THE FEMALE ATHLETE TRIAD

SPTS: CSM 2017
THURSDAY, FEBRUARY 16, 2017
11:00 AM – 1:00 PM

SPEAKERS: CAROL FERKOVICH MACK DPT, SCS, CSCS, TERESA SCHUEMANN PT, DPT, SCS, ATC, CSCS; BARB HOOGENBOOM PT, EDD, SCS, ATC AND CHRISTINE MORGAN PT, DPT, SCS

DISCLOSURES: NONE

COURSE DESCRIPTION

Female Athlete Triad is defined as interrelationships among energy availability, menstrual function, and bone mineral density. Female athletes often present with disorders in one or more of the three components. Energy availability is considered to be the "lynch-pin" of the triad. This spectrum affects the body’s ability to utilize energy for basic physiological functions which has implications on recovery from injury, development or maintenance of bone mass, menstrual function, and the cardiovascular system.

As triad components occur across a spectrum, early intervention is essential before disorders worsen. Proper screening for energy availability is needed and several validated tools are available. Education on nutrition, energy balance, and relative energy deficiency is also important. Recognition of menstrual dysfunction and low bone mineral density are complicated, however guidelines can aid with screening and work with a multidisciplinary team can secure the diagnosis. Multidisciplinary care is challenging but necessary for the successful management of the athlete with this condition. As such, this session will discuss the latest evidence related to the spectrum of disorders within female athlete triad, screening, assessment and management. It will also address the recent International Olympic Committee (IOC) consensus statement regarding “Relative Energy Deficiency in Sport” and provide guidelines for risk assessment and return to play of female athletes with one or more of the unhealthy components of the female athlete triad spectrums.

OBJECTIVES

AT THE CONCLUSION OF THIS SESSION, THE PARTICIPANT WILL BE ABLE TO:
1. **Identify and Define the Three Spectrums of the Female Athlete Triad.**

2. **Identify the “Lynchpin” Spectrum and Relate to the Other Two Spectrums.**

3. **Understand the Development of the Female Athlete Triad Concept from Its Inception to the Present, Contemporary View.**

4. **Define RED-S and Contrast with the Female Athlete Triad.**

5. **Define Energy Availability, and How This Becomes Disturbed.**

6. **Define Optimal Nutritional Balance of Macronutrients, Excellent Sources of Micronutrients and List Common Nutritional Deficiencies in the Female Athlete.**

7. **Describe Optimal Referral Strategies for the Female Athlete with Nutritional Deficiencies.**

8. **Gain an Understanding of Each of the Spectrums and the Whole of the Female Athlete Triad With Respect to Screening, Assessment and Management as a Part of a Multi-Disciplinary Team.**

---

INTRODUCTION OF THE SESSION: **(Carol Ferkovich Mack)**

**Introduction & Historical Perspective (Teresa Schuemann)**

**A. Development**

1. First Described in the 1990’s
3. Described relationship between 3 independent entities
   a. (1) Eating Disorders
b. (2) Amenorrhea

c. (3) Osteoporosis

B. Broadening Concept

1. Concept has evolved over the last 2 decades
2. Broadening of topics
   a. Disordered Eating (including but not only eating disorders)
   b. Menstrual irregularities
   c. Decreased Bone Mineral Density

C. Current View (Nattiv et al, 2007)
1. Female Athlete Triad spectrums – 3 Spectrums
   a. Energy Availability
   b. Menstrual status
   c. Bone Mineral status/Bone metabolism

**Contemporary View of Female Triad Spectrums: (Barb Hoogenboom)**

**A. Contemporary View** (DeSouza MJ et al 2014)

From the beginning to Updated ACSM Position Stand: Contemporary view of “Spectrums”. Figure 1 An athlete’s condition moves along each spectrum at a different rate, in either direction in response to diet and exercise. Note: EA affects both BMD directly via metabolic hormones and indirectly via effects on menstrual function.

a. Energy availability (LEA with or without an eating disorder–Reduced EA with or without disordered eating–Optimal energy availability)

b. Menstrual function (Functional Hypothalamic Amenorrhea–Subclinical Menstrual Disorders–Eumenorrhea)

c. Bone mineral density (Osteoporosis–Low BMD–Optimal Bone Health)


B. IOC Consensus Statement (2014)- Introduction of the term “Relative Energy Deficiency in Sport (RED-S)”, “a broader term” and expansion of the discussion to include male athletes (IOC Position Stand on Female Athlete Triad was published in 2005).

a. New with RED-S: energy deficiency can happen in athletes of either sex, and the claim that the clinical phenomenon in female athletes is NOT a triad of three entities, rather a syndrome resulting from energy deficiency. Hub and spoke diagram, with the Triad interposed.
b. There are serious implications for health and performance related to multiple systems (CV, GI, endocrine, metabolic, immune, reproductive, skeletal [growth and development], renal, and CNS)

c. Psychological stress or depression can result in low EA and ED’s

d. Risk assessment model and Decision-based Return-To-Sport Model also proposed, to help protect well being of and safe return to sport for athletes.

C. The Female Athlete Triad Coalition responds (2015)

a. 30-year history of research and publications, with strong evidence for clinical sequelae of the Triad. Also, well documented clinical importance of this diagnosis.

b. “We strongly believe that it is unwise and misleading to propose a new approach based on faulty science” and good reason to suspect sex differences exist that are protective to men (testosterone, low energy costs for reproduction, as examples)

c. Subsuming the term “Female Athlete Triad” under the umbrella of RED-S has the potential to be confusing


D. Welcome to 2017- “Where we are”, and “What every Physical Therapist Should Know”

a. Every PT should know the three facets of the Female Athlete Triad and the presentation of the negative “end of the spectrum” in our female athletes.
b. Know that an athlete does not have to have all facets of the Triad to compromise her health.

c. We should acknowledge that RED-S may exist in other athletes, and be in tune with those athletes.

d. We should have pre-participation and examination screening procedures in place for female athletes with regard to the three facets of the Triad.

e. We need to acknowledge that we ARE NOT the professional best suited to manage many aspects of the Triad, however we are a vital part of the team who would work with female athletes who may be susceptible to the Triad and it’s sequelae.

f. We need to have ready referrals for those female athletes who need intervention beyond the scope of practice of the physical therapist: Registered dieticians, psychologists/counselors, endocrinologists, OB/GYN, etc. etc.

g. Refer if even one part of the Triad is identified.

**ENERGY AVAILABILITY SPECTRUM & NUTRITION: (Barb Hoogenboom)**

**A. BRIEF REVIEW OF THE EA SPECTRUM**, identifying the positive and negative endpoints and the vast area in between.

**B. WHAT IS ENERGY AVAILABILITY?** Why do athletes experience Low Energy Availability?

a. Values and equations (Resting metabolism $\sim 30$ kcal/kgFFM/day; energy balance $\sim 45$ kcal/kgFFM/day)

   Dietary energy intake –
   
   **Exercise energy expenditure**

   **Energy Availability**

b. Causes of EA deficits (Expenditure > Intake; Intake < expenditure); purposive or inadvertent.

c. Risk factors for LEA (dietary restriction [total, food types, food avoidances], prolonged/heavy exercise bouts, vegetarian/vegan diets, early start of sport specific training, injury, sudden increase in training volume)

**C. OF SPECIAL CONCERN FOR FEMALE ATHLETES:**

a. Macronutrient balance and adequacy

   i. ACSM guidelines for macronutrient balance
ii. General guidelines
iii. Where the female athlete is likely to be “out of balance”
iv. Consequences
b. Micronutrient balance and adequacy
   i. Guidelines for AMDR’s
   ii. Where the female athlete is likely to be “out of balance”
   iii. Consequences?
c. Special consideration: Vegetarian and Vegan athletes

D. RELATIONSHIP OF KNOWLEDGE TO ACTION
   a. What do we know? Athletes, PT’s, and coaches....
   b. How knowledgeable are athletes?
   c. Does knowledge translate into behaviors?
   d. Does knowledge impact performance

E. THE ROLE OF THE PHYSICAL THERAPIST, WHERE DO WE FIT?
   a. Basic educational strategies
   b. Referral!

MENSTRUAL STATUS SPECTRUM: (Teresa Schuemann)

A. EUMENORRHEA

B. MENSTRUAL IRREGULARITIES
   a. OLIGOMENORRHEA
   b. LUTEAL SUPPRESSION
   c. ANOVULATION
   d. AMENORRHEA
      i. PRIMARY
      ii. SECONDARY

1. HYPOTHALAMIC AMENORRHEA

C. REASONS FOR AMENORRHEA
a. Pregnancy
b. Hypothalamic Amenorrhea
   i. Exercise-Induced Amenorrhea
c. Abnormalities of Reproductive Tract
d. Ovarian failure
e. Pituitary tumors
f. Chronic anovulation
g. Polycystic ovarian disease

D. Consequences of Amenorrhea

Bone metabolism spectrum including stress fracture information: (Christine Morgan)

Triad Management: screening/interdisciplinary management/prevention (Carol Ferkovich-Mack)

A. Screening:

1. “Existence of any one Triad component should prompt more thorough investigation for others” - Female Athlete Triad Consensus Panel
   a) Difficulty to ID athletes with one component (Stickler, Hoogenboom, Smith 2015)
      (1) Prevalence of one component in female HS/college/elite athletes: 0-16%;
         (a) 24% female triathletes (Yi 2016)
      (2) Two components: 3-27%
      (3) All 3: 0-16%
      (4) Components interact with each other- athlete with 1 component at risk for all 3
      (5) Must ID/treat athletes with subclinical disorders before they worsen
         (a) Subclinical disordered eating often missed
            i) Eating patterns obscure
            ii) Do not have criteria to fit established diagnoses (anorexia, bulimia)
   b) Only 43% of SPTS/Ortho section members could ID all 3 components (Troy et al)
      (1) 48% physicians
      (2) 8% coaches
c) Identification of low energy availability complex; requires objective view of the whole athlete (Stickler, Hoogenboom, Smith 2015)
   (1) Not only present in aesthetic/weight dependent sports (Sundgot-Boren 1993)
   (2) Focus on recognition of presence/causes of the low energy availability

2. WHO to screen?
   a) Female Athlete Triad Consensus Panel: screen all HS and college athletes
      (1) Early intervention critical in adolescents
         (a) 90% peak bone mass attained by age 18 (Matkovic 1994)
         (b) “Window of opportunity” for optimal bone health
   b) Female patients at PT eval

3. Athlete has to willingly/truthfully participate
   a) Often don't realize they have low EA/bone density
   b) May believe lack of menstruation is normal

4. WHAT to screen for?
   a) History of...
      (1) Menstrual irregularities, amenorrhea
      (2) Stress fractures
      (3) Critical comments about eating/weight from parents, coaches, teammates
      (4) Depression
      (5) Dieting
   b) Personality factors (perfectionism, obsessiveness)
   c) Pressure to lose weight
   d) Early start to sport-specific training
   e) Overtraining
   f) Recurrent, non-healing injuries
   g) Inappropriate coaching behavior

5. HOW to screen?
   a) PT session: general questions on menstrual status during the history and systems review
   b) Pre-participation Examination: Female Athlete Triad Consensus Panel screening questions
      (1) Have you ever had a menstrual period?
      (2) How old were you when you had your first menstrual period?
      (3) When was your most recent menstrual period?
      (4) How many periods have you had in the last 12 months?
(5) Are you presently taking any female hormones (estrogen, progesterone, birth control pills)?
(6) Do you worry about your weight?
(7) Are you trying or has anyone recommend that you gain or lose weight?
(8) Are you on a special diet or do you avoid certain types of foods/food groups?
(9) Have you ever had an eating disorder?
(10) Have you ever had a stress fracture?
(11) Have you ever been told you have low bone density (osteopenia or osteoporosis)?

c) Validated tools
   (1) LEAF Questionnaire - for all aspects of triad (Melin 2014).
   (2) Eating Disorders Inventory (EDI-3) - for eating disorders (Clausen 2011)
   (3) EAT-26- for eating disorders (Garner 1993)
   (4) Brief Eating Disorder in Athletes Questionnaire (BEDA-Q): distinguishes between female elite athletes with and without ED/DE (Martinsen 2014)

d) IOC Consensus statement:
   (1) “Although various screening instruments exist, they have not been validated and there is no consensus on which screening tool has the best efficacy”
   (2) Tools exclude men, disabled athletes; not ethnically diverse
   (a) Male athletes: lower prevalence but present in male sports
      i) Severely reduced EA documented in male cyclists (Vogt et al)
      ii) High prevalence of underweight international ski jumpers (Muller et al)
      iii) Male endurance athletes at high risk for low BMD
   (b) Athletes of non-caucasian ethnicity
      i) Limited evidence of differences in BMD among ethnic groups in athletes
      ii) Preliminary data: African-American and African Black athletes with similar symptoms of low energy availability (Kark 2012)
      iii) Caucasian athletes with greater risk disordered eating/energy deficiency, menstrual dysfunction
iv) No published studies in Hispanic athletes; limited evidence on Asian athletes
   (c) Recently developed Relative Energy Deficiency in Sport Clinical Assessment Tool (RED-S CAT)- November 2016

e) Pay attention to athletes with history of multiple bone stress injuries ("red flag")?
   (1) Others:
      (a) Decreased performance
      (b) Mood changes
      (c) Frequent illness
   (2) Tendencies of eating disorder:
      (a) Food restriction
      (b) Purging behaviors
      (c) Altered eating habits

B. INTERDISCIPLINARY MANAGEMENT:

1. Treat athletes with 1 or more components- must be interdisciplinary
   a) Physician
   b) Registered Dietician
   c) ATC
   d) Mental health expert
   e) PT
   f) Coach

2. Role of PT: recognize/refer to healthcare team
   a) Questions during PT eval or pre-participation screening
   b) Validated screening tools
   c) Injury history

3. Registered sports dietician: comprehensive nutritional assessment
   a) Determination of athlete’s energy availability

4. Physician
   a) Comprehensive physical examination
      (1) Labs (CBC, possible EKG)
      (2) Evaluation of altered menstrual cycle
      (3) Bone scan with dual-energy X-ray absorptiometry (DEXA) to determine bone density

5. Goals of treatment (Stickler, Hoogenboom, Smith 2015)
   a) Re-establish menstrual cycle
   b) Enhance bone mineral density through changes in diet, training, increased energy availability

6. Pharmacological treatment
   a) Medical, hormonal management
b) Oral contraceptives
   (1) Prescribed to restore menstruation
   (2) Non-conclusive evidence on restoration of bone density (Nazem et al 2012)
   (3) Estrogen replacement- minimal evidence of outcomes in young, athletic population
   (4) Bone restorative medications (bisphosphonates)
       (a) Require endocrinologist/specialist in metabolic bone diseases
       (b) No published studies on use in female athletes with triad disorders (Female Athlete Triad Consensus Panel)

   c) Non-pharmacological treatment
      (1) Nutritional counseling
          (a) Increase energy input/ decrease expenditure
          (b) Diet quality
          (c) Bone health, calcium, vitamin D intake
      (2) Behavior modification (dietary restriction, overtraining)
      (3) Biomechanical factors to decrease bone stress

7. Prognosis:
   a) Different recovery rates for each component
      (1) Energy status: days to weeks
          (a) Outcomes:
              i) Stimulates anabolic hormones, bone formation
              ii) Reverses energy conservation adaptations
      (2) Menstrual status: months
          (a) Outcomes:
              i) Increased reproductive hormones
              ii) Increased estrogen exerts anti-resorptive effect on bone
      (3) Bone mineral density: years
          (a) Outcomes:
              i) Increased estrogen continues to inhibit bone resorption
              ii) Increased energy status stimulates anabolic hormones, bone formation

8. Return to play:
   a) No standardized guidelines
   b) Complex process
   c) Risk of sports participation:
      (1) Female collegiate runners with menstrual dysfunction- more severe bone stress injuries vs eumenorrheic runners

(2) Predictors of delayed return to running (Nattiv 2013):
   (a) Low BMD
   (b) Higher MRI grade bone stress injury
   d) PT can work with physician on safe return to play progression
   e) Female Athlete Triad Consensus Panel: Risk Stratification
(1) “Cumulative Risk Score”
   (a) Based on cumulative risk assessment
(2) Athletes with anorexia nervosa and BMI <16 kg/m² or moderate-

severe bulimia nervosa (purging >4 times/week) should be restricted from training/competition

(a) Future participation dependent on treatment

f) IOC relative energy deficiency in sport clinical assessment tool (RED-S CAT) (Mountjoy 2016)

(1) Based on guidelines from Norwegian Olympic Training Center
(2) Simpler, functional model for the clinician
(3) “High Risk- Red Light” no clearance
(4) “Moderate Risk- Yellow Light” clearance with supervised

II. PREVENTION
A. Education- education- education!
   1. Athletes
   2. Coaches
   3. Caregivers
   4. Other PT’s
   5. Entire healthcare team
B. Education topics:
   1. Triad components
   2. How to detect signs/symptoms
   3. Nutrition
      a) Nutrient dense foods
      b) Dietary habits for long-term health
      c) Caloric demands of sport and training
d) Calcium requirements
   (1) Calcium in presence of vitamin D: necessary for “bone banking” in adolescent years

4. Proper training
   a) Gradual increases in stimulus, intensity of training
   b) Importance of rest/recovery

C. Dispel myths: (Stickler, Hoogenboom, Smith 2015)
   1. Thinner is NOT better
      a) Likely muscle loss with loss of weight
      b) Low body weight, low energy availability may decrease performance
      c) Nutrition/health can enhance performance - not weight
   2. Amenorrhea is NOT normal in trained athletes
      a) Risk of decreased sports performance, relation to injury, delayed healing
      b) If athlete has not had period for 3 months or more - refer to physician
   3. Low carb diets/food exclusion is NOT OK
      a) Low carb diet in athletes likely results in low energy availability
      b) Avoiding foods (dairy, red meat) may affect bone health and performance
   4. Multiple stress fractures are NOT normal with training
      a) Bones ineffectively dealing with stress placed on them
      b) May indicate dietary abnormalities or training errors

D. Resources for health professionals, athletes, parents, coaches (Stickler, Hoogenboom, Smith 2015)
   1. femaleathletetriad.org
   2. thinkeatplay.org/triad-talk
   5. sportsnutritionsociety.org/find-a-nutritionist.html

E. Athletes Targeting Health Exercise and Nutrition Alternatives (ATHENA)
   2. Educates HS female athletes on self esteem, societal pressure, healthy norms, sports nutrition
   3. Peer led
      a) “Squad leaders”: coach and student-athletes
      b) Goal setting, self-monitoring of behaviors
   4. Long-term outcomes studied by Elliot et al. Participants vs controls:
a) Decreased diet pill use  
b) Informed on calcium requirements  
c) Ability to select a heavier body weight image as “healthy”

References

• Garner et al. Eating disorders among athletes: Research and recommendations)
• Nazem et al. The female athlete triad. Sports Health 2012
