FEMALE RUNNERS: WHAT SHOULD WE BE WORRIED ABOUT?
Ovarian Histology

Follicle → Maturing Follicle → Ovulation → Corpus Luteum → Degenerate C. Luteum

Body Temperature:
- 37°C
- 36°C

Hormones:
- Estradiol
- Luteinizing Hormone
- Progesterone

Endometrial Histology

Day of Menstrual Cycle
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28

(Average values. Durations and values may differ between different females or different cycles.)
MY RUNNING CAREER
5 Marathons

2 25Ks

3 15Ks

10Ks

6 Half Marathons

5Ks
AGENDA

• Pregnancy
• Female Athlete Triad
BENEFITS OF RUNNING DURING PREGNANCY

- Improved CV function
- Limited weight gain
- Improved attitude and mental state
- Easier / less complicated labor
- Lower risk of C-section
- Lower risk of developing gestational diabetes mellitus
- Enhanced post partum recovery
CONCERNS...

• Raising core body temperature too high
• Joint laxity and lower extremity edema
STRENUOUS AND VIGOROUS

• Running to the point of exhaustion or breathlessness

• Weight training

• Elite / Competitive athletes
WHEN TO STOP RUNNING

- Vaginal bleeding, amniotic fluid leakage
- Shortness of breath before exercise
- Dizziness, headache, chest pain
- Calf pain, swelling
- Pre-term labor
- Decreased fetal movement
RETURN TO RUNNING: POST PARTUM

2-4 weeks (gradual)

6-8 weeks for C-section

Decreased core strength / proprioception
Quiz time!
“Awareness and comfort in treating the female athlete triad: are we failing our athletes?”

- 48% of USA physicians
- 43% of physical therapists
- 32% of athletic trainers
  - 8% of all coaches
“Female athlete triad awareness among multispecialty physicians”

- Total of 931 physicians participated
  - 37% had heard of the Triad
  - 51% reported feeling comfortable either treating the Triad or referring a patient with the Triad

- Awareness rates:
  - 80% Orthopaedic Surgery
  - 55% OB/GYN
  - 52% PM&R / Rheumatology
“Ultra-marathon athletes at risk for the female athlete triad.”

- 92% of participants had not heard of the Triad before
- 32% of runners reported disordered eating
- 44% of runners at **HIGH** risk for the Triad
KNOWLEDGE OF THE FEMALE ATHLETE TRIAD

- Stress
- Fracture
- Bone Mineral Density
- DXA Scan
- Energy Availability
- Eating Disorder
- Stress Fracture
- Training Schedule
- Amenorrhea
- Anorexia
- Menstrual Cycle
- Osteoporosis
- Treatment Team
- Bulemia
- Contract
- Euhmenorrhea
1992 - ACSM
- Disordered eating, amenorrhea, and osteoporosis
HISTORY OF THE TRIAD

• 2005 – IOC
  • Low energy availability with or without an ED, amenorrhea, osteoporosis

• 2007 - ACSM
  • Spectrum of energy availability, menstrual function, and bone mineral density
Low Energy Availability with or without an Eating Disorder

Optimal Energy Availability

Optimal Bone Health

Subclinical Menstrual Disorders

Low BMD

Eumenorrhea

Osteoporosis

Functional Hypothalamic Amenorrhea

Reduced Energy Availability with or without Disordered Eating
HISTORY OF THE TRIAD

• 2014 – Female Athlete Triad Coalition
  • Same components
  • Updated risk stratification and RTP guidelines

• 2014 – IOC
  • Relative Energy Deficiency in Sport (RED-S)
  • Impaired physiological function (metabolic rate, menstrual function, bone health, immunity, protein synthesis, CV health)
TRIAD COALITION CONSENSUS STATEMENT AND RETURN TO PLAY

Screening Recommendations:

- Female athletes, at all levels, should undergo screening annually using a self-report questionnaire.
- Existence of any one component should prompt a more thorough evaluation for the others.
TRIAD COALITION SCREENING QUESTIONS

• Have you ever had a menstrual period?
• How old were you when you had your first menstrual period?
• When was your most recent menstrual period?
• How many periods have you had in the last 12 months?
• Are you presently taking any female hormones (estrogen, progesterone, birth control pills)?
• Do you worry about your weight?
• Are you trying to or has anyone recommended that you gain or lose weight?
• Are you on a special diet or do you avoid certain types of foods or food groups?
• Have you ever had an eating disorder?
• Have you ever had a stress fracture?
• Have you ever been told you have low bone density (osteopenia or osteoporosis?)
LOW ENERGY AVAILABILITY

Generally the underlying trigger for the other two components

Prevalence of DE in female, elite athletes
20% in adults
13% in adolescents
ENERGY AVAILABILITY

- **BMI**
  - Percentiles adjusted for age and gender until age 20

- **Physiological Markers**
  - Reduced Resting Metabolic Rate (RMR)
  - Low T3 levels (triiodothyronine)
  - Measured RMR/predicted RMR less than 0.9

- **Dietary Intake vs Energy Expenditure**
  - Imprecise but improving
  - Should utilize a registered dietician for evaluation
  - http://www.femaleathletetriad.org/calculators/
MENSTRUAL DYSFUNCTION

Primary Amenorrhea
- 7% collegiate women
  - 22% cheerleading, diving, gymnastics

Secondary Amenorrhea
- 2-5% collegiate women
  - 69% dancers
MENSTRUAL DYSFUNCTION

- Functional hypothalamic amenorrhea due to low energy availability is a diagnosis of exclusion

- PCP should rule out pregnancy and other endocrinopathies

- Menstrual dysfunction doesn’t show up in the training room
# Bone Mineral Density

<table>
<thead>
<tr>
<th>Years of Age</th>
<th>What is happening</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-14</td>
<td>Bone mineral accrual <strong>occurs rapidly</strong></td>
</tr>
<tr>
<td>16</td>
<td>Bone mineral accrual <strong>slows drastically</strong></td>
</tr>
<tr>
<td>18</td>
<td>Peak bone mass attained</td>
</tr>
</tbody>
</table>
DEFINITION OF LOW BONE MINERAL DENSITY

- 5-15% Higher BMD
- BMD Z-score < -1.0 SD warrants further attention
DEFINITION OF BMD

- Z-score between -1.0 and -2.0
- History of nutritional deficiency, hypoestrogenism, stress fx or other secondary risk factor for fx

Low BMD in Athletes
RECOMMENDATIONS FOR DXA ASSESSMENT

*In adolescents, DXA should include the whole body and lumbar spine (excluding the head)*
*Re-scan at 12 months for adults and 6 months in adolescents*
TREATMENT RECOMMENDATIONS

- Patient
- Physician
- Coach
- Mental Health Professional
- Athletic Trainer
- Nutritionist/Dietician
TREATMENT RECOMMENDATIONS

- Non-pharmacologic treatment preferred
- Increasing energy availability is mainstay treatment technique
- Goal is to resume menses and improve bone health
Recovery of Bone Mineral Density

Recovery of Menstrual Status

Recovery of Energy Status

Process: Days or Weeks

Outcomes:
↑ Energy status will stimulate anabolic hormones and bone formation
↑ Energy status will reverse energy conservation adaptations

Process: Months

Outcomes:
↑ Reproductive Hormones
↑ Estrogen exerts an anti-resorptive effect on bone

Process: Years

Outcomes:
↑ Estrogen continues to inhibit bone resorption
↑ Energy status will stimulate anabolic hormones and bone formation
RETURN TO PLAY

• 2012 Consensus Statement on “The Team Physician and the Return to Play Decision.”

• The Physician’s duty is “to return an injured or ill athlete to practice or competition without putting the individual at undue risk for injury or illness.”
Step 1: Evaluation of Health Status

Medical Factors
- Patient Demographics (age, ethnicity)
- Symptoms (fatigue, lightheadedness, skeletal pain, weight loss/weight fluctuations)
- Personal Medical History (triad risk factors - severity/chronicity, adolescent growth phase, hospitalizations, other medical factors)
- Family History/Genetics (eating disorders, other psychiatric illnesses, menstrual dysfunction, osteoporosis, fracture history)
- Signs (Physical Exam) (bradycardia, low BP/orthostatic, low BMI <17.5, low % body fat, lanugo, Russell’s sign, other)
- Lab Tests/ECG/DXA (metabolic panel, CBC, hormonal work-up if oligomenorrhea and/or amenorrhea, 25-OH Vit D if low BMD or bone stress injury, TSH and TTFs, other; ECG if ED or if indicated; DXA if indicated; X-ray and imaging if suspect bone stress injury)
- Functional Tests (functional movement screen if indicated, other as indicated)
- Psychological State (depression, anxiety, OCD co-morbidities; severity of illness; athlete’s willingness to participate in treatment; psych testing if indicated)
- Potential Seriousness (ED, other psych hospitalization, chronicity of each triad spectrum, co-morbidities, bone health eval/DXA)
- Cumulative Risk Assessment Score (based on cumulative triad risk stratification)

Sport Risk Modifiers
- Type of Sport (lean versus non-leanness sport, sport with subjective judging, thin physique felt advantageous, endurance sport, weight class, impact nature/bone loading)
- Position Played (perceived advantage if lean)
- Competitive Level (competitive versus non-competitive, high school, club, college/intercollegiate/division rank, elite, professional, Olympic)
- Timing & Season (in season vs off season, early in season or late)
- Pressure from Athlete (desire to compete and excel)
- External Pressure (coach, family, friends, administration, society)
- Masking the Injury (analgesia, ignoring symptoms)
- Conflict of Interest (scholarship athlete, professional, Olympic athlete, other)

Step 2: Evaluation of Participation Risk

Step 3: Decision Modification

Decision Modifiers

*Return-to-Play Decision
# Female Athlete Triad: Cumulative Risk Assessment

<table>
<thead>
<tr>
<th>Risk Factors</th>
<th>Magnitude of Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low EA with or without DE/ED</td>
<td>□ No dietary restriction</td>
</tr>
<tr>
<td></td>
<td>□ Some dietary restriction†; current/past history of DE;</td>
</tr>
<tr>
<td></td>
<td>□ Meets DSM V criteria for ED*</td>
</tr>
<tr>
<td>Low BMI</td>
<td>□ BMI $\geq 18.5$ or $\geq 90%$ EW** or weight stable</td>
</tr>
<tr>
<td></td>
<td>□ BMI $17.5 &lt; 18.5$ or $&lt; 90%$ EW or $5$ to $&lt; 10%$ weight loss/month</td>
</tr>
<tr>
<td></td>
<td>□ BMI $\leq 17.5$ or $&lt; 85%$ EW or $\geq 10%$ weight loss/month</td>
</tr>
<tr>
<td>Delayed Menarche</td>
<td>□ Menarche $&lt; 15$ years</td>
</tr>
<tr>
<td></td>
<td>□ Menarche $15$ to $&lt; 16$ years</td>
</tr>
<tr>
<td></td>
<td>□ Menarche $\geq 16$ years</td>
</tr>
<tr>
<td>Oligomenorrhea and/or Amenorrhea</td>
<td>□ $&gt; 9$ menses in 12 months*</td>
</tr>
<tr>
<td></td>
<td>□ $6$-$9$ menses in 12 months*</td>
</tr>
<tr>
<td></td>
<td>□ $&lt; 6$ menses in 12 months*</td>
</tr>
<tr>
<td>Low BMD</td>
<td>□ $Z$-score $\geq -1.0$</td>
</tr>
<tr>
<td></td>
<td>□ $Z$-score $-1.0^{***} &lt; -2.0$</td>
</tr>
<tr>
<td></td>
<td>□ $Z$-score $\leq -2.0$</td>
</tr>
<tr>
<td>Stress Reaction/Fracture</td>
<td>□ None</td>
</tr>
<tr>
<td></td>
<td>□ 1</td>
</tr>
<tr>
<td></td>
<td>□ $\geq 2$; $\geq 1$ high risk or of trabecular bone sites†</td>
</tr>
<tr>
<td>Cumulative Risk (total each column, then add for total score)</td>
<td>____ points +</td>
</tr>
</tbody>
</table>
# Recommendations by Risk Stratification

<table>
<thead>
<tr>
<th></th>
<th>Cumulative Risk Score*</th>
<th>Low Risk</th>
<th>Moderate Risk</th>
<th>High Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Full Clearance</strong></td>
<td>0 – 1 point</td>
<td>□</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Provisional/Limited Clearance</strong></td>
<td>2 – 5 points</td>
<td>□ Provisional Clearance</td>
<td>□ Limited Clearance</td>
<td></td>
</tr>
<tr>
<td><strong>Restricted from Training and Competition</strong></td>
<td>≥ 6 points</td>
<td></td>
<td></td>
<td>□ Restricted from Training/Competition-Provisional □ Disqualified</td>
</tr>
</tbody>
</table>
TRIAD CLEARANCE AND RTP

• #1 Full Clearance – Low risk
  • Follow up as determined by physician
TRIAD CLEARANCE AND RTP

• #2 Provisional/Limited Clearance (2 categories)
  • Provisional
    • Moderate risk
    • Athlete is cleared, but must follow up with requested members of the multidisciplinary team, as determined by the team physician, and have necessary tests within a defined time period
    • Consider written contract
  • Limited Clearance
    • Athlete is cleared, but team physician determines training/competition is limited, due to current risk factors
    • Must follow up with requested multi-disciplinary team members, as determined by the team physician, and have necessary tests within a defined time period
    • Written contract
TRIAD CLEARANCE AND RTP

• #3 Not Cleared (2 categories)
  • Provisional
    • High risk
    • Athlete is not cleared
    • Management/treatment of triad condition and follow up within defined time period and reassessed for clearance/RTP
  • Written contract

• Disqualified
  • High risk
  • Athlete unable to safely train/complete
  • Athlete treated for medical condition
REVIEW

Running while pregnant

Running with triad risk factors
• 2014 Female Athlete Triad Coalition Consensus Statement on Treatment and Return to Play of the Female Athlete Triad
• 2014 IOC Consensus Statement: beyond the Female Athlete Triad – Relative Energy Deficiency in Sport (RED-s)
• 2009 NATA Position Statement on Preventing, Detecting, and Managing Disordered Eating in Athletes
• 2007 ACSM Position Stand on The Female Athlete Triad
• 2015 Committee on Obstetric Practice Committee Opinion on Physical Activity and Exercise During Pregnancy and the Postpartum Period

Loucks AB, Thuma JR. Luteinizing hormone pulsatility is disrupted at a threshold of energy availability in regularly menstruating women. J Clin Endocrinol Metab 2003;88:297-311


