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<tr>
<td>Hypertrophic cardiomyopathy</td>
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<tr>
<td>Congenital heart disorders</td>
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<tr>
<td>Coronary artery disease</td>
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<tr>
<td><strong>Endocrine/metabolic</strong></td>
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<tr>
<td>Diabetes</td>
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<td>Electrolyte disturbance</td>
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<td>Hypothyroidism</td>
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<td><strong>Hematologic</strong></td>
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<tr>
<td>Anemia</td>
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<tr>
<td>Iron deficiency</td>
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<td><strong>Infectious disease</strong></td>
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<td>Endocarditis</td>
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<tr>
<td>Hepatitis</td>
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<td>Mononucleosis</td>
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<td>Viral syndromes</td>
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<tr>
<td><strong>Neoplasm</strong></td>
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<tr>
<td>Occult malignancy</td>
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<tr>
<td>Leukemia/lymphoma</td>
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<tr>
<td><strong>Nutritional</strong></td>
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<tr>
<td>Poor diet</td>
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<tr>
<td>Anorexia nervosa</td>
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<td>Bulimia nervosa</td>
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<tr>
<td><strong>Psychosocial</strong></td>
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<tr>
<td>Anxiety</td>
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<tr>
<td>Depression</td>
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<tr>
<td>Stress</td>
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<tr>
<td><strong>Pulmonary</strong></td>
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<tr>
<td>Asthma</td>
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<tr>
<td>Exercise-induced bronchospasm</td>
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<tr>
<td>Allergic rhinitis</td>
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<td><strong>Toxic exposure</strong></td>
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<tr>
<td>Alcohol</td>
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<tr>
<td>Street drugs</td>
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<tr>
<td>Medication side effects</td>
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<tr>
<td><strong>Other</strong></td>
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<tr>
<td>Overtraining syndrome</td>
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<tr>
<td>Pregnancy</td>
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</tbody>
</table>
Overtraining
Overtraining

- Persistent unexplained, underperformance syndrome.
- Occurs in 10-20% of elite endurance athletes.
- Occurrence in non-elite endurance participants?
Incidence


5-10% in swimmers training up to 14,000 m/day


5-10% in swimmers over 6-month period


6.8 % “stale”, but 32.1% showed training “distress”


Elite athletes from British national teams, 15% overtrained; male 17%, female 11%
Definition: Overreaching

An accumulation of training and/or non-training stress resulting in short-term decrement in performance capacity with or without related physiological and psychological signs and symptoms of overtraining in which restoration of performance capacity may take from several days to several weeks.

Halson SL, Jeukendrup AE: Sports Med 2004;34(14)
Functional Overreaching

- Utilized by athletes during a typical training cycle to enhance performance
- Intensified training can result in a decline in performance; but, with appropriate recovery, ‘supercompensation’ effect may occur resulting in enhanced performance
- Recovery from a state of overreaching occurs within a 2-week period (taper)
Definition: Overtraining

Accumulation of training and/or non-training stress resulting in long-term decrement in performance capacity with or without related physiological and psychological signs and symptoms of overtraining in which restoration of performance capacity may take several weeks or months.

Halson SL, Jeukendrup AE: Sports Med 2004;34(14)
Fig. 1. The overtraining continuum.

FIGURE 1. Graphic depiction of periodization of training. The green line represents repeated cycles of training and recovery. The red line represents heavy training with incomplete recovery (overreaching). With prolonged overreaching, quick recovery does not occur and overtraining syndrome develops.
Overreaching/Overtraining

- Threshold for this syndrome varies for every athlete
- Stress due to training, psychological stress, illness?
- Dx of exclusion
- Rx: rest for ??

Reported symptoms

- Fatigue
- Unexplained sense of effort
- History of heavy training and competition
- Monotonous training
- Frequent minor infections
- Unexplained heavy, stiff, sore muscles
- Mood disturbance
- Change in sleep quality
- Loss of energy
- Loss of competitive drive
- Loss of appetite
- Loss of libido


29% decline in performance using time-to-fatigue protocol
Profile of Mood State (POMS)

Figure 1. Iceberg mood profile of elite runners (Morgan 1980). The POMS subscales include tension/anxiety (Te), depression (De), anger (An), vigor (Vi), fatigue (Fa), and confusion (Co).
Overtraining hypotheses

• Glycogen depletion hypothesis (decreased glycogen stores lead to decreased levels of BCAA)
  – Unsupported by current research

• Hypothalamic hypothesis (dysregulation of HPA axis)
  – Unsupported

• Branched chain amino acid hypothesis (decreased amino acids lead to increased tryptophan leads to fatigue)
  – Inadequate scientific support

• Cytokine hypothesis
Cytokine hypothesis


Little supporting evidence
Confirmatory tests

- Creatine kinase
- Urea
- Ammonia
- Uric acid
- Nocturnal urinary excretion of catecholamines
- Testosterone/cortisol
- Heart rate variability
- IGFBP-3

- Not
- Not
- Not
- Not
- 
- Holds promise, but...
- Holds promise, but...
- Holds promise, but...

University of Minnesota
Without confirmatory testing, the overtraining syndrome is a diagnosis of exclusion.

Consider: Other more common causes of fatigue in athletes...
Treatment

• Relative rest

• Relative rest

• Relative rest

• Relative rest
So, let’s be practical

Consider other common causes of fatigue in the student-athlete population

The evidence for this is Level 2
Best Experience
My differential dx at 516 15th Ave. SE

- Sleep deprivation
- Illness
- Inadequate nutrition
- Iron (ferritin) deficiency
- Vitamin D deficiency
- Exercise-induced bronchoconstriction
- Depression
- Staleness/Overtraining
Illness

• Hx of sx of recent illness, exposure to others with illness, or current sx.

• Post-viral asthenia

• Infectious mononucleosis
  – If sx atypical, obtain EBV IgG, IgM

• Rx
Sleep Hygiene
Iron (Ferritin) Deficiency

- Common cause of fatigue, poor training and performance (aerobic capacity, anaerobic activities)
- More to come on Sunday...

Vitamin D Deficiency

- Ubiquitous in climate at 45°N, 93°W
  - Vitamin D modulates
    - Bone homeostasis
    - Immune system
    - Skeletal muscle
    - Cardiac muscle

- Normal (30-80)
- Some suggest levels > 50 for optimal performance
- Rx: Vit D replacement

Exercise-Induced Bronchoconstriction

- Important to consider as diagnostic possibility.
- Sx: fatigue, but usually associated with cough (during or after exercise).
- Athlete may not appreciate shortness of breath
- 10% of general population, 40% in those with allergies, 90% in those with asthma
- Rx: appropriate use of inhaled meds
Inadequate Nutrition

- Demands of training may not be met by dietary intake
- Dietary changes that occur in the college athlete
Depression

- 12% of adult population presenting to primary care offices suffer from depression
- Prevalence in adolescent population 5-8%
- Fatigue may be only presenting complaint
- Associated sx
  - Sleep disturbance
  - Loss of appetite
  - Apathy
  - Rx: meds and/or psychiatric consultation
Summary
Bibliography

In addition to those cited in presentation,


Robson P: Elucidating the Unexplained Underperformance Syndrome in Endurance Athletes The Interleukin-6 Hypothesis. Sports Med 2003; 33 (10): 771-781