Objectives

After attending in this session, participants will:

• Recognize that the absence of menstruation is not a positive adaptation to training, but rather a physiological strategy by the body to protect itself from further energy loss by preventing the ability to become pregnant

• Distinguish amenorrhea and low bone mineral density as a consequence of low energy availability as a genetic component

• Construct a plan for dietary intake, training, recovery, and body composition to meet functional demands and support health
The Female Athlete Triad

• Defined 1992
• 3 inter-related entities
  – Disordered eating
  – Amenorrhea
  – Osteoporosis
• Greatest risk in young female athletes in lean physique sports
• American College of Sports Medicine Position Stand
  – Original 1997
  – Updated 2007
The Female Athlete Triad

• 2007 update
  – Spectrum of symptoms & conditions between health & disease
  – Identifies *low energy availability*
    • May occur unintentionally
    • May involve disordered eating/eating disorders
Spectrum of the Female Athlete Triad

- Optimal Energy Availability
- Reduced Energy Availability with or without Disordered Eating
- Eumenorrhea
- Optimal Bone Health

- Low Energy Availability with or without an Eating Disorder
- Functional Hypothalamic Amenorrhea
- Osteoporosis
- Subclinical Menstrual Disorders
- Low BMD

(Intermountain Healthcare)
Energy Availability Defined

• Amount of dietary energy remaining for other body functions after exercise training

• Dietary energy intake (EI) – exercise energy expenditure (EEE) normalized to fat-free mass (FFM)
  – \( EA = (EI - EEE)/FFM, \text{ kcal/kg FFM/day} \)

• Example:
  – Dietary energy intake of 2000 kcal/day
  – Exercise energy expenditure of 600 kcal/day
  – Fat-free mass of 51 kg

\[ EA = (2000 - 600)/51 = 27.5 \text{ kcal/kg FFM/day} \]
Exercise Energy Expenditure = \text{MET} \times \text{Weight (kg)} \times \text{Duration (hrs)}

Please note that weight is expressed in kilograms (kg). The conversion factor of pounds to kilograms is 0.45; that is, a person weighing 100 lbs. weighs 45 kg. Also, note that duration is in hours, and not in minutes. It is important that people are honest about the time they really spent exercising. Water breaks or stretching should not be counted as exercise!

<table>
<thead>
<tr>
<th>Activity</th>
<th>MET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking, 2.8-3.2 mph, level, moderate pace</td>
<td>3.0</td>
</tr>
<tr>
<td>Gymnastics</td>
<td>4.0</td>
</tr>
<tr>
<td>Dancing, ballet, jazz, tap, modern</td>
<td>4.8</td>
</tr>
<tr>
<td>Walking, 4 mph, level, brisk pace</td>
<td>5.0</td>
</tr>
<tr>
<td>Cross-country skiing (not racing)</td>
<td>6.0</td>
</tr>
<tr>
<td>Dancing, Aerobic</td>
<td>6.5</td>
</tr>
<tr>
<td>Tennis, Backpacking, Ice Skating, Swimming freestyle (moderate pace)</td>
<td>7.0</td>
</tr>
<tr>
<td>Basketball, volleyball (competitively)</td>
<td>8.0</td>
</tr>
<tr>
<td>Bicycling, 12-13.9 mph, moderate effort</td>
<td>8.0</td>
</tr>
<tr>
<td>Bicycling, 13-15.9 mph, vigorous effort</td>
<td>10.0</td>
</tr>
<tr>
<td>Running, 6 mph (10 min mile)</td>
<td>10.0</td>
</tr>
<tr>
<td>Soccer (competitively)</td>
<td>10.0</td>
</tr>
<tr>
<td>Running, 8 mph (7.5 min mile)</td>
<td>13.5</td>
</tr>
</tbody>
</table>

Http://prevention.sph.sc.edu/tools/docs/docs/documents_compendium.pdf
Exercise Energy Expenditure

EEE = MET X Wgt (kg) X Duration (hours)

60 kg Female soccer player; soccer practice for 2 hours; 30 minutes of running at 10 min miles

Running = 10 MET  Soccer = 10 MET

\[
10 \times 60 \times 2 = 1200 \text{ kcal} \\
10 \times 60 \times .5 = 300 \text{ kcal}
\]

EEE = 1500 kcal
Prevalence of the Triad

- Review – ED/DE: 0-19% male athletes, 6-45% female athletes*
- 425 female college athletes, 7 Universities**
  - 3.3 % reported a diagnosis of anorexia nervosa
  - 2.3 % reported a diagnosis of bulimia nervosa
  - 15.2 – 32.4 % scored “at-risk” for EDO
  - 31 % reported menstrual irregularity
  - 34.3 % reported bone injuries during collegiate career

Prevalence of the Triad in Dancers

• Lifetime prevalence of any eating disorder (ED) was 50% in professional dancers.

• Point prevalence of ED ranged 13.6% - 26.5% in young student dancers.

• Prevalence of menstrual disturbance varied
  – 10.2% for secondary amenorrhea
  – 70% for lifetime history of menstrual disturbance

• 32% of university-level dancers developed a menstrual disturbance during their freshman year.

• Prevalence of low bone mineral density
  – 10% - 46.5% for low bone mineral density/osteopenia
  – 8.9% - 23.8% for osteoporosis

Hincapie. Arch Phys Med Rehab 2010
The brain's job is to protect the self.
LOW STORED ENERGY (aka BMI/wgt)

LOW ENERGY INTAKE (aka diet)

HIGH ENERGY EXPENDITURE (aka training)
Energy Intake (Diet/EI)

Stored Energy (BMI/wgt/FFM)

Energy Expenditure (Training/EEE)

EA = (EI – EEE)/FFM → kcal/kg FFM/day

No periods
EA = (EI - EEE)/FFM → kcal/kg FFM/day

ENERGY INTAKE (Diet/EI)

STORED ENERGY (BMI/wgt/FFM)

ENERGY EXPENDITURE (Training/EEE)

NO PERIODS
ENERGY INTAKE
\(\text{(Diet/EI)}\)

STORED ENERGY
\(\text{(BMI/wgt/FFM)}\)

ENERGY EXPENDITURE
\(\text{(Training/EEE)}\)

\[
EA = \frac{\text{(EI} - \text{EEE})}{\text{FFM}} \rightarrow \text{kcal/kg FFM/day}
\]

NO PERIODS
28 day regular menstrual cycle

Amenorrheic

GENETICS/UNIQUE BIOLOGY
3 periods/yr
Normal BMD

3 periods/yr
Low BMD

GENETICS/
UNIQUE BIOLOGY
Risk Factors for Female Athlete Triad

• 1\textsuperscript{st} menstrual period after age 15
• Infrequent menstrual periods (< 9 periods/yr)
• Low body mass index-BMI (< 18.5 kg/m\textsuperscript{2})
  – 5’6” – 115 lbs → BMI 18.6
  – 5’4” – 108 lbs → BMI 18.4
  – 5’2” – 101 lbs → BMI 18.5
• Disordered eating or an eating disorder
  – Restrictive eating
  – Binge/purge behaviors
  – Excessive training
Other Risk Factors to Consider

• (+) Family history of osteoporosis
• (+) Family history of eating disorder
• Vegetarianism (*gateway to anorexia*)
• History of low calcium intake (lactose intolerance)
• Low vitamin D level
• Prior stress fracture(s)
• Co-existing personality factors (perfectionism) and/or mental health disorders (e.g., anxiety, obsessive compulsive disorder)
• Participation in weight-class or weight-sensitive sport
Screening for the Female Athlete Triad

- 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)?
Optimal screening for the Triad occurs during the PPE.
(+) Screening $\rightarrow$ Definitive Diagnosis*

- Physician
  - Disordered eating
  - Eating disorder
  - Cause of amenorrhea
  - Evaluate bone health
- Dietitian
  - Nutritional intake
- Mental Health Professional *if indicated*

**Z-score** = Match to age-group Peers

**T-score** = Match to women at peak bone mass

* Applies to females premenopausal women > 20 years of age
Treatment: Low Energy Availability

• Athletes with disordered eating/eating disorder
  – Multidisciplinary team treatment with physician, dietitian and mental health professional

• Athletes with low energy availability, but no evidence of disordered eating
  – Dietitian

GOAL: Optimize energy intake and stored energy to result in normal menstruation
<table>
<thead>
<tr>
<th>Weight control behavior</th>
<th>Physiological &amp; health effects</th>
<th>Effect on performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting/starvation</td>
<td>Energy &amp; nutrient deficiency, glycogen depletion, loss of lean body mass, decrease in RMR, reduced BMD</td>
<td>Poor exercise performance due to general weakness, reduced ability to cope with pressure, decreased muscle force, and increased susceptibility for disease &amp; injuries</td>
</tr>
<tr>
<td>Diet pills</td>
<td>May suppress appetite and slight increase in RMR. May induce rapid HR, anxiety, nervousness, inability to sleep, dehydration. Any weight loss quickly regained once use is discontinued</td>
<td>Indirectly impairs performance and may be classified as doping</td>
</tr>
<tr>
<td>Laxatives or enemas</td>
<td>Weight loss primarily water weight and is regained once use discontinued. Dehydration &amp; electrolyte imbalances, constipation, cathartic colon and steatorrhea</td>
<td>May affect concentration &amp; hydration status. May be addictive and athlete can develop resistance, requiring larger doses to produce same effect</td>
</tr>
<tr>
<td>Diuretics</td>
<td>Wt loss primarily water weight and is quickly regained once use discontinued. Dehydration and electrolyte imbalances possible</td>
<td>Poor performance and classified as doping</td>
</tr>
<tr>
<td>Self-induced vomiting</td>
<td>Large body water losses can lead to dehydration and electrolyte imbalances. GI problems including esophagitis, esophageal perforation &amp; ulcers</td>
<td>May lead to electrolyte imbalance. Largely ineffective at promoting weight (body fat) loss</td>
</tr>
<tr>
<td>Saunas</td>
<td>Dehydration and electrolyte imbalances can occur in extreme cases</td>
<td>Wt loss primarily water wt and quickly regained once fluids are replaced</td>
</tr>
<tr>
<td>Excessive exercise</td>
<td>If combined with low EA increases risk of chronic fatigue, illness, overuse, injury, menstrual dysfunction</td>
<td>Experience the effect of lack of recovery</td>
</tr>
</tbody>
</table>

From Sundgot-Borgen et al. 2013 & Beals 2004
Role of the Dietitian: The Approach

• Nutrition Assessment:
  – Age, height, weight
  – Body composition
  – Medications/supplements
  – Menstrual function
  – Injury history – stress fractures?
  – 24 hour recall
  – Training schedule – intensity, frequency, volume
  – EA
### Assessment of Needs: Energy, CHO, Protein

#### Name:

<table>
<thead>
<tr>
<th>Weight (lbs)</th>
<th>Weight - Kg</th>
<th>Age (years)</th>
<th>Height (in)</th>
<th>Height - cm</th>
<th>Height - m</th>
<th>LBM</th>
<th>Body Fat %</th>
<th>IBW</th>
<th>%IBW</th>
</tr>
</thead>
<tbody>
<tr>
<td>110</td>
<td>50.000</td>
<td>17</td>
<td>64.5</td>
<td>163.83</td>
<td>1.6383</td>
<td>42.60</td>
<td>14.8</td>
<td>120</td>
<td>0.91666667</td>
</tr>
</tbody>
</table>

#### BMI

18.62872544

1. Harris Benedict - Females: BEE = 655.1 + 9.6W + 1.9H - 4.7A  
   Males: 66.47 + 13.75W + 5H - 6.76A  
   REE Estimate: M=0.45kcal/lb/hr; F=0.40kcal/lb/hr

<table>
<thead>
<tr>
<th>Harris Benedict</th>
<th>Rec 1.3-1.5</th>
<th>Mod 1.7-2.0</th>
<th>Intense 2.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1366.477</td>
<td>1584</td>
<td>2112</td>
<td>2640</td>
</tr>
</tbody>
</table>

Click on above cell to determine activity coefficient

2. DRI Energy Requirement Equation - Female: 354 * 6.91(age) + PA(9.38kg + 72.6m)  
   Males: EER = 662 - (9.53 x age) + PA(15.91 x wt + 539.6 * m)

<table>
<thead>
<tr>
<th>Activity Level</th>
<th>PAL</th>
<th>Multiples of BMR</th>
<th>PA Coefficient</th>
<th>PA Coefficient (M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sedentary</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Low Active</td>
<td>&gt;1.4</td>
<td>1.4</td>
<td>1.12</td>
<td>1.11</td>
</tr>
<tr>
<td>Active</td>
<td>&gt;1.6</td>
<td>1.6</td>
<td>1.27</td>
<td>1.25</td>
</tr>
<tr>
<td>Very Active</td>
<td>&gt;1.9</td>
<td>1.9</td>
<td>1.45</td>
<td>1.48</td>
</tr>
</tbody>
</table>

#### DRI Women

<table>
<thead>
<tr>
<th>DRI</th>
<th>CHO</th>
<th>g CHO</th>
<th>CHO Kcal</th>
<th>% EI (HB) F</th>
<th>% EI (HB) M</th>
<th>PRO</th>
<th>g PRO</th>
<th>PRO Kcal</th>
<th>% EI (HB) F</th>
<th>% EI (HB) M</th>
</tr>
</thead>
<tbody>
<tr>
<td>2092.824496</td>
<td>4/kg</td>
<td>200.00</td>
<td>800.00</td>
<td>45.03%</td>
<td>34.29%</td>
<td>0.8g/kg</td>
<td>40.00</td>
<td>160.00</td>
<td>9.01%</td>
<td>6.86%</td>
</tr>
<tr>
<td>2961.12225</td>
<td>5/kg</td>
<td>250.00</td>
<td>1000.00</td>
<td>56.29%</td>
<td>42.66%</td>
<td>0.9g/kg</td>
<td>45.00</td>
<td>180.00</td>
<td>10.13%</td>
<td>7.71%</td>
</tr>
</tbody>
</table>

#### DRI Men

<table>
<thead>
<tr>
<th>DRI</th>
<th>CHO</th>
<th>g CHO</th>
<th>CHO Kcal</th>
<th>% EI (HB) F</th>
<th>% EI (HB) M</th>
<th>PRO</th>
<th>g PRO</th>
<th>PRO Kcal</th>
<th>% EI (HB) F</th>
<th>% EI (HB) M</th>
</tr>
</thead>
<tbody>
<tr>
<td>1105.400</td>
<td>6/kg</td>
<td>400.00</td>
<td>1600.00</td>
<td>90.07%</td>
<td>68.58%</td>
<td>1.1g/kg</td>
<td>55.00</td>
<td>220.00</td>
<td>12.38%</td>
<td>9.45%</td>
</tr>
</tbody>
</table>

#### Owen

| Owen | 10g/kg | 500.00 | 2000.00 | 112.50% | 85.22% | 1.3g/kg | 65.00 | 260.00 | 14.64% | 11.14% |

#### Cunningham

| Cunningham | 1g/kg | 55.00 | 220.00 | 123.84% | 94.29% | 1.4g/kg | 70.00 | 280.00 | 15.76% | 12.00% |

| Cunningham | 2g/kg | 110.00 | 440.00 | 135.10% | 102.87% | 1.5g/kg | 75.00 | 300.00 | 16.80% | 12.86% |

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![Intermountain Healthcare logo](Intermountain Healthcare logo.png)
Role of the Dietitian

Nutrition Therapy:

– Role of nutrition:
  • Energy for ADL’s
  • Cognitive and emotional health
  • Immune health
  • Bone health
  • **Performance**

– *Food as Medicine*
Role of the Dietitian

Nutrition Therapy:

– Work towards 40-45 kcal/kg/FFM
– Practically: 300-500 kcal/day
– Extra snack!
  • PB & J
  • Clif bar + apple
  • 16 oz chocolate milk
  • 5% fat Greek yogurt + ½ c granola
  • Banana + 2 tbsp. peanut butter
  • ½ pint Ben & Jerry’s...
– Maybe: calcium supplement + vitamin, iron
Dietitian: Team Communication

Physician/medical provider:
• Weight/goal weight
• Lab work – nutrient deficiencies, bone density, REE, body composition
• Exercise
• Nutrition – dietary analysis, fluids
• Behaviors

Therapist:
• Support their work
• Recommendations/strategies
• What we’re working on
• Behaviors
Modified from Gambacciani, et al., Endocrinol 2003; 3 (1): 1
Summary

• Absence of menstruation is **NOT** a positive adaptation to training. It is a strategy to “protect the self” from further energy loss by turning off reproductive function (thereby preventing pregnancy)

• Amenorrhea and low bone mineral density as a consequence of low energy availability have a **STRONG** genetic component
Summary

• In athletes with eating disorders
  – Multidisciplinary treatment is essential
  – Consider pharmacologic management of co-existing mental health disorders (depression, anxiety, obsessive compulsive disorder)
  – Residential care is a poor prognostic factor for college athletic participation
Summary

• *What’s an athlete to do?*
  – Optimize dietary intake, training, recovery, and body composition to meet functional (sport performance + school performance + activities of daily living) demands and support health
2014 Female Athlete Triad Coalition Consensus Statement on Treatment and Return to Play of the Female Athlete Triad:
1st International Conference held in San Francisco, California, May 2012 and 2nd International Conference held in Indianapolis, Indiana, May 2013

Mary Jane De Souza,1 Aurelia Nathe,2 Elizabeth Joy,3 Madhusmita Misra,4 Nancy J Williams,1 Rebecca J Mallinson,1 Jenna C Gisles,3 Marion Olmsted,5 Marcia Goodson,7 Gordon Matheson,8 Expert Panel

ABSTRACT
The female Athlete Triad is a medical condition often observed in physically active girls and women, and involves three components: (1) low energy availability with or without disordered eating, (2) menstrual dysfunction and (3) low bone mineral density. Female athletes often present with one or more of the three Triad components, and an early intervention is essential to prevent its progression to serious endpoints that include clinical eating disorders, amenorrhea and osteoporosis. This consensus statement represents a set of recommendations developed following the 1st San Francisco, California, USA) and 2nd Indianapolis, Indiana, USA) International Symposia on the Female Athlete Triad. It is intended to provide clinical guidelines for physicians, athletic trainers and other healthcare providers for the screening, diagnosis and treatment of the female Athlete Triad and to provide clear recommendations for return to play. The 2014 Female Athlete Triad Coalition Consensus Statement on Treatment and Return to Play of the Female Athlete Triad expert panel has proposed a risk stratification point system that takes into account magnitude of risk to assist the physician in decision-making regarding sport participation, clearance and return to play. Guidelines are offered for clearance categories management by a multidisciplinary team and implementation of treatment contracts. This consensus paper has been endorsed by the Female Athlete Triad Coalition and International Consortium of leading Triad researchers, physicians and other healthcare professionals, the American College of Sports Medicine and the American Medical Society for Sports Medicine.

INTRODUCTION
This consensus statement is the first of its kind and represents a set of recommendations developed following the 1st San Francisco, California, USA and 2nd Indianapolis, Indiana, USA) International Consensus Meetings on the Female Athlete Triad (Triad). It is intended to provide clinical guidelines for physicians, athletic trainers and other healthcare providers for the treatment of the Triad and to provide clear recommendations for return to play. The Consensus recommendations herein were developed using a consensus-based approach similar to that utilised by the International Consensus Statement on Concussion.1 This consensus statement will serve as a supplement to the American College of Sports Medicine (ACSM) revised position stand on the Triad published in 2007. The 2007 position stand provided the scientific evidence documenting the existence and causes of the Triad.7 Practical information for athletes, coaches, parents and a list of resources and helpful information on the Triad can be readily viewed on the Female Athlete Triad Coalition website at http://www.femaleathletetriad.org. This consensus paper has been endorsed by The Female Athlete Triad Coalition, an International Consortium of leading Triad researchers, physicians and other healthcare professionals, the American College of Sports Medicine and the American Medical Society for Sports Medicine.

While agreement exists concerning the primary guidelines and recommendations communicated in this document, the authors acknowledge that the underlying levels of scientific evidence regarding some elements of the Triad, particularly related to treatment strategies, are still evolving. The treatment guidelines and return-to-play recommendations proposed herein are based on the published literature available to date, with consensus from the International team of experts convened at the two meetings. As such, management and return-to-play decisions should be based on informed clinical judgment keeping in mind individual risk factors and concerns as described herein.

DEFINITION OF THE FEMALE ATHLETE TRIAD MODEL:
The Triad is a medical condition often observed in physically active girls and women, and involves any one of the three components: (1) low energy availability (LEA) with or without disordered eating (DE), (2) menstrual dysfunction and (3) low bone mineral density (BMD)" (see figure 1). Female athletes often present with one or more of the three Triad components, and an early intervention is essential to prevent its progression to serious endpoints that include clinical eating disorders (EDs), amenorrhea and osteoporosis.3 In 1997, the Task Force on Women’s Issues of ACSM published the first Triad position stand which described a syndrome of three distinct but
References


• Beals, KA Disordered eating among athletes: a comprehensive guide for health professionals. Champaign, IL: Human Kinetics, 2004