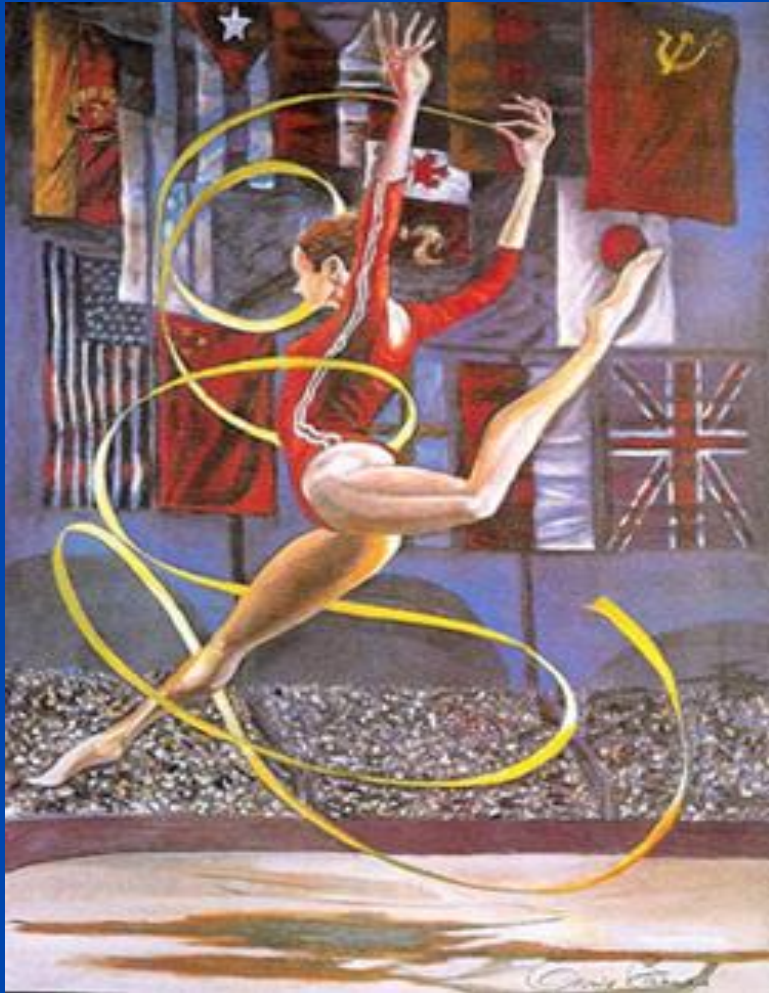


# Too much of a good thing



## The Female Athlete Triad:

Toward improved screening  
and management

Asma Javed

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# Disclosure

- No relevant financial disclosure
- No conflict of interest

# Objectives

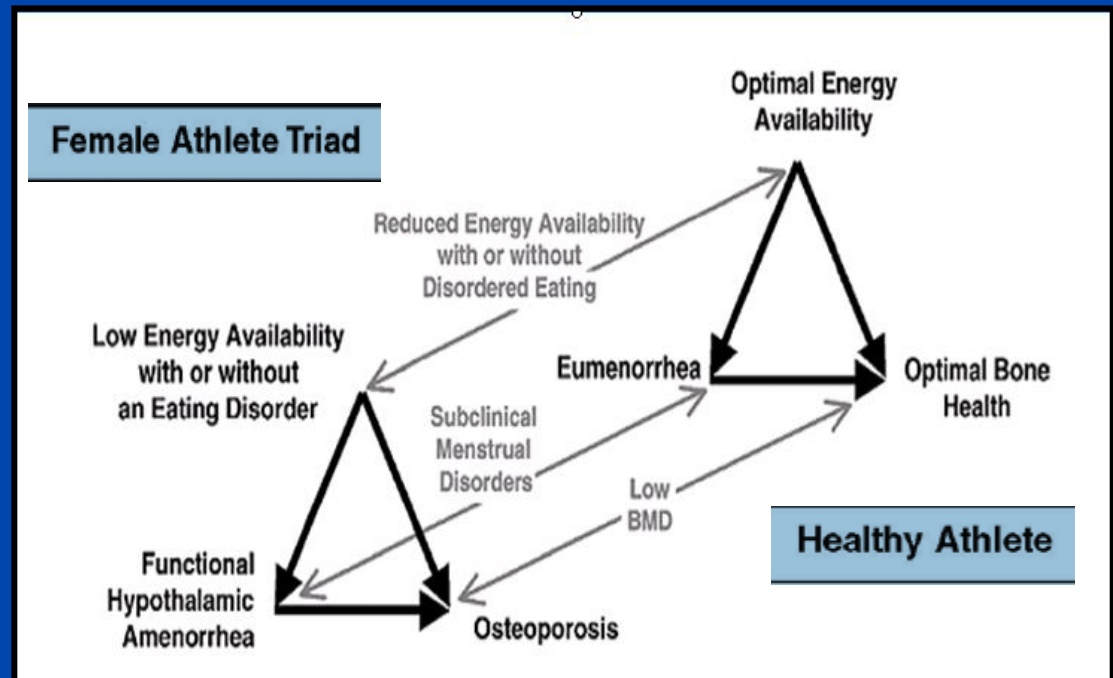
- Define the components of the female athlete triad and their epidemiology.
- Review current screening and management guidelines and address barriers to identification.
- Devise a plan for primary care physicians to screen for, identify and treat the triad.

# Female Athlete Triad



First defined in 1992 by American College of Sports Medicine as presence of:

- Eating disorder
- Amenorrhea
- Osteoporosis



# Trends: 'Think of them as epidemics'



# “Tipping Point” in female athletics

Title IX: Educational Amendment Act 1972



1972 - 1 in 27 high school girls played a varsity sport.

2010- 1 in 2 high school girls played a varsity sport.

# How common is the Female Athlete Triad?

	<b>High School</b>	<b>College</b>
<b>Disordered Eating</b>	18.20%	25%
<b>Menstrual Irregularities</b>	23.50%	25.80%
<b>Low Bone Mineral Density</b>	4.10%	1.80%
<b>Complete Triad Syndrome</b>	1.20%	<b>0.9%</b>

**Lean/aesthetic sport Vs. Non-Lean sport athletes - Prevalence 2-3 times higher**

# How does the triad occur?

## Key Feature: Low energy availability

Energy availability = Energy Intake – Exercise Energy Expenditure

Energy Availability > Resting Metabolic Rate

Low energy availability < Resting Metabolic Rate

Normal energy availability- 45 kcal/kg FFM/day

LH pulsatility disrupted < 30 kcal/kg FFM/day

No specific body fat percentage below which athlete is at risk

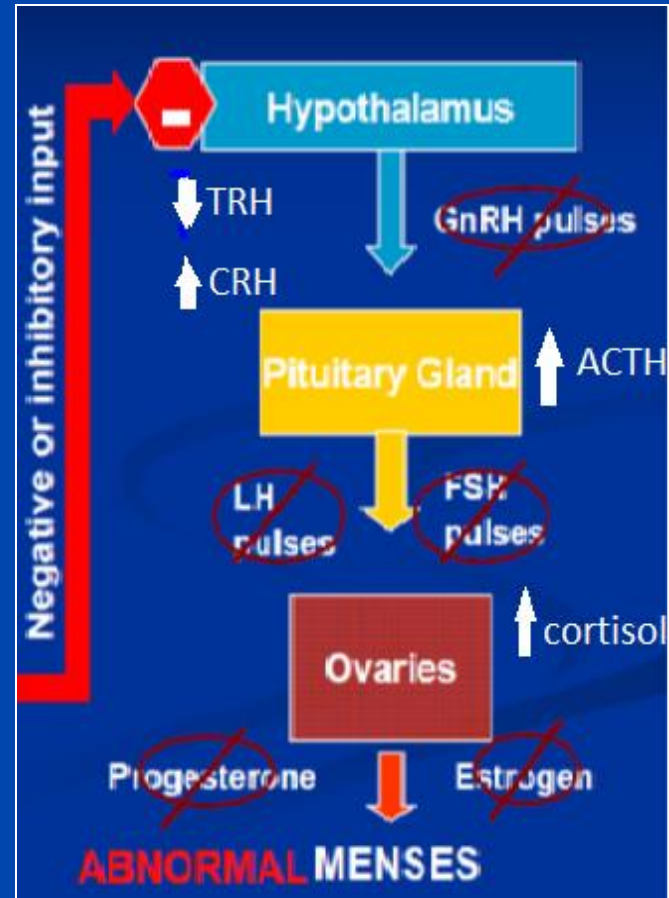


# Female Athlete Triad: Pathophysiology

## Menstrual dysfunction

- Primary Amenorrhea
- Secondary Amenorrhea
- Oligomenorrhea
- Subclinical menstrual disorders

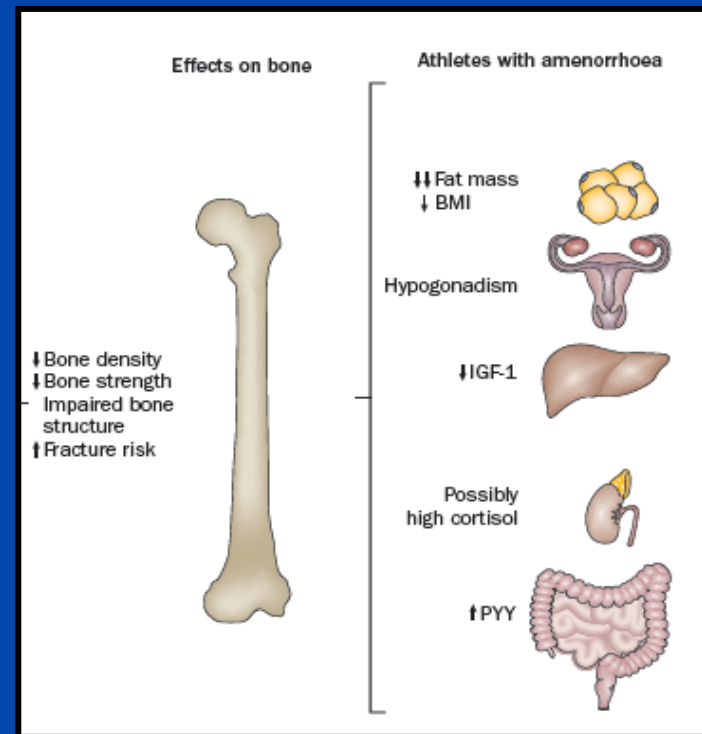
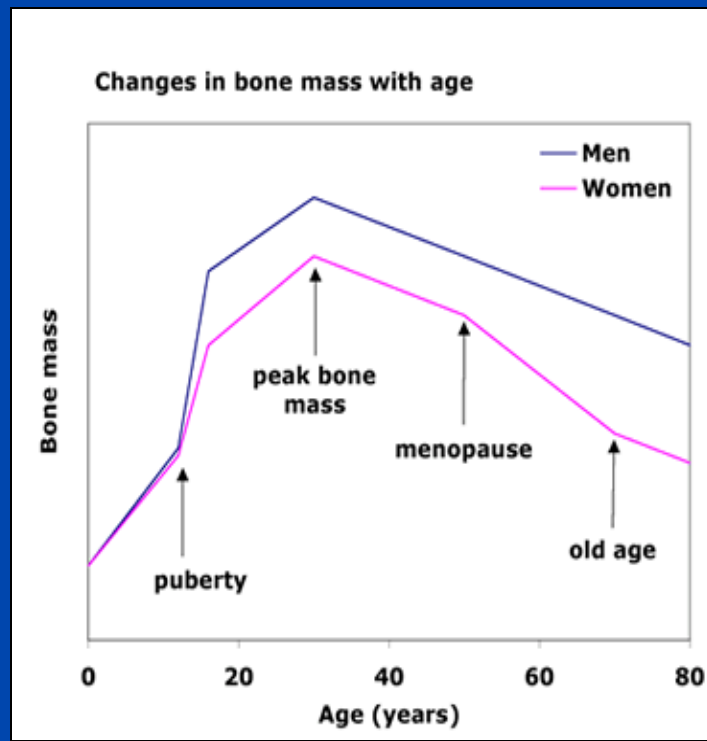
**Menstrual dysfunction  
is not a normal part of  
training!**



# Female Athlete Triad: Pathophysiology

## Bone Mineral Loss (Low estrogen and energy)

- Females gain more than 50% of skeletal mass during adolescence
- Amenorrheic adolescent athletes lose 2% of bone mass/yr (menopause)



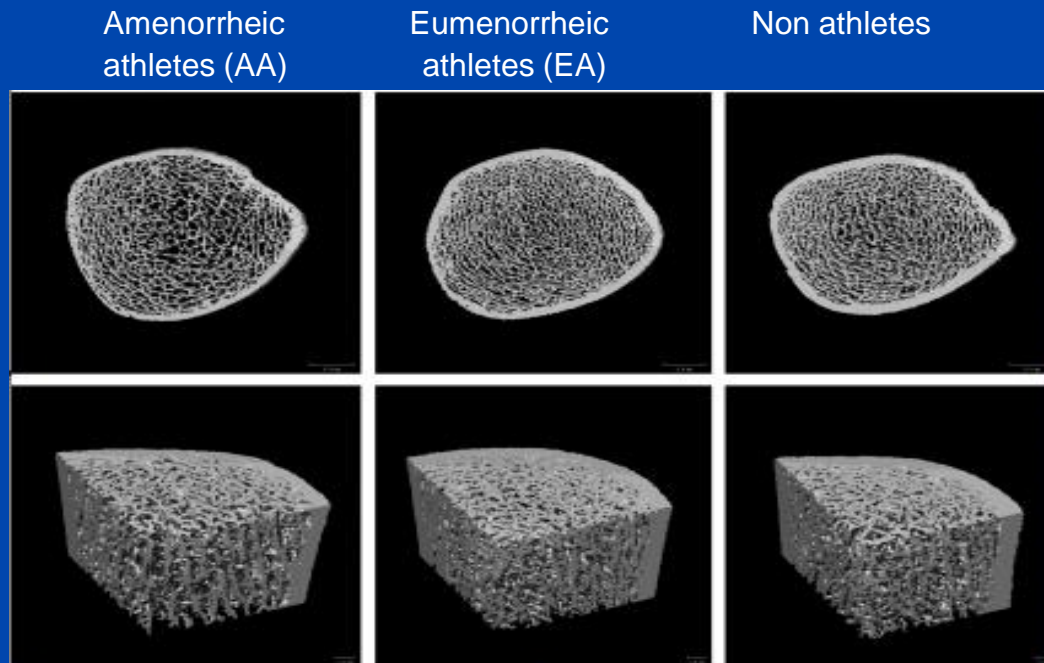
# Is exercise good or bad?

*J Clin Endocrinol Metab.* 2011 Oct;96(10):3123-33. doi: 10.1210/jc.2011-1614. Epub 2011 Aug 3.

**Bone microarchitecture is impaired in adolescent amenorrheic athletes compared with eumenorrheic athletes and nonathletic controls.**

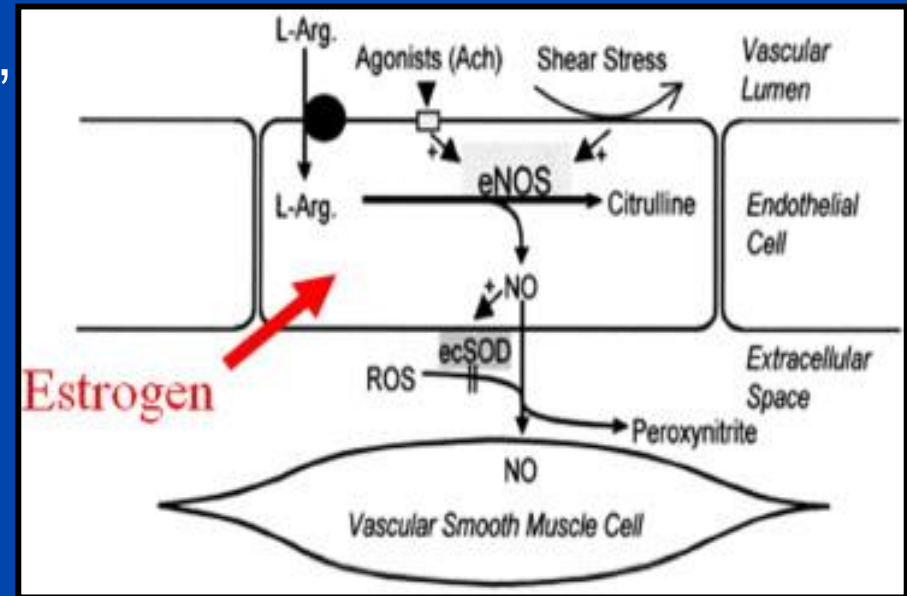
Ackerman KE, Nazem T, Chapko D, Russell M, Mendes N, Taylor AP, Bouxsein ML, Misra M.

Neuroendocrine Unit, Massachusetts General Hospital and Harvard Medical School, Boston, Massachusetts 02114, USA.



# Female Athlete Tetrad?

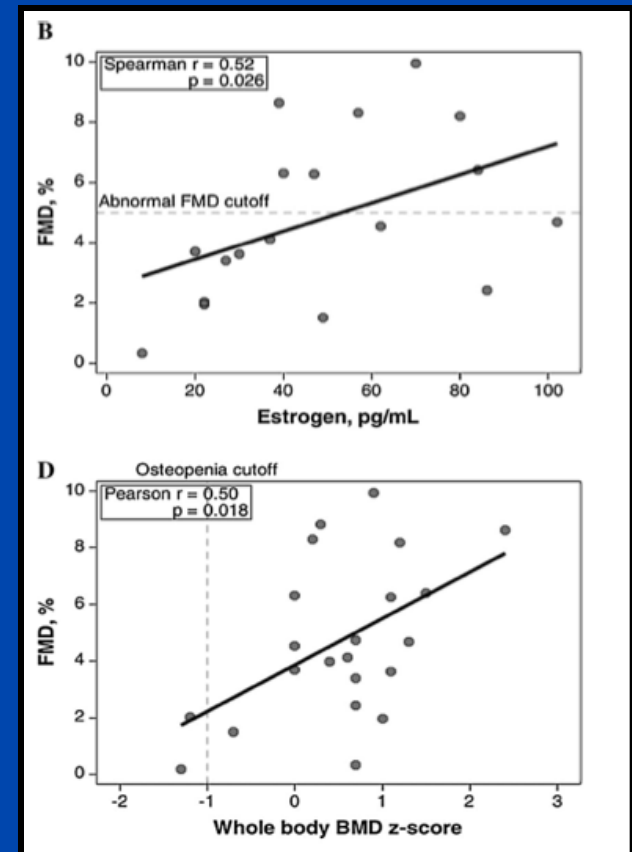
- **Endothelial dysfunction** has been reported in young athletes, similar to post-menopausal woman
- May herald premature cardiovascular events and further adverse effects on bone in amenorrheic athletes.



# Association Between the Female Athlete Triad and Endothelial Dysfunction in Dancers

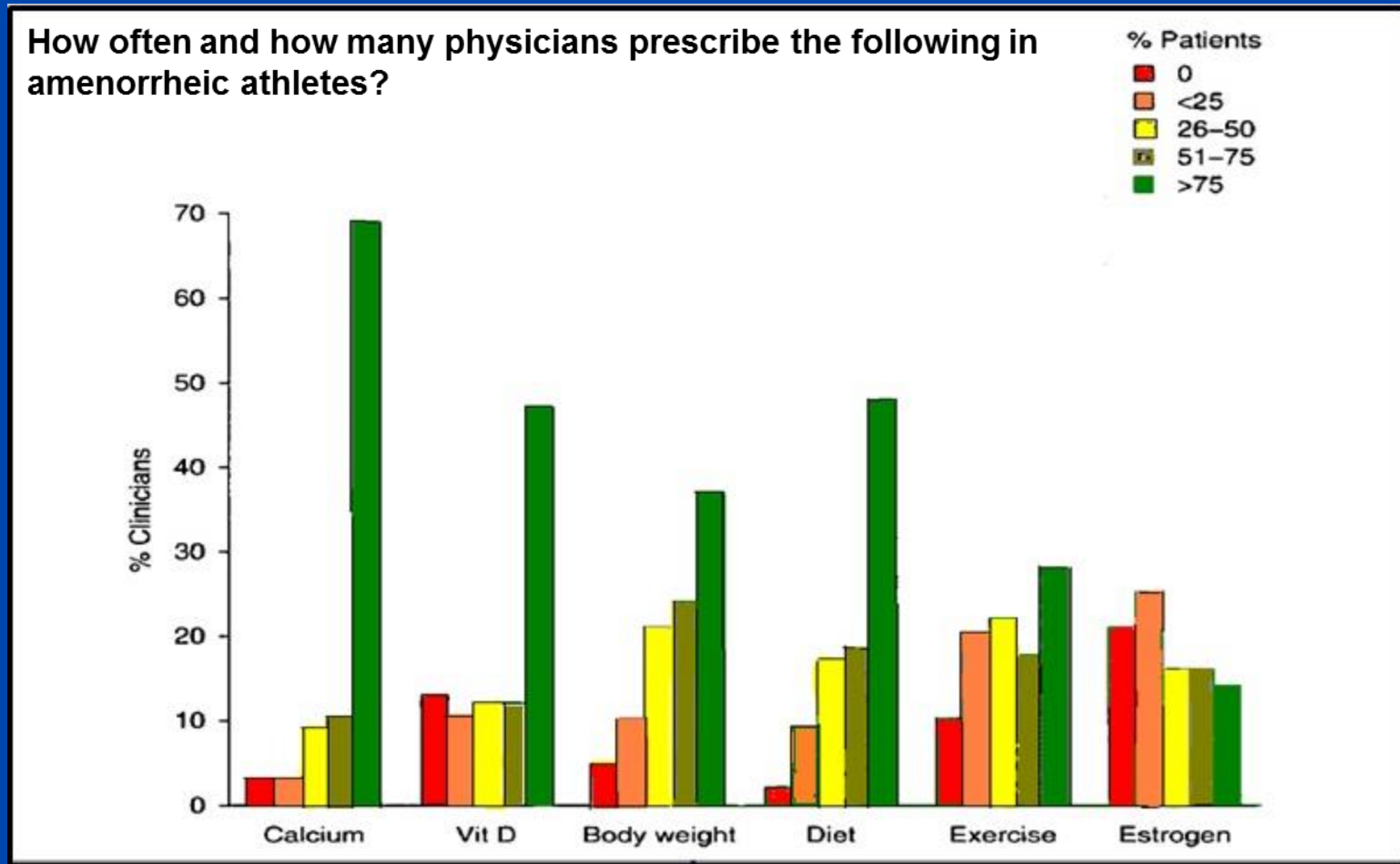
*Anne Z. Hoch, DO,\*† Paula Papanek, PhD, MPT, LAT,‡ Aniko Szabo, PhD,§  
Michael E. Widlansky, MD,\*¶ Jane E. Schimke, AAS,\* and David D. Gutterman, MD†*

- Study population: professional dancers 18-35 yo
- N = 22
- Outcome: flow mediated dilation (FMD)
- Result: FMD values significantly correlated with estrogen and BMD
- Conclusion: Endothelial dysfunction in professional dancers correlates with low estrogen and BMD which has implications on CV and bone health.



# Female athlete triad: How are we doing?

2009- 29% of 128 physicians surveyed correctly identified all 3 triad components.



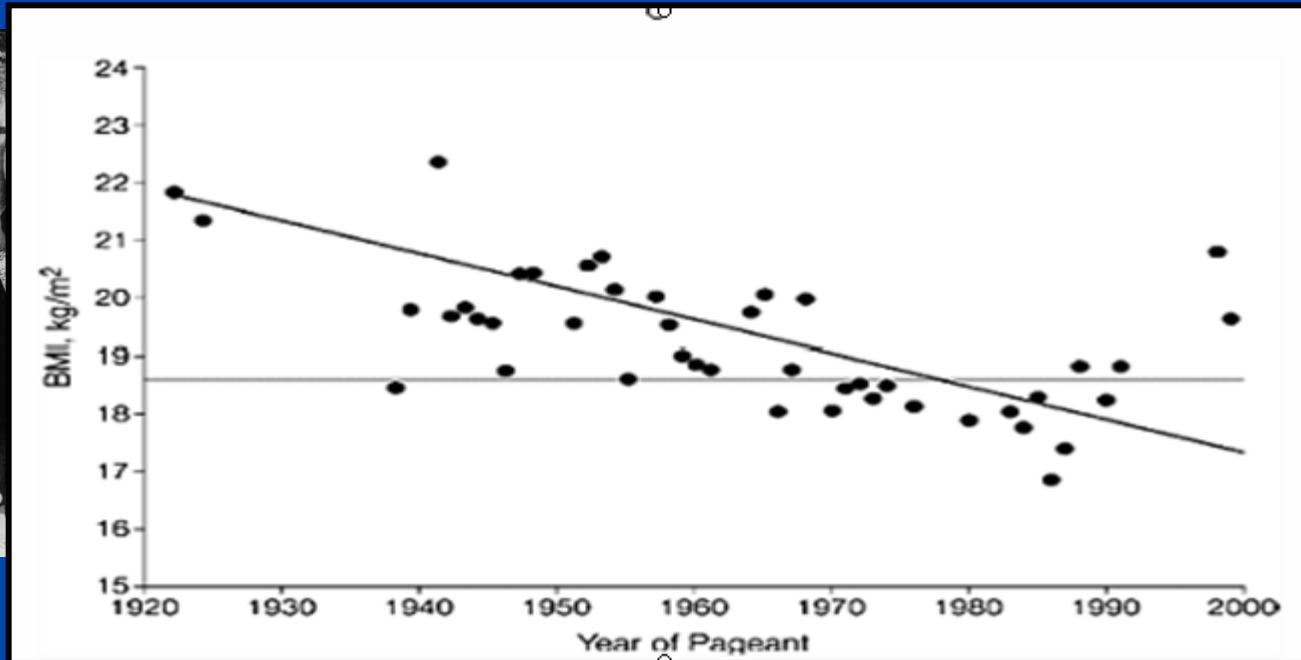
# What are the barriers to evaluation?

What is the 'ideal' body weight?

BMI changes over time

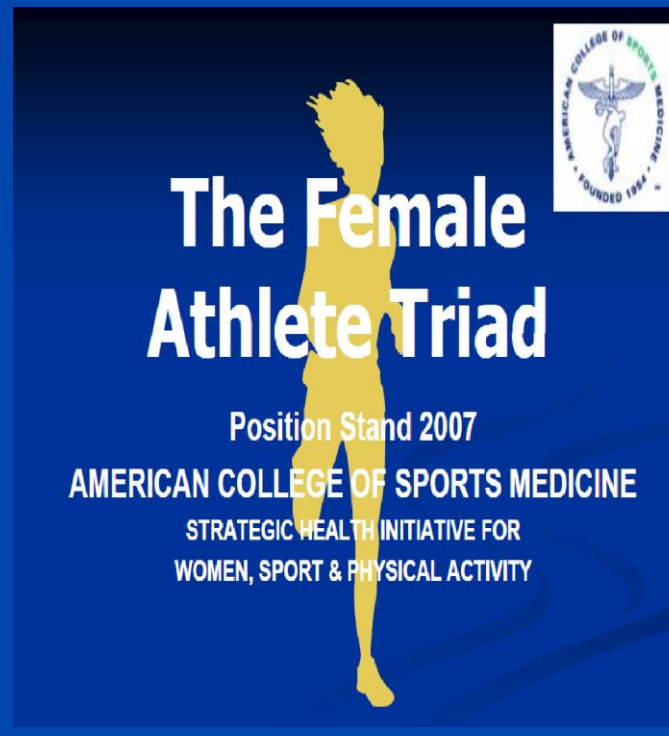


1927



# Female Athlete Triad Screening, Diagnosis and Management

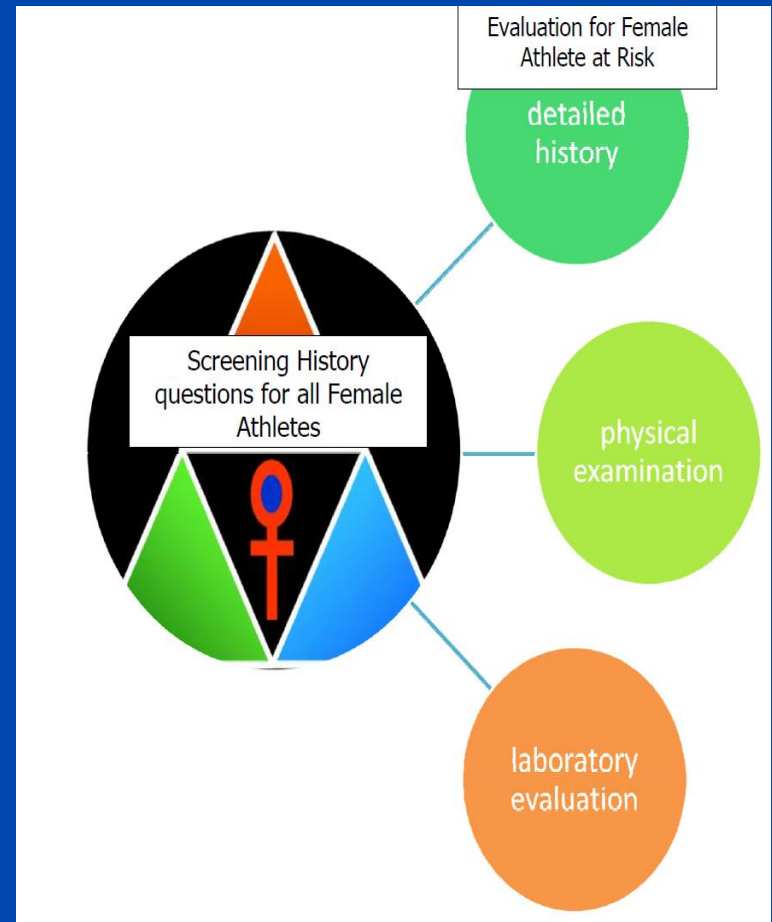
Current recommendations provided by The Female Athlete Triad Coalition





# Screening recommendations

- Screen all female athletes with a 12 question yes/no female athlete triad questionnaire
- For those defined as 'at risk' for the triad, detailed interview and additional physical examination and/or laboratory testing recommended.



# AAP/AAFP Screening

7 of 12 items recommended by triad coalition present

**PREPARTICIPATION PHYSICAL EVALUATION HISTORY FORM**  
*(Note: This form is to be filled out by the patient and parent prior to seeing the physician. The physician should keep this form in the chart.)*

Date of Exam \_\_\_\_\_  
 Name \_\_\_\_\_ Date of birth \_\_\_\_\_  
 Sex \_\_\_\_\_ Age \_\_\_\_\_ Grade \_\_\_\_\_ School \_\_\_\_\_ Sport(s) \_\_\_\_\_

**Medicines and Allergies:** Please list all of the prescription and over-the-counter medicines and supplements (herbal and nutritional) that you are currently taking.

Do you have any allergies?  Yes  No. If yes, please identify specific allergy below:  
 Medicines  Pollens  Food  Stinging insects

Explain "Yes" answers below. Circle questions you don't know the answers to.

GENERAL QUESTIONS	Yes	No	MEDICAL QUESTIONS	Yes	No
1. Has a doctor ever denied or restricted your participation in sports for any reason?			26. Do you cough, wheeze, or have difficulty breathing during or after exercise?		
2. Do you have any ongoing medical conditions? If so, please identify below: <input type="checkbox"/> Asthma <input type="checkbox"/> Anemia <input type="checkbox"/> Diabetes <input type="checkbox"/> Infections <input type="checkbox"/> Other _____			27. Have you ever used an inhaler or taken asthma medicine?		
3. Have you ever spent the night in the hospital?			28. Is there anyone in your family who has asthma?		
4. Have you ever had surgery?			29. Have you been without or are you missing a kidney, an eye, a testicle, breast, your spleen, or any other organ?		
<b>HEART HEALTH QUESTIONS ABOUT YOU</b>	Yes	No	30. Do you have groin pain or a painful bulge or hernia in the groin area?		
5. Have you ever passed out or nearly passed out (fainted) or <b>AFIB</b> ever?			31. Have you had infectious mononucleosis (mono) within the last month?		
6. Have you ever had discomfort, pain, tightness, chest during exercise?			32. Do you have any swollen, swollen, sore, or other skin conditions?		
7. Does your heart ever race or skip beats (jitters)?					
8. Has a doctor ever told you that you have any chronic ail that apply: <input type="checkbox"/> High blood pressure <input type="checkbox"/> A heart <input type="checkbox"/> High cholesterol <input type="checkbox"/> A heart <input type="checkbox"/> Coronary disease <input type="checkbox"/> Other _____					
9. Has a doctor ever ordered a test for your heart (echocardiogram)?					
10. Do you get lightheaded or feel more short of during exercise?					
11. Have you ever had an unexplained seizure?					
12. Do you get more tired or short of breath more during exercise?					
<b>HEART HEALTH QUESTIONS ABOUT YOUR FAMILY</b>					
13. Has any family member or relative died of the unexpected or unexplained sudden death (sudden death) or unexplained car accident, or stroke?					
14. Does anyone in your family have hypertension, diabetes, or high cholesterol?					
17. Have you ever had an injury to a bone, muscle that caused you to miss a practice or a game?					
18. Have you ever had any broken or fractured bone?					
19. Have you ever had an injury that required a injection, therapy, a brace, a cast, or crutches?					
20. Have you ever had a stress fracture?					
21. Have you ever been told that you have low testosterone or abnormal testosterone? (Does it affect your ability to have children?)					
22. Do you regularly use a brace, orthotics, or orthotics?					
23. Do you have a bone, muscle, or joint injury that is chronic?					
24. Do any of your joints become painful, swollen, or stiff?					
25. Do you have any history of juvenile arthritis?					

I hereby state that, to the best of my knowledge, my answers to the above questions are complete and correct.

Signature of athlete \_\_\_\_\_ Signature of parent/guardian \_\_\_\_\_ Date \_\_\_\_\_

**47. Do you worry about your weight?**

**48. Are you trying to or has anyone recommended that you gain or lose weight?**

**49. Are you on a special diet or do you avoid certain types of foods?**

**50. Have you ever had an eating disorder?**

**FEMALES ONLY**

**52. Have you ever had a menstrual period?**

**53. How old were you when you had your first menstrual period?**

**54. How many periods have you had in the last 12 months?**

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20. Have you ever had a stress fracture?



# The 'at risk' female athlete: Detailed Evaluation

## Low energy Availability

## Screening Tools for Eating Disorders:

- ESP, SCOFF\* for physicians
- Referral to registered dietitian
- 3- or 7-day food record
  
- Resting and Exercise energy expenditure

### The SCOFF questions\*

Do you make yourself Sick because you feel uncomfortably full?

Do you worry you have lost Control over how much you eat?

Have you recently lost more than One stone in a 3 month period?

Do you believe yourself to be Fat when others say you are too thin?

Would you say that Food dominates your life?

\*One point for every "yes"; a score of  $\geq 2$  indicates a likely case of anorexia nervosa or bulimia

# The 'at risk' female athlete

## Detailed Evaluation

### Athletic amenorrhea

#### Diagnosis of exclusion

- Rule out pregnancy
- Chronic illness - CBC, CMP, ESR
- Thyroid or ovarian dysfunction – TSH, LH, FSH
- Pituitary tumor- Prolactin, consider imaging
- Adrenal pathology- testosterone, DHEA-S, 17-OHP
  
- Progesterone Challenge
  - Medroxyprogesterone acetate orally 5-10 mg for 10 days

# The 'at risk' female athlete Detailed Evaluation

## Bone Mineral Loss

- (ISCD) recommends use of age and sex matched Z-scores
- The ACSM recommends DXA scans for premenopausal women with
    - (i) oligomenorrhea or amenorrhea >6 months or
    - (ii) disordered eating > 6 months;
    - (iii) stress fracture



# Female athlete Triad: Management

## Multidisciplinary Management

- Non pharmacologic



# Non pharmacologic Management

Increase energy intake, Reduce energy expenditure

- Strongest evidence- Wt. gain (1-2 kg) or 10% less exercise - Resumption of menses in 11 months
- Eat by discipline, not appetite
- Psychotherapy for athletes with ED
- Early referral to mental health provide



# Non pharmacologic Management

- Change work-out routine from cardiovascular to weight-training
- Progressive high intensity training
- Plyometric exercises



The role of the physical therapist is crucial



# What are the barriers to evaluation?

- Inadequate knowledge regarding the triad, brief visits
- Menstrual cycles >35 days in 65% of girls 1-2 years post menarche
- Athletes may welcome menstrual interruption
- What is the 'ideal' body weight?

# Pharmacologic Management

## Estrogen therapy- Where is the evidence?

Few trials in athletes, mixed results

- OCPs not of benefit in bone mass accrual in Anorexia.
- Cyclic menses induced by OCP falsely reassuring.
- OCPs decreases IGF-1 levels and free testosterone.

## Estrogen Therapy: AAP Current recommendations

- OCPs to prevent further loss of BMD in an athlete with amenorrhea > 16 years of age if BMD is decreasing despite adequate nutrition and body weight.

# Pharmacologic Management

## Calcium and vitamin D supplementation

- Never prospectively assessed
- IOC recommends calcium intake of 1500 mg/d
- Vitamin D is 400 to 800IU/d



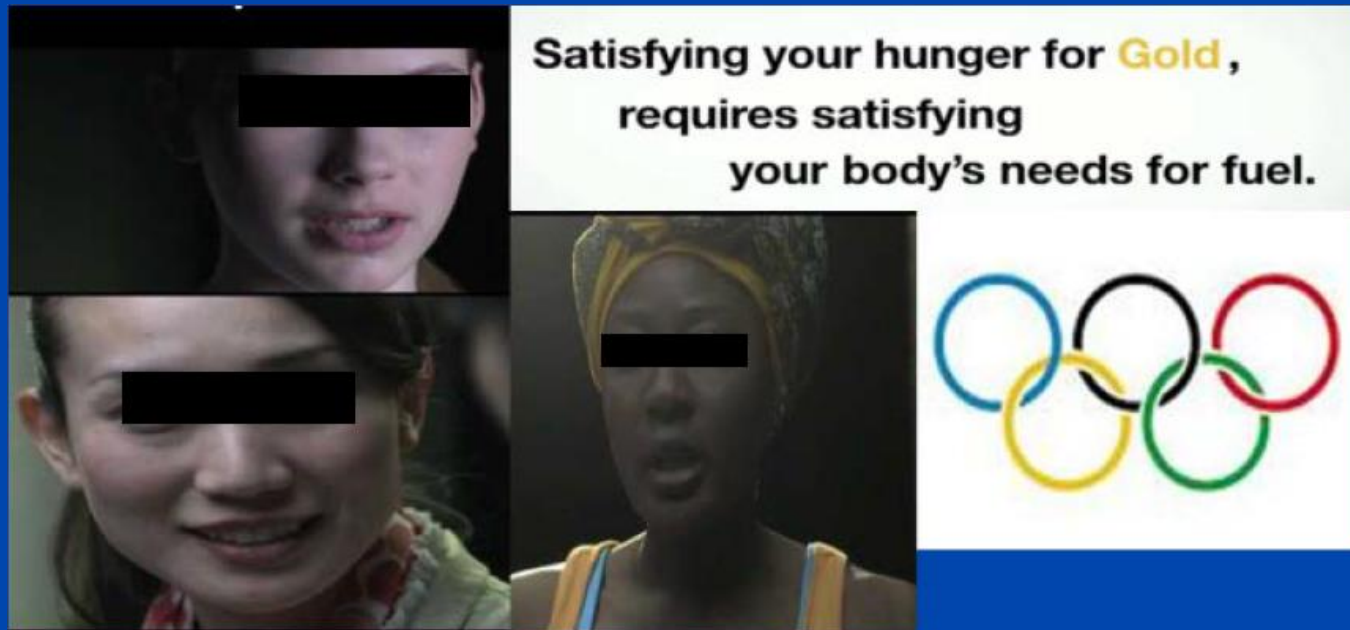
## Future Directions

Bisphosphonates, Rh-IGF-1, Rh-Human Leptin,  
Transdermal estrogen

# Female Athlete Triad: Prevention

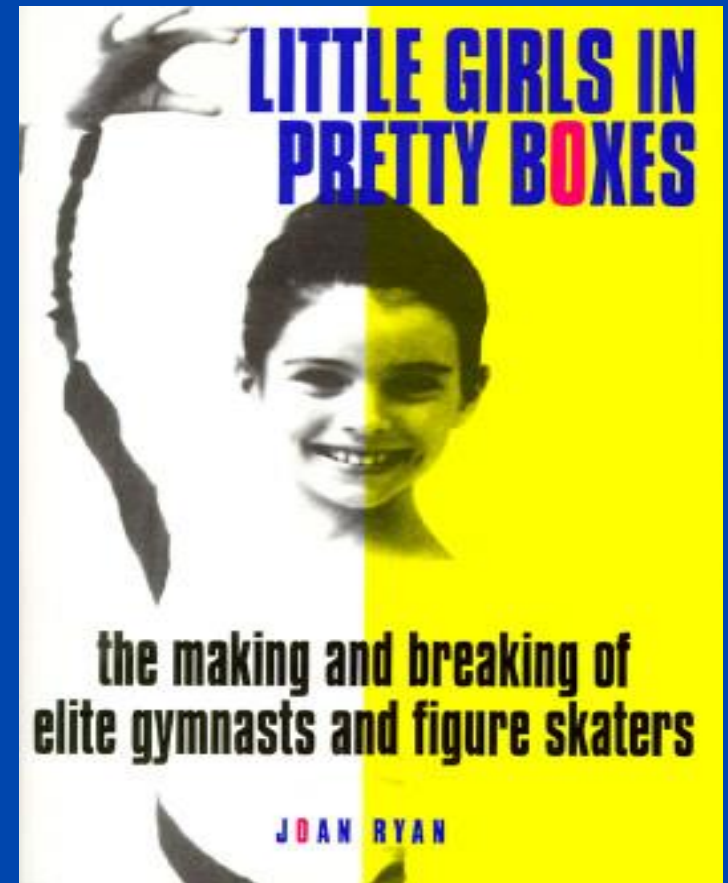
**Change the Mindset, Involve Athlete:** Educate physicians, physical therapists, dietitians, coaches, athletes, parents, athletic trainers and school administrators

**Nutrition education:** Reduce emphasis on body weight



# Resources

1. American College of Sports Medicine [www.acsm.org](http://www.acsm.org)
2. ACSM Female Athlete Triad Position Stand, 2007  
[http://www.femaleathletetriad.org/~triad/wpcontent/uploads2008/10ACSM\\_Female\\_Athlete\\_Triad\\_Position\\_Stand\\_2007.pdf](http://www.femaleathletetriad.org/~triad/wpcontent/uploads2008/10ACSM_Female_Athlete_Triad_Position_Stand_2007.pdf)
3. American Dietetic Association Sports, Cardiovascular, and Wellness Nutritionists (SCAN) Dietetic Practice Group [www.scandpg.org](http://www.scandpg.org)
4. Female Athlete Triad Coalition [www.femaleathletetriad.org/](http://www.femaleathletetriad.org/)
5. International Olympic Committee NCAA Coaches Handbook, *Managing the Female Athlete Triad* <http://www.femaleathletetriad.org/wp-content/uploads/2008/10/NCAA-Managing-the-Female-Athlete-Triad.pdf>
6. National Athletic Trainers Association Position Statement: Preventing, Detecting, and Managing Disordered Eating in Athletes, 2008  
<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2231403/>
7. Nutrition and Athletic Performance Joint Position Paper  
<http://www.eatright.org/About/Content.aspx?id=8365>
8. Women's Sports Foundation [www.womenssportsfoundation.org/](http://www.womenssportsfoundation.org/)



# Thank You!

- Please direct any questions to [Javed.asma@mayo.edu](mailto:Javed.asma@mayo.edu)