Female Athlete Triad

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Acknowledgements

- Current Sports Medicine Reports: 2014 Female Athlete Triad Coalition Consensus Statement on Treatment and Return to Play of the Female Athlete Triad
- American Family Physician: The Female Athlete Triad: Recommendations for Management

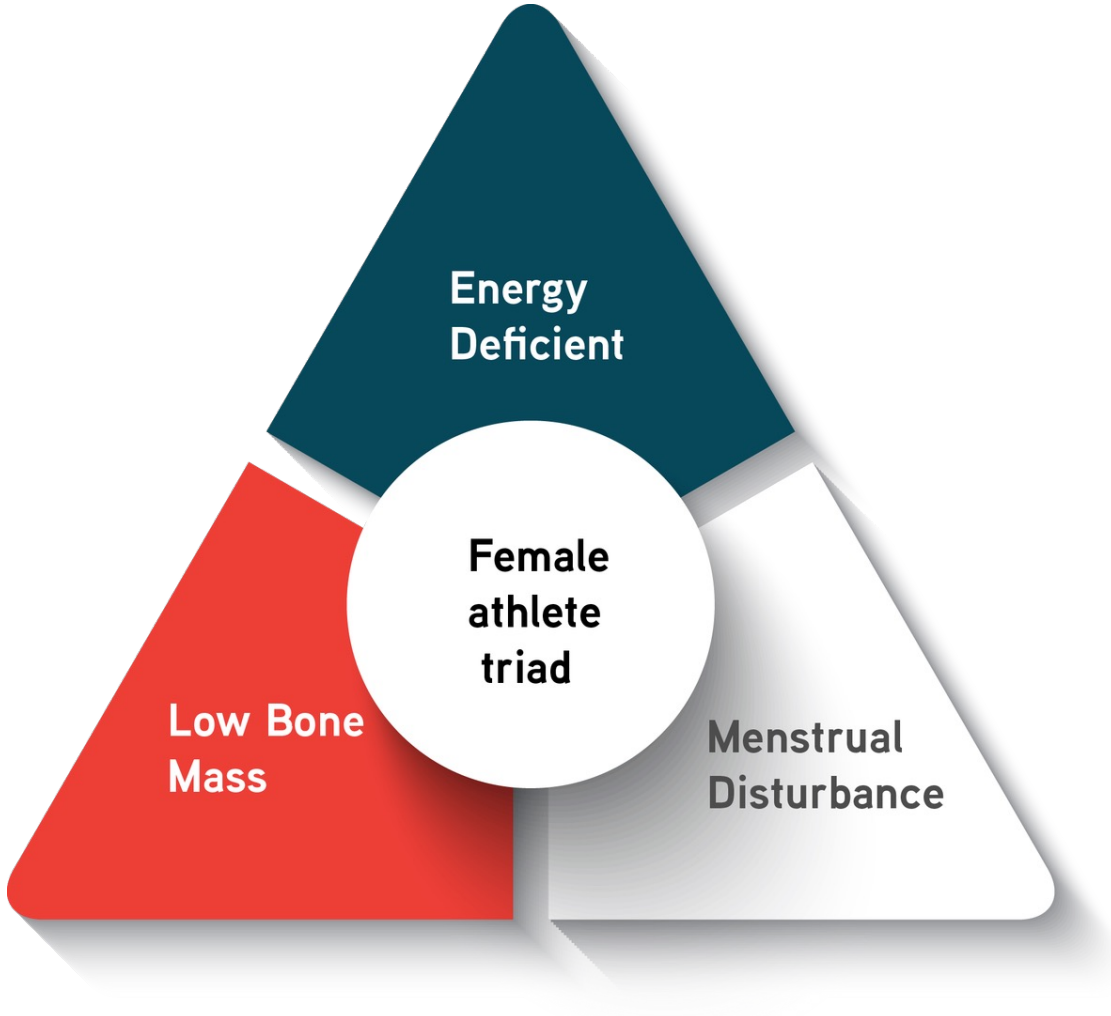
Objectives

- Define the female athlete triad
- Understand why the triad is harmful to an athlete and risk factors for the female athlete triad
- Become familiar with how to screen for the female athlete triad
- Introduce the diagnosis and treatment for the female athlete triad

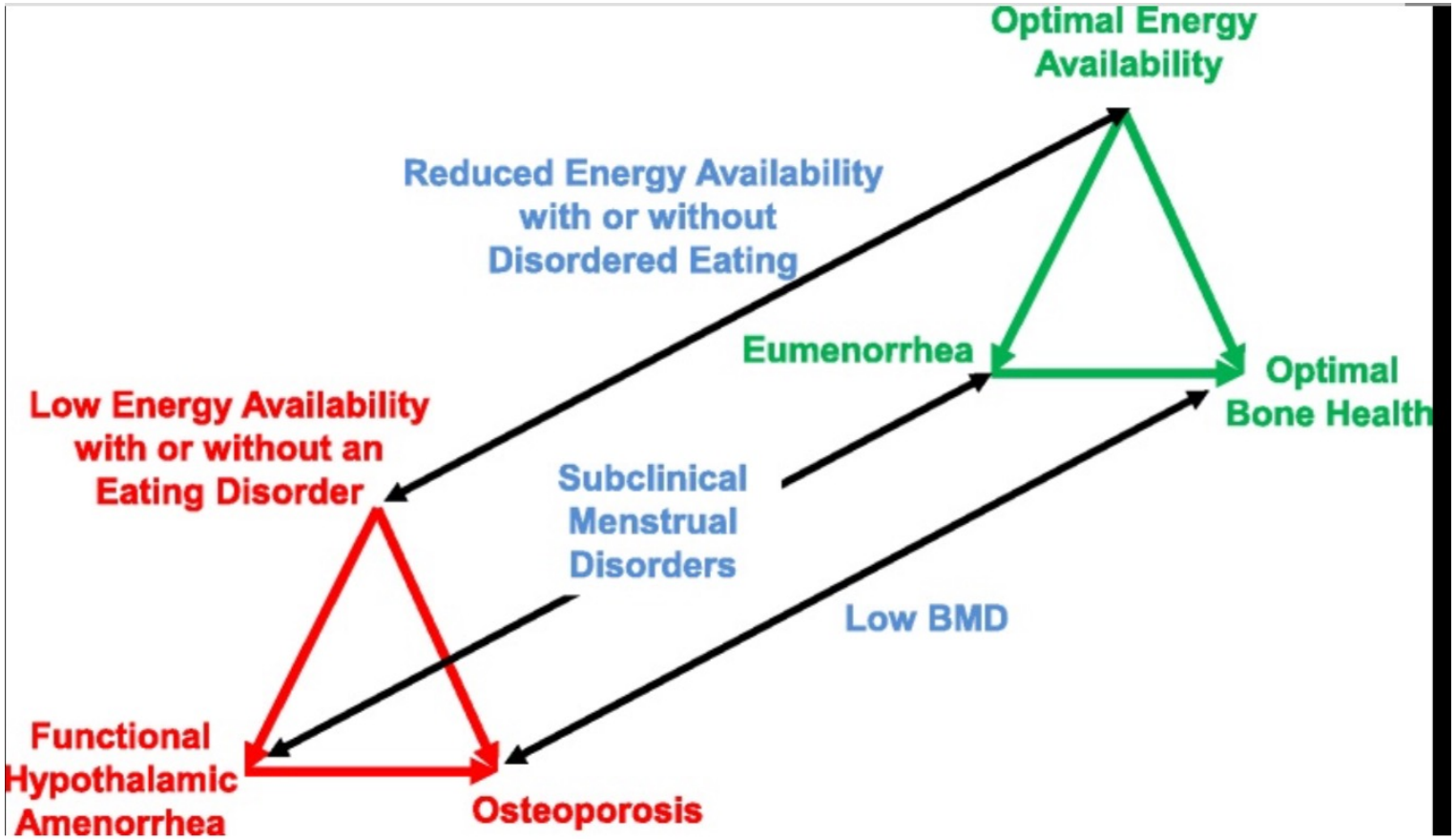
What is the Female Athletic Triad?

The interrelationship between energy availability, menstrual function, and bone density.

- It is a medical condition often observed in physically active females involving three interrelated components:
  1. low energy availability with or without disordered eating (lack of nutrition relative to caloric expenditure)
  2. Menstrual dysfunction
  3. Low Bone mineral Density (BMD)



Spectrums of the Triad



Epidemiology and those at greatest risk

- Athletes who participate in sports that emphasize leanness (e.g., “aesthetic” sports such as cheerleading, gymnastics, and dance) and endurance (e.g., long-distance running, swimming) are at greatest risk
- Data indicates that 36% of female high school athletes have low energy availability, 19% to 54% have menstrual irregularity, and 13% to 19% have low BMD.
- In aesthetic and endurance athletes, 10% to 15% have at least two components of the female athlete triad. The presence of even one component is concerning and should warrant further investigation.

Risk Factors for the female triad

- History of dieting
- Pressure to lose weight
- Comments about weight and eating: can occur from coaches, parents and teammates
- Dieting history
- Depression history
- Overtraining
- History of stress fractures and/or recurrent injury

Why is the triad harmful to female athletes?

- Lower energy availability plays a role in inducing exercise-associated menstrual disturbances
- Low energy availability can have negative musculoskeletal effects independent of estrogen levels
- Bone stress injuries are more common in female athletes with menstrual irregularities and/or low bone mineral density
- Low estrogen levels associated with prolonged reproductive suppression can negatively impact musculoskeletal and cardiovascular health

Immediate and long-term health consequences:

TABLE 1

Health Consequences of the Female Athlete Triad

Immediate
Increased musculoskeletal injuries (e.g., sprains, strains, tendonitis)
Infertility (reversible if energy availability and menses normalize)
Poor athletic performance due to low energy availability
Stress fractures
Long term
Infertility (if energy availability and menses do not normalize)
Lifelong eating disorder or disordered eating
Low bone mineral density/ osteoporosis
Psychiatric disease

Information from references 1 and 2.

Role of estrogen and nutrition on bone

- Estrogen inhibits bone resorption and stimulates bone formation
- Inadequate nutrition including Ca and vitamin D deficiencies lead to bone resorption
- Important in our youth to screen since the largest accrual of bone mineral density occurs in adolescence and BMD peaks in late adolescence and early adulthood.

Screening: Early Detection of at-risk athletes is Critical

- Screening should be conducted for both high school and collegiate athletes at preparticipation physical evaluations (PPE).
- Recommended for athletes to undergo annual screening with the triad-specific questionnaire
- Existence of any one of the triad components should prompt more thorough investigation for the others

• 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, and 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 ED?
• Have you ever had a stress fracture?
• Have you ever been told you have low bone density (osteopenia or osteoporosis)?

Triad consensus panel screening questions.

Diagnosing Triad Conditions

Accurate diagnosis is dependent on a multidisciplinary approach

1. Physician
    - Determine if eating disorder or disordered eating is present
    - Determine the cause of amenorrhea
    - Evaluate bone health
2. Dietician
    - Help evaluate nutritional intake
3. Mental health professional if the athlete has disordered eating or a clinical eating disorder

The workup:

- Standard workup for amenorrhea is needed prior to diagnosing functional hypothalamic amenorrhea
- You want to exclude other causes of amenorrhea:
  - Pregnancy, prolactinoma, PCOS, premature ovarian failure and thyroid diseases
- ECG – especially for those with bradycardia
- Consider a DEXA in those with at least one high-risk criterion or at least two moderate risk criteria

Who Should Get DXA Scans for BMD Testing?

Indications for DXA testing in an athlete include the following:

- **≥1 "high-risk" triad risk factors**
  - ○ History of a *Diagnostic and Statistical Manual of Mental Disorders*, Fifth Edition (DSM-V) diagnosed ED ([6])
  - ○ BMI ≤17.5 $kg \cdot m^{-2}$, <85% estimated weight, or recent weight loss of ≥10% in 1 month
  - ○ Menarche at ≥16 years of age
  - ○ Currently experiencing or history of <6 menses over 12 months
  - ○ Two prior stress reactions/fractures, one high-risk stress reaction/fracture (Fig. 4), or a low-energy nontraumatic fracture ([16,72,85])
  - ○ Prior *z*-score of less than −2.0 (after at least 1 year from baseline DXA); or
- **≥2 "moderate-risk" triad risk factors**
  - ○ Currently experiencing or history of DE for 6 months or longer
  - ○ BMI between 17.5 and 18.5 $kg \cdot m^{-2}$, 85–90% estimated weight, or recent weight loss of 5% to 10% in 1 month
  - ○ Menarche between 15 and 16 years of age
  - ○ Currently experiencing or history of six to eight menses over 12 months
  - ○ One prior stress reaction/fracture
  - ○ Prior *z*-score between −1.0 and −2.0 (after at least a 1-year interval from baseline DXA)
- In addition, an athlete with history of ≥1 nonperipheral or ≥2 peripheral long bone traumatic fractures (nonstress) should be considered for DXA testing if there is 1 or more moderate- or high-risk triad risk factors (Fig. 4). This will depend on the likelihood of fracture, given the magnitude of the trauma (low or high impact) and age at which the fracture occurred. Athletes on medications for 6 months or longer that may impact bone (such as depot medroxyprogesterone acetate, oral prednisone, and others) ([106]), also should be considered for DXA testing.

Treatment

- Non pharmacologic management is first-line therapy and the use of multidisciplinary team is recommended (dietician +/- mental health professional)
- Therapeutic goals: increased energy availability, weight gain, and resumption of normal menses
- Pharmacologic considerations:
  - For osteoporosis - consider treatment if after 1 year, new fractures occur during the nonpharmacological treatment
  - Hormone replacement therapy:
    - Transdermal estrogen patch with cyclic progesterone (for those 16-21 yo)
    - Nuvaring
    - Birth control pills

Clearance and Return to Play: Cumulative Risk Assessment and Medical Risk Stratification

Risk Factors	Magnitude of Risk Low Risk = 0 points each	Moderate Risk = 1 point each	High Risk = 2 points each
Low EA with or without DE/ED	☐ No dietary restriction	☐ Some dietary restriction‡; current/past history of DE;	☐ Meets DSM V criteria for ED*
Low BMI	☐ BMI ≥ 18.5 **or** ≥ 90% EW** or weight stable	☐ BMI 17.5 < 18.5 **or** < 90% EW **or** 5 to < 10% weight loss/month	☐ BMI ≤17.5 **or** < 85% EW **or** ≥ 10% weight loss/month
Delayed Menarche	☐ Menarche < 15 years	☐ Menarche 15 to < 16 years	☐ Menarche ≥16 years
Oligomenorrhea and/or Amenorrhea	☐ > 9 menses in 12 months*	☐ 6-9 menses in 12 months*	☐ < 6 menses in 12 months*
Low BMD	☐ Z-score ≥ -1.0	☐ Z-score -1.0*** < - 2.0	☐ Z-score ≤ -2.0
Stress Reaction/Fracture	☐ None	☐ 1	☐ ≥2; ≥ 1 high risk or of trabecular bone sites†
Cumulative Risk (total each column, then add for total score)	**____ points +**	**____ points +**	**____ points = ____Total Score**

	Cumulative Risk Score*	Low Risk	Moderate Risk	High Risk
Full Clearance	0 – 1 point	☐		
Provisional/Limited Clearance	2 – 5 points		☐ Provisional Clearance ☐ Limited Clearance	
Restricted from Training and Competition	≥ 6 points			☐ Restricted from Training/ Competition-Provisional ☐ Disqualified

The End

“Family physicians are well positioned to educate patients, families, and coaches about the female athlete triad during preparticipation examinations and well-woman visits. Family physicians are often the first point of contact for women with amenorrhea and musculoskeletal injuries, both of which are associated with the female athlete triad. Although the benefits of regular exercise far outweigh the risks, the female athlete triad may negatively affect a significant number of female athletes. Family physicians can help change the culture in sports through improved detection of this disorder and educating patients and communities.”

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