Athletes At Risk: The Female Athlete Triad

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“No person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance...”

- Title IX of the Educational Assistance Act (1972)

Female HS Athletes

3,267,664

1111%

294,015
Female Athlete Triad

- Condition recognized in athletes since 1970's
- ACSM Symposium (1981) “Menstrual Irregularities in Female Athletes”
- 1st described officially by ACSM who coined the term ‘Female Athlete Triad’ (1993)

Female Athlete Triad

- Coalition's Consensus Paper endorsed by ACSM, American Medical Society for Sports Medicine, American Bone Health Alliance, NCAA

“Female Athlete Triad”

- Disordered Eating
- Osteoporosis
- Amenorrhea
Female Athlete Triad Coalition (2014)

“Female Athlete Triad”

Lower weight believed to optimize performance/endurance

Emphasis on lean body mass

Lower weight believed to optimize performance/endurance

Weight classifications

Sports at Risk:

Disordered Eating
Disordered Eating

Definition: Caloric Intake is **INADEQUATE** for Caloric Expenditure

- **Unintentional** energy deficit
  - Intense training, overly committed

- **Intentional** energy deficit
  - Effort to enhance looks or improve performance

Most do not meet DSM-IV criteria for Anorexia or Bulimia

Prevalence:

- Adult Athletes: 20% (females); 8% (males)
- Adolescent Athletes: 13% (females); 3% (males)

Disordered Eating Continuum

- Some Caloric Restriction
- Occasional Purging Behavior
- Anorexia Nervosa
- Bulimia Nervosa

Disordered Eating Contributing Factors

- Optimizing Performance
- Western Culture
- Social Factors
- Unhealthy Family Dynamics
- Low Self Esteem
- Psych Factors
- Personality Traits
- Obsessive Compulsive
- Perfectionism
Disordered Eating: Differential Diagnosis

- Depression
- Mood disorders
- Overtraining syndrome
- Anorexia or Bulimia Nervosa
- Neoplasm
- Systemic Illness
- Sexual, physical, substance abuse

Disordered Eating Consequences

**Impaired Athletic Performance**
- ↓ endurance
- ↓ strength
- ↓ run time, speed
- ↓ concentration
- ↑↑ risk of injury

**Endocrine**
- Menstrual dysfunction

**Psychological**
- Depression

**Metabolic**
- Fluid & electrolyte imbalances

Amenorrhea
Amenorrhea

Primary Amenorrhea
- Absence of menses by age 16

Secondary Amenorrhea
- Absence of 3-6 consecutive cycles
- Fewer than 3 cycles/yr

Oligomenorrhea
- Cycles longer than 35 days

Amenorrhea Epidemiology

Prevalence of Amenorrhea

General female population: 5%
Adult female athletes: up to 66%

Prevalence of Amenorrhea in adolescent females is **not known**

Amenorrhea Pathophysiology

Previously thought women had to maintain certain body fat to cycle → amenorrhea due to ↓ body mass or ↓ adipose stores

This is a **COMMON** occurrence, but is it **NORMAL**?

Recent studies suggest **energy availability** is at root of the problem

Overall caloric deficiency
Imbalance of macronutrient composition

Energy deficiency causes a **hypometabolic state**
Amenorrhea: Differential Diagnosis

- Pregnancy
- Pituitary tumor: prolactinoma
- Thyroid dysfunction
- Polycystic ovaries
- Premature ovarian failure

Osteoporosis: In general, caused by estrogen deficiency in women. Bone loss accelerates after menopause. Younger women who stop menstruating also have compromised bone density. Premature bone loss

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  - Bone loss accelerates after menopause
  - Younger women who stop menstruating also have compromised bone density

Inadequate bone formation

- Low bone mass
- Microarchitectural deterioration
Osteoporosis Pathophysiology

Estrogen maintains bone mass and slows bone resorption

Directly affects osteoblasts to increase cell proliferation

Decreased circulating estrogen leads to inadequate bone formation

Osteoporosis

Hypoestrogenic state leads to partially irreversible bone density loss

60% of peak bone mass acquired during adolescence

Females achieve peak bone density by age 20

If amenorrheic during these critical bone growing years, will NEVER get that bone density back, even after resuming menses

Osteoporosis Epidemiology

Prevalence in adult & adolescent athletes unknown

Amenorrheic adolescents have lower BMD than eumenorrheic adolescents

Those with delayed menarche and low weight during adolescence have lowest BMD

Osteoporosis, nutritional deficiencies, & delayed menarche increase the risk of stress fractures
Osteoporosis: Differential Diagnosis

- Skeletal dysplasia
- Juvenile osteoporosis
- Hemoglobinopathy
- Endocrine disorders (hyperthyroidism, hyperparathyroidism, DM)
- Cushing syndrome
- Medications (steroids, heparin, dilantin)
- Scurvy

Disordered Eating

OSTEOPOROSIS

AMENORRHEA

Female Athlete Triad

Medical College of Wisconsin Women’s Sports Medicine and Cardiovascular Research Center study:

- When post-menopausal women stop having their period, it significantly ↑ their risk of having cardiovascular disease
- Loss of blood vessel dilation is one of the earliest manifestations of CV disease in post-menopausal women
Female Athlete Triad-Tetrad?

- Women and girls with the Triad have the same steroid and hormonal profile as post-menopausal women.
- Testing on college level athletes revealed that those who had the Triad also had the early vascular change that is a precursor to C-V disease.
- Lobbying to change the name to the Female Athlete Tetrad to encompass these C-V ramifications.

Relative Energy Deficiency In Sport (RED-S)

- "To more accurately describe the clinical syndrome originally known as the Female Athlete Triad, the IOC introduced a more comprehensive, broader term: Relative Energy Deficiency in Sport (RED-S)."
- "The syndrome of RED-S refers to impaired physiological functioning caused by relative energy deficiency, and includes but is not limited to impairments of metabolic rate, menstrual function, bone health, immunity, protein synthesis, and cardiovascular health."
- "Although the literature on low EA has focused on female athletes, it has also been reported to occur in male athletes."

Relative Energy Deficiency In Sport (RED-S)

- "Although the literature on low EA has focused on female athletes, it has also been reported to occur in male athletes."
Potential Performance Effects of RED-S

Screening (DC’s too)

Pre-participation History & Physical

- Age of menarche, regularity, LMP
- Diet/exercise patterns
- Weight fluctuations
- Body composition goals
- Previous injuries, stress fractures
- Medicines, supplements

Must be very literal and redundant!

Screening: Typical Characteristics

- Perfectionist personality
- Competitive athlete
- Self-critical behavior
- Low self-esteem
- Depressive symptoms
- Achieving or maintaining low body weight/lean physique
- Stress fractures without significant change in training
- Multiple or recurrent stress fractures
- Adolescent or young adult
Physical Exam

General appearance:
- Cachetic/tired/pale
- Height/weight/BMI low
- Bradycardia and Hypotension
- Hair falling out
- Lanugo
- Yellow skin

Signs of energy deficiency:
- Dry skin
- Brittle nails
- Cool extremities

Signs of binging/purging:
- Calluses on middle/ring finger
- Dental enamel erosion
- Parotid gland enlargement

Signs of systemic illness:
- Thyroid enlargement
- Hirsutism

Evaluation

Always obtain pregnancy test if amenorrheic

Other tests as indicated
- TSH, prolactin, FSH
- CBC/LFTs
- DHEA, 17-hydroxyprogesterone, testosterone

Consider DEXA scan

Consider EKG
Treatment

**Multidisciplinary approach**

- Team Physician (this can be you)
- Sports nutritionist
- Psychiatrist/psychologist
- Parents
- Coach
- Athletic trainer
- Physical therapist

**Long-term treatment usually required**

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**Treatment**

- **Restore positive or at least neutral energy balance**
  - ↓ exercise intensity 10-20%
  - ↑ calories
  - Reasonable weight gain .5-1 lb/wk

- **Resumption of adequate nutrition** usually resolves menstrual irregularities

- **Calcium:** 1200 mg daily (1500 mg if amenorrhea)
- **Vit D:** 1500-200 IU/day

- **Nutritionist AND Psychological Counseling for disordered eating**

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**Treatment: Timeframes**

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*Female Athlete Triad Coalition (2014)*
Cumulative Risk Assessment

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Low Risk</th>
<th>Moderate Risk</th>
<th>High Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low BMI</td>
<td>Low (&lt; 18.5)</td>
<td>&lt; 19.5</td>
<td>≤ 20.0</td>
</tr>
<tr>
<td>Low BMIF</td>
<td>Low (&lt; 20.0)</td>
<td>&lt; 23.0</td>
<td>≤ 25.0</td>
</tr>
<tr>
<td>Reduced Muscle Mass</td>
<td>Low (&lt; 75% of expected)</td>
<td>&lt; 80%</td>
<td>≤ 85%</td>
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<tr>
<td>Body Mass Index</td>
<td>Low (&lt; 20.0)</td>
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Return To Play Guidelines:

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<th>High Risk</th>
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<tr>
<td>0 – 1 points</td>
<td>Provisional Clearance</td>
<td>Limited Clearance</td>
<td>Restricted from Training and Competition</td>
</tr>
<tr>
<td>2 – 5 points</td>
<td>Provisional Clearance</td>
<td>Limited Clearance</td>
<td>Restricted from Training and Competition</td>
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<tr>
<td>≥ 6 points</td>
<td>Provisional Clearance</td>
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Female Athlete Triad Coalition (2014)
**Recommend Using Written Contract**

- **Athletes in the moderate-risk and high-risk categories** should receive a written contract that is reviewed and presented to them by the team physician.

- The **goal of the written contract** is to specify the criteria necessary for ongoing or future clearance and RTP for the female athlete with the multidisciplinary team members and to ensure a shared understanding of how the clinical status of the athlete will be followed with each member of the multidisciplinary team.

- The **team physician coordinates** the treatment goals with each multidisciplinary team member, includes the specific recommendations and the requested frequency of visits and expectations for each team member.
BEWARE!

Many athletes are **resistant to treatment, especially if the disordered eating is intentional**

Rigid, demanding, or uncaring doctor can cause patient to be more resistant to treatment

Must be gentle and understanding, yet firm and uncompromising

Pt may not be motivated, even if smiling in the office

Intentional Disordered Eating

Internet movement in favor of eating disorders

**Pro-ED:** any ED  **Pro-ana:** anorexia  **Pro-mia:** bulimia

Tips to fool doctors, parents, friends

Contain “thinspiration”- pics of thin models to provide inspiration

Intentional Disordered Eating: Tips to Fool Doctors

- Drink a lot of water before you go. A pint of water is about a pound.
- Practice meditation to control your heart rate.
- Put a little salt in each glass of water to raise your blood pressure for a short time.
- Dress warmly to hopefully retain enough heat that your temp will be normal.
- Big shoes or a giant belt, change in your pockets, coins in your bra add weight
- If your throat is sore from purging, make an obvious fuss about it; that way, he/she won’t be surprised to see redness and irritation.
- Lanugo is a dead give-away. The razor is your friend.

Source: cravingthin.weebly.com/hiding-it.html
Factors ↓ Prognosis

- Length of disorder/chronicity
- Age of patient (older ↓ prognosis)
- Failed prior treatment
- Hx of disturbed family relationships
- Poor individual adjustment
- Isolation, pressure, feeling uncared for
- Athletic identity (can’t broaden ID beyond life as athlete)
- Married (implies longer disease process)
- Correcting weight issues without addressing psych. issues

Preventive Measures

- Increased awareness & sensitivity to the problem are key
- National governing bodies looking at mandatory education for coaches
- Physician or trainer should monitor body composition/wt
  - ED can be exacerbated by pressure from coach to be a certain weight
- Teaching coaches/athletes that the best fueled athlete, not the thinnest, will be a better competitor
- Society needs to acknowledge and honor diversity of body size and shape

Preventive Measures

- Good early screening mechanisms
  - Pre-participation exams
  - Screening questionnaire
- Pre-season education of athletes
  - Emphasize that athletes can improve body composition, strength, endurance, energy level, mental focus, & ability to cope with stress by being fueled
- Education at an early age
  - Kids starting organized sports at 6-8 years of age
    - 80% of 10-year-old females fear being "fat"
    - Given our concerns over childhood obesity, is this a realistic fear?
Preventive Measures

Afflicted athletes talk to peers

Peer mentors on team

Community outreach programs
  - Educational & prevention lectures to people who deal with young student athletes
    - Coaches, Athletic Directors, School Nurses, Teachers, etc

References
- Froedtert & Medical College of Wisconsin Every Day Jan-April 2006.
- IOC Medical Commission. IOC Position Stand on The Female Athlete Triad.

Image Credits
- Female Athlete Collage: www.womenssportsfoundation.org
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