Forty Year Perspective on Title IX and Women’s Sports Medicine

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Title IX

• Federal law enacted in 1972 (President Nixon):
• “No person shall on the basis of sex be excluded from participating in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance”
Participation Figures from NCAA

Figure 1. Adjusted Participation Figures from the NCAA Participation Report

Notes: These figures were adjusted assuming that existing NCAA members (as of 1981) have 57% more male athletes and 74% more female athletes than institutions that joined the NCAA after 1981. The unadjusted data are drawn from the 1981-82-2005-06 NCAA Sports Sponsorship and Participation Rates Report.

Impact of Title IX on Sport

• Higher education institutions responded to Title IX by increasing women’s participation rather than by decreasing men’s participation.

• (wrestling declined during a 3yr period when they were exempt from Title IX (1984-88))
Increase in Women in sport

Data from NCAA:

Between 2004-2010

Increase in proportion of female student athletes in
Division I: 14 %;
Division II: 21 %;
Division III: 14 %

NCAA Gender Equity Report (2012)
What about the Female Athlete Triad?

- Drinkwater (1981) identified menstrual abnormalities in female athletes
- 1992 ACSM workshop coined the term “Female Athlete Triad”
And then...

- The International consensus statement: beyond the Female Athlete Triad-Relative Energy Deficiency in Sport (RED-S)

Mountjoy (2014)
RED-S

Low Energy Availability (EA) alters endocrine function and direct and indirect impacts on bone may occur in female and male athletes

Ihle (2004); Hackney (2008)
Relative Energy Deficiency in Sport (RED-S)

- Impaired physiological function:
  - Metabolic rate
  - Menstrual function
  - Bone health
  - Immunity
  - Protein synthesis
  - Cardiovascular health

Mountjoy (2014)
Figure 1 Health Consequences of Relative Energy Deficiency in Sport (RED-S) showing an expanded concept of the Female Athlete Triad to acknowledge a wider range of outcomes and the application to male athletes (*Psychological consequences can either precede RED-S or be a result of RED-S). Adapted from Constantinou.14

Mountjoy (2014)
Figure 2  Potential Performance Effects of Relative Energy Deficiency in Sport (*Aerobic and anaerobic performance). Adapted from Constantini.54
RED-S

Underlying problem:

Inadequacy of energy to support range of body functions for optimal health and performance
RED-S

• EA = EI - energy cost of exercise relative to fat-free mass (FFM)
• Healthy adults = 45kcal/kg FFM/day equates to energy balance

Loucks (2004)
All athletes can have low EA

• So can male and female athletes have the “Female Athlete Triad?” or “Triad” Yes!

• Clinical observation of low estrogen easier than that of low testosterone
RED-S

• Male athletes in sports emphasizing Leanness may exhibit deficits in nutrition, reduction in sex hormones and or impaired bone health

Tenforde (2015)
RED-S

• Higher prevalence of EDs in men participating in aesthetic, endurance, weight class, and anti-gravitation (12.9%) sports than in athletes participating in non-leanness sports (4.6%). 25 times higher than in general population. Same figures as female athletes.

Hypogonadotropic Hypogonadism

- Multiple studies showing that in male cyclists, runners the higher the mileage/week; the lower the testosterone. Twice the average weekly mileage volume led to 40% reduction in testosterone and 43% reduction in sperm counts in runners

Roberts (1993)
Low Bone Mass

• Prevalence unknown

• Subset of male athletes with highest prevalence of LBM: endurance and weight class sports.

• 19-40% of elite collegiate and post-collegiate male runners with a cut off of Z-or T score less than -1.0

Tenforde (2016)
### Table 1  Relative Energy Deficiency in Sport risk assessment model for sport participation (modified from Skårderud et al)\(^{140}\)

<table>
<thead>
<tr>
<th>High risk: no start red light</th>
<th>Moderate risk: caution yellow light</th>
<th>Low risk: green light</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anorexia nervosa and other serious eating disorders</td>
<td>Prolonged abnormally low % body fat measured by DXA or anthropometry using The International Society for the Advancement of Kinanthropometry ISAK(^{143}) or non-ISAK approaches(^{122})</td>
<td>Healthy eating habits with appropriate energy availability</td>
</tr>
<tr>
<td>Other serious medical (psychological and physiological) conditions related to low energy availability</td>
<td>Substantial weight loss (5–10% body mass in 1 month)</td>
<td>Normal hormonal and metabolic function</td>
</tr>
<tr>
<td>Extreme weight loss techniques leading to dehydration induced haemodynamic instability and other life-threatening conditions</td>
<td>Attenuation of expected growth and development in adolescent athlete</td>
<td>Healthy BMD as expected for sport, age and ethnicity</td>
</tr>
<tr>
<td>Abnormal menstrual cycle: FHA amenorrhoea ≥6 months</td>
<td>Menarche ≥16 years</td>
<td>Healthy musculoskeletal system</td>
</tr>
<tr>
<td>Abnormal hormonal profile in men</td>
<td>Reduced BMD (either from last measurement or Z-score &lt; −1 SD).</td>
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<tr>
<td>History of 1 or more stress fractures associated with hormonal/menstrual dysfunction and/or low EA</td>
<td>Athletes with physical/psychological complications related to low EA/ disordered eating - ECG abnormalities- Laboratory abnormalities</td>
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<tr>
<td></td>
<td>Prolonged relative energy deficiency</td>
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<td></td>
<td>Disordered eating behaviour negatively affecting other team members</td>
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<td>Lack of progress in treatment and/or non-compliance</td>
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</tbody>
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BMD, bone mineral density; DXA, dual-energy X-ray absorptiometry; EA, energy availability; FHA, functional hypothalamic amenorrhoea; ISAK, International Society for the Advancement of Kinanthropometry

<table>
<thead>
<tr>
<th>Steps</th>
<th>Risk modifiers</th>
<th>Criteria</th>
<th>Red-S-specific criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1 Evaluation of health status</td>
<td>Medical factors</td>
<td>Patient demographics</td>
<td>Age, sex (see Yellow light column of table 1) Recurrent dieting, menstrual health, bone health</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Symptoms</td>
<td>Weight loss/fluuctuations, weakness</td>
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<tr>
<td></td>
<td></td>
<td>Medical history</td>
<td>Hormones, electrolytes, ECG and DXA</td>
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<tr>
<td></td>
<td></td>
<td>Signs</td>
<td>Depression, anxiety, disordered eating/eating disorder</td>
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<tr>
<td></td>
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<td>Laboratory tests</td>
<td>Abnormal hormonal and metabolic function</td>
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<td>Psychological health</td>
<td>Stress fracture</td>
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<td>Potential seriousness</td>
<td></td>
</tr>
<tr>
<td>Step 2 Evaluation of participation risk</td>
<td>Sport risk modifiers</td>
<td>Type of sport</td>
<td>Weight sensitive, leaness sport</td>
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<td></td>
<td></td>
<td>Position played</td>
<td>Individual vs team sport</td>
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<tr>
<td></td>
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<td>Competitive level</td>
<td>Elite vs Re-creational</td>
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<tr>
<td>Step 3 Decision modification</td>
<td>Decision modifiers</td>
<td>Timing and season</td>
<td>In/out of season, travel, environmental factors</td>
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<td>Pressure from athlete</td>
<td>Desire to compete</td>
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<td>External pressure</td>
<td>Coach, team owner, athlete family and sponsors</td>
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<td>Conflict of interest</td>
<td>If restricted from competition</td>
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<td>Fear of litigation</td>
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DXA, dual-energy X-ray absorptiometry.
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<th>High risk red light</th>
<th>Moderate risk yellow light</th>
<th>Low risk: green light</th>
</tr>
</thead>
<tbody>
<tr>
<td>▶ No competition</td>
<td>▶ May compete once medically cleared under supervision</td>
<td>▶ Full sport participation</td>
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<tr>
<td>▶ Supervised training allowed when medically cleared for adapted training</td>
<td>▶ May train as long as is following the treatment plan</td>
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<td>▶ Use of written contract (see supplementary appendix 1)</td>
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Conclusion

• Over the past 40 years since Title IX and ushering of medical attention to female athletes, it is now being recognized that the physiology is parallel to male athletes with low EA.
• Low gonadal hormones give way to low bone mass also. Clinically, stress fractures may signal an underlying RED-S in boys/men and girls/women alike.
• Stress fractures may be the tip of the iceberg for Low Energy Availability leading to underlying low testosterone and/or low estrogen resulting in RED-S; a more global clinical syndrome.
Thank you

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