Menstrual Dysfunction: A screening for all female athletes

Julie Young, MA ATC PES
Conflict of Interest

No Conflict

- The views expressed in these slides and the today’s discussion are mine
- My views may not be the same as the views of my company’s clients or my colleagues
- Participants must use discretion when using the information contained in this presentation
Objectives

• Be able to describe the prevalence of menstrual dysfunction (and why it’s important)
• Be able to explain how menstrual dysfunction leads to increased injury risk and prolonged recovery.
• Evaluate females for menstrual dysfunction and make recommendations for farther assessment and treatments as appropriate.
Case study

• 16 year old softball pitcher
• Comes in for back pain
• No previous injuries
• Hasn’t increased her training recently
• You don’t know her BMI, but…
Case Study

- 18 year old cross country runner
- Comes in for vague hip pain
- Hx of 4th metatarsal and tibial stress fractures
- Has been increasing her ‘personal workouts’ to prepare for collegiate athletics
- Don’t know her BMI, but…..
Who do you screen for menstrual dysfunction as a part of the female athlete triad?
Female Athlete Triad

• Historic Components
  – Osteoporosis
  – Ammenorhea (>3 missed periods in a row)
  – Eating disorder
    • Anorexia
    • Bulimia
Female Athlete Triad

- Historic Components
- Osteoporosis
- Amenorrhea (>3 missed periods in a row)
- Eating disorder
  - Anorexia
  - Bullema

- 1-4% of collegiate female athletes met these criteria
- By this time, successful intervention is difficult
The Female Athlete Triad

• Defined by the ACSM as a combination of three conditions:
  – Low energy availability (with or without disordered eating)
  – Menstrual dysfunction
  – Altered bone mineral density

• Low energy availability underlies the three interrelated conditions of the Triad.
  = Energy in - RMR – activity

• Those with one component of the Triad are at HIGH RISK for developing the others

De Souza 2014 BJSM
Relationship of Components

Female Athlete Triad Spectrums

Optimal Energy Availability

Reduced Energy Availability with or without Disordered Eating

Low Energy Availability with or without an Eating Disorder

Eumenorrhea

Subclinical Menstrual Disorders

Optimal Bone Health

Low BMD

Functional Hypothalamic Amenorrhea

Osteoporosis

Low BMD

Subclinical Menstrual Disorders

Optimal Bone Health

Eumenorrhea

Reduced Energy Availability with or without Disordered Eating

Low Energy Availability with or without an Eating Disorder

Functional Hypothalamic Amenorrhea

Osteoporosis
The Female Athlete Triad: Prevalence

- Difficult to assess as different clinicians use different screening methods

- High school
  - Disordered eating 18-36%
  - Menstrual dysfunction 19-54%
  - Decreased BMD 14-22%

- College
  - Disordered eating 15-62%
  - Menstrual dysfunction 25-36%
  - Decreased BMD 10%

- Professional
  - Disordered eating
  - Menstrual dysfunction 44-69%
  - Decreased BMD 22-50%

78% of high school athletes have at least one component!  
Hoch 2009 CJSM
Let’s talk about each component in turn...
Menstrual Dysfunction

• **Definition:**
  – **Primary Amenorrhea**
    • Delayed menarche until age 14 without the development of secondary sexual characteristics
  – **Secondary Amenorrhea**
    • Absence of menstruation for 3 consecutive months with previously regular menses
    • Absence of menstruation for 6-12 months if previously oligomenorrheic
  – **Oligomenorrhea***
    – Menstrual cycles occurring > 35 days apart
    – Less than 10 periods in 12 months

*can take up to 2 years post menarche for cycle to be regular
Menstrual Dysfunction - Consequences

• **Benefits**
  – No menses, no cramps, no mess

• **Consequences**
  – Decreased bone mass
    • Associated with amenorrhea >6mos
  – Increased musculoskeletal injuries and increased time to recovery
  – Increased risk of stress fractures (2-4X)
  – **Peak bone mass may be diminished**
  – Endothelial dysfunction and an unfavorable lipid profile
  – Infertility
Menstrual Dysfunction

• NOT related to BMI
• NOT related more to overuse injuries/stress fractures
• Relationship with lean-build sports participations less clear
  • Fischer et al 2014
Altered Bone Mineral Density

- Most bone development occurs during early childhood and adolescence
  
  • **Up to 60% of bone mass is acquired during adolescence**

- BMD peaks at the end of the second decade
- BMD starts declining at about age 30, at a rate of 0.3 - 1% per year (unless associated menstrual irregularity, then 1-2% per year)
- Weight bearing activities will increased BMD on dependent bones, but not NWB bones
BMD measurement scale

- Normal bone density
- Osteopenia (Low bone density)
- Osteoporosis

Nationwide Children's
When your child needs a hospital, everything matters.
Altered Bone Mineral Density

• Definitions:
  – “Low BMD”: Z-score < -1.0 in addition to a hx of nutritional deficiencies, hypoestrogenism, and/or stress fracture

• Diagnosed by DEXA scan
  – Lumbar spine
  – Whole body - head
  – Femoral neck? Forearm?
  – Not all DEXA’s are comparable

• CAUTION – BMD is a snapshot and adolescents who should be building bone may look “normal” even when losing bone mass
Altered Bone Mineral Density: Consequences

• Worry about premature loss of bone if the athlete has missed more than 6 consecutive periods
• Direct correlation between number of missed menses and incidence of stress fractures
• Although resumption of normal menses will regain some of lost BMD, they may never catch back up to controls
  – Dependent on timing, duration and severity of low energy availability
Low Energy Availability: Disordered Eating

- Anorexia nervosa
- Bulimia nervosa
- Disordered Eating NOS
- “Anorexia athletica”
- Inadvertent disordered eating

- 2-3% of female college athletes have anorexia or bulimia
- 15 – 62% of female college athletes report disordered eating

- \( >30 \text{Kcal/Kg Lean body mass} = \text{critical point in adult women} \)
Disordered Eating - Consequences

- Irritability/depression/anxiety
- Decreased concentration
- Loss of muscle mass
- Loss of bone mass
- Increased risk of musculoskeletal injuries
- Prolonged recovery from injury
- Decreased performance
- Menstrual irregularity
- GI disorders
- Parotid gland enlargement

- Fluid and electrolyte disturbances
  - Dehydration
  - Acid-base disturbance
  - Cardiac arrhythmia

- Death
**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 the result of RED-S*). Adapted from Constantini. 54
Endothelial Dysfunction

• Characterized by a shift of the endothelium toward reduced vasodilation, a proinflammatory state, and prothrombic properties.
• Flow-mediated dilation (FMD) of arteries is decreased.
• The severity of endothelial dysfunction has been shown to have prognostic value for cardiovascular events.
• Cardiovascular disease is the #1 cause of death in women.
Red-S and the Triad Knowledge and Screening in AT’s

• 98% of collegiate AT’s heard of the Triad
  – ONLY 13% IDENTIFIED ENERGY IMBALANCE
• 33% heard of RED-S
• 60% screened for eating disorders (75% of those did all athletes)
• 70% screened for MD
Energy Availability

• Females may unknowingly be at risk for components of the Triad
  – lack of knowledge of proper nutrition
  – not making time to eat adequately
  – appetite not sufficient for energy expenditure
Female Athlete Triad - Complications

• Knowledge of athletes:
  • 1/6 on questions about link between menses and bone health
    * lower knowledge associated with MD
    * High risk athletes answered more questions correctly

  Feldmann 2011 JPAG

• Culture of some athletics

• Knowledge of health care providers
  – Largely unknown
  – 19% of school nurses able to identify 3 components of Triad

  Fischer AN 2015
The Female Athlete Triad

• High prevalence + Costly consequences =
  • NEED FOR SCREENING

• Early intervention
Screening Opportunities

• Bone Health
  – DEXA
  – Serum vitamin D, calcium

• Energy availability
  – Questionnaires + exercise expenditure calculations + body comp/resting metabolic rate
  – Direct measurements

• CONS:
  • Expensive
  • Time consuming
  • Measurement accuracy
Screening Opportunities

• Menstrual Dysfunction is the easiest/cheapest/fastest screening for the Triad!
The Female Athlete Triad: Screening

- Optimal timing during PPEs or other annual exams
- Acute visits for fractures, weight change, disordered eating, amenorrhea, bradycardia, arrhythmia, depression, or gyne exams
- Women with one component of the Triad should be screened for the other components
  - Athletes with menstrual irregularity more likely to report disordered eating
  - Athletes with disordered eating more likely to report bone injuries

- Keep a high index of suspicion!!
The Female Athlete Triad: PPE

Disordered eating:

Menstrual dysfunction:

Altered bone mineral density:
Female Athlete Triad Screening - PPE

• Only 7% of athletes were classified with MD on PPE questions alone
  – Fischer 2014

• Brightpath (AAP endorsed questionnaire)
  – Only asks LMP and “regularity”
Additional Questions

• When was your most recent menstrual period?
• Hx of menstrual irregularities and amenorrhea
• Changes to cycle length or ‘heaviness’ during training
• Hx of stress fractures
• Are you taking any female hormones (estrogen, progesterone, birth control pills or items?)
• Have you ever been told that you have low bone mineral density (osteopenia or osteoporosis)?
• Recurrent and non-healing injuries/overtraining
Exercise related questions?

• Exercise Vital Sign
  – How many minutes a day in moderate/vigorous physical activity
  – How many days/week in MVPA
    • MINIMUM 150 min/week in adults
    • MINIMUM 420 min/week in those 6-18
    • Max for school aged children is # hours/week of their age
  – MVPA important
    • Might help tease out energy balance (intake vs. expenditure)
Other factors that may affect menstrual dysfunction

- h/o critical comments about eating or weight from parent, coach or teammate
- h/o depression
- h/o dieting
- personality factors (perfectionism, obsessiveness)
- pressure to lose weight and/or frequent weight cycling
- early start of sports specific training
- inappropriate coaching behavior
MD screening: It’s not perfect

• 18-20% adolescents use OCP’s
  – OCP’s mask MD

• RECALL BIAS
  – Only 56% of women remember the exact day

• Other Causes of MD
  – Hormonal imbalances
  – Medications (anti-epilieptics, anti-psychotics)
  – Polycystic Ovarian Syndrome
  – Fibroids or polyps

• Premenarchal females OR females >2 years post menarche
Relationship of Triad components

- Very few studies prospectively assess all three arms of the Triad
- Pilot data on female high school athletes
  - 56% fell below the 30Kcal/Kg lean body mass
  - 14% menstrual dysfunction (>35 days, <10 periods/12 mon)
  - 21% low BMD on DEXA
MD screening

• Great opportunity to educate
  – Primary Prevention
• Reason for screening
• Importance of menstrual tracking
Another Screening Method?
Another Screening Method?

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Cumulative Risk (total each column, then add for total score) | _____ points + | _____ points + | _____ points - _____ Total Score
Risk Factor Screening

• 29% of collegiate athletes identified as moderate or high risk
  – Greater proportion of lean build sports
  – Increased risk of prospective bone stress injuries
  – Affected bones were higher cancellous (pelvis, femur)
• ~25% had delayed menarche!!!
• ~25% had ammenorhea or oligomennorhea
• You have someone you are worried about…

• Now what?
Referrals

• Helpful to have a relationship with appropriate medical providers BEFORE you need to make a referral
  – RD: https://www.scandpg.org/search-rd/
  – MD: PCP or team physician should be first step!
    • Team physician guidelines in place BEFORE season starts
When should you make a referral to Sports nutrition?

- Dx stress fracture – especially if second
- BMI < 85% ideal
- ≤ 1 serving of Ca rich food per day
- Not eating breakfast
- Not eating lunch or snacks before practice
- Losing weight
- Consider if BMI <15% for age
- Consider if BMI < 17.5
- Consider if oligomenorrheic (may want to work up or refer to MD if amenorrheic…)
When should you refer to a physician? (and expect DEXA testing)

- Any one of the following:
  - History of an eating disorder
  - BMI < 85% ideal (or < 17.5 if > 20yo)
  - Recent weight loss ≥ 10% in one month
  - Menarche ≥ 16yo
  - < 6 periods in last year
  - 2 prior stress fxs OR 1 high risk stress fx OR low-energy non-traumatic fx
    - High risk = femoral neck, sacrum, pelvis, vertebral body
  - Prior Z score < -2.0
When should you refer to a physician? (cont)

• OR ≥ 2 “moderate risk” factors
  • Current or h/o DISORDERED eating for ≥ 6 months
  • BMI b/w 17.5-18.5 OR < 90% ideal
  • Weight loss of 5-10% in one month
  • Menarche between 15-16
  • Oligomenorrhea (6-8 cycles in last 12 months)
  • One prior stress fracture
  • Prior BMD of Z -1.0 to -2.0
The Female Athlete Triad - Treatment

- **Primary Goal:** Increase energy availability by increasing energy intake and/or reducing energy expenditure
  - Will improve body mass/composition and help resume normal menses
  - Multidisciplinary team approach
    - Sports physician
    - Registered sports dietician
    - Certified sports psychologist or mental health practitioner
    - Athletic trainers
    - Family, coaches, friends
    - Sports administrators
Psychotherapy Treatment

- Ensure that the clinician treating the athlete has special expertise and knowledge of the athletic population
- Individual therapy
  - Cognitive-behavioral treatment (CBT)
  - Acceptance and commitment therapy (ACT)
  - Dialectical behavior therapy (DBT)
- Group therapy
- Inpatient vs outpatient
- Pharmacologic treatment - SSRIs
The Female Athlete Triad - Treatment

- Weight gain
  - Leads to recovery of menstrual function
  - Leads to improvement of endothelial dysfunction
  - Leads to improvement in bone mineral density (even in absence of resumption of menses)
- Will likely need to modify diet AND decrease exercise load in amenorrheics
  - Weight gain in fat mass that leads to recovery is often seen ED patients
- May just need to modify diet in oligomenorrheics or low BMI
  - Exercising women without an ED may see return of menses or BMD with an increase in fat-free mass
- Weight gain must be monitored and documented
The Female Athlete Triad - Treatment

• Also consider:
  • Ca 1000-1300mg/day
  • Vit D 600IU/day
    • Keep Vit D 32-50ng/mL range
    • Consider loading dose if <30
    • 50,000IU Vit D2 QW for 8 weeks, then daily dose
  • Has not been studied prospectively

• Does not appear to help increase BMD without improved energy balance
The Female Athlete Triad - Treatment

• Remember:
  • Time to resumption of menses may vary among women and is dependent on the severity of the energy deficiency and duration of menstrual dysfunction
  • Time to recover bone mineral density takes much longer…
The Female Athlete Triad - Treatment

Recovery of Bone Mineral Density

Recovery of Menstrual Status

Recovery of Energy Status

**PROCESS:** Days or Weeks

**OUTCOMES:**
- ↑ Energy status will stimulate anabolic hormones (IGF-1) 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 (IGF-1) and bone formation

*Nationwide Children's*

*When your child needs a hospital, everything matters.*
Treatment Pharmacotherapy - Hormones

- Estrogen
  - Decreased energy availability can lead to estrogen deficiency, and thus decreased BMD
  - High dose estrogen (such as found in most combination OCPs) may suppress IGF-1 secretion and actually decrease bone formation
  - No evidence to support use in athletes without anorexia or bulimia
  - New evidence in AN girls 12-18 shows an increase in spine and hip BMD z-scores over 18mos when using transdermal physiologic dose estrogen replacement (Misra, 2011)

- Because amenorrhea in athletes is associated with a range of disturbances in hormones and nutrients (*), estrogen therapy alone is unlikely to normalize the metabolic factors that impair bone formation

- * (total tri-iodothyronine, leptin, insulin, IGF-1/IGF-binding, protein-1, glucose, luteinizing hormone pulsatility, follicle-stimulating hormone, estradiol and progesterone, growth hormone and cortisol)
The Female Athlete Triad - Treatment

- Bone Response to Loading
  - Rate of loading causes higher strain
  - Loading results in
  - Inc. crosslinks
  - Alignment of osteocytes
  - Inc. BMD

![Diagram of bone structure and osteocytes](image-url)
Increasing BMD

• Ground reaction forces
  • 10 max VJ’s 3x week BMD gains similar to higher volumes of jumps
• Contraction of muscles
  • Thought to be better way to improve whole body BMD
  • Total Hip BMD higher than jump training
  • Eccentric training
• Exercise RX
  • Intensity
    – 70-90% 1RM
  • Volume
    – 2-3 days/week
    – 2-3 sets with 1-3 min rest in between
• Speed
  – Higher osteogenic response with power movements

Guadalupe-Grau et al 2009
• When can I go back?
Return to Play

- Evidence-based independent risk factors associated with poor outcome
  - Low energy availability (with or without ED/DE)
  - Low BMI
  - Delayed menarche
  - Oligo/amenorrhea
  - Low BMD
  - Stress reaction/fracture history
  - Lean sports
- Cumulative Risk
  - Bone outcomes worse with combination of risk factors
  - Dose response relationship
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- **points**  
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- **points** - **Total Score**
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<td><strong>Provisional/Limited Clearance</strong></td>
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<td>□ Provisional Clearance</td>
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<td>□ Restricted from Training/Competition-Provisional</td>
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Return to Play

- Low Risk
  - Full clearance
  - Follow-up as determined by physician
Return to Play

• Moderate Risk
  • Provisional Clearance
    • Cleared, but must f/u with requested members of the multidisciplinary team, as determined by team physician, and have necessary tests when ordered
    • Consider a written contract
  • Limited Clearance
    • Cleared, but training/competition limited
    • Must follow-up and have tests as above
    • Consider a written contract
Return to Play

• High Risk
  • Provisional
    • Not cleared for play at this time
    • Management/Tx for triad issues with f/u to assess for future clearance or return to play
    • Written contract
  • Disqualified
    • Athlete unable to safely train or compete
    • Treatment for medical conditions
Return to Play

Step 1: Evaluation of Health Status
- Medical Factors
  - Patient Demographics (age, ethnicity)
  - Symptoms (fatigue, lightheadedness, skeletal pain, weight loss/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 TFTs, 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)

Step 2: Evaluation of Participation Risk
- Sport Risk Modifiers
  - Type of Sport (leanness vs 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 vs 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)

Step 3: Decision Modification
- Decision Modifiers
  - Conflict of Interest (scholarship athlete, professional, Olympic athlete, other)

*Return-to-Play Decision
Take Home Points for the AT

- Prevalence of Triad (intentional or unintentional) is high
- Long term consequences
- Should be screening at all PPE’s AND all injuries!!
- AT’s in position to
  - Educate about tracking menstrual periods
  - Catch Triad components early in continuum
  - Play active role in referrals and treatment
    - Especially in BMD!
Thank you!
References

• Hobart JA, Smucker DR. The Female Athlete Triad. Am Fam Phys 61(11), June 1, 2000.
References

• Thein-Nissenbaum JM, Carr KE. Female Athlete Triad syndrome in the high school athlete. Physical Therapy in Sport 12 (2011) 108-116