

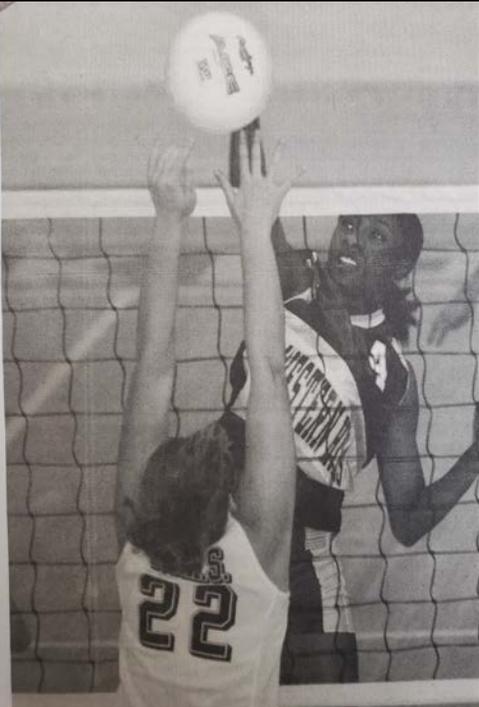
THE CUTTING  
EDGE  
OF PEDIATRICS

Texas Children's  
Hospital®

# Girls: Gyn Issues & Athletics

**Chimsom T. Oleka, MD, FACOG**  
Pediatric and Adolescent Gynecologist

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### My Sports History:

- Ballet (1yr)
- Bumper Bowl Team (1yr)
- Unicycling/Juggling Team (2yrs)
- Gymnastics/Tumbling (1-2yrs)

Former Varsity Multi-Sport Athlete

- Soccer (3-4 years)
- Cheerleading (2 years)
- Cross Country (1 year)
- Volleyball (4 competitive years)
- Track and Field (7 competitive years)
  - Former Division I Track and Field Athlete

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## TITLE IX

- Title IX was established in 1972 to provide everyone with equal access to any program or activity that receives Federal financial assistance, including sports
- By the 1980s, involvement of women and girls in sports play had increased by 700%
- While we still have far to go before every girl has equal access to sports, *especially girls of color*, it is clear that we are making progress
- Today, 2 in 5 high school girls participate in sports as compared to 1 in 27 in the early 70s
- At the 2016 Rio Olympics, the world watched as woman after woman broke barriers, shattered records and won 28 of the 46 gold medals awarded to the US Olympic Team

"Title IX and the Rise of Female Athletes in America" Women's Sports Foundation, [womenssportsfoundation.org](http://womenssportsfoundation.org) Sept 2016

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## Benefits of Girls in Sport

- Positive and enriching experience for physical, emotional and mental development
- A wonderful way to encourage regular exercise throughout life by setting the stage for a physically active lifestyle
- Puberty is a critical time period for the adolescent girl
  - Confidence drops 30%
  - Pubexit "Mass Exodus of Girls from Sport" begins
- Increases confidence, self-esteem and positively influences concept of self and self-image during this critical time
  - 2015 U.S. consumer data study, showed that women ages 18 to 24 are twice as likely to be confident if they play sports regularly, compared to those who do not play at all.

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## Benefits of Girls in Sport

# 61%

of female executives  
said sports contributed  
to their career success

“Sports have taught me that success and failure are both acceptable.”  
–Karen Sutton, MD, Orthopedic Surgeon, Yale University

“Learning from your mistakes and picking yourself up when you literally or figuratively fall down definitely sets you up for dealing with the natural successes and failures of life. It’s like learning a language; it trains your brain differently even if you don’t end up using it. You learn skills you keep with you for a lifetime.”

–Piera Gelardi, Co-Founder and Executive Creative Director of Refinery29)

“Sports has taught me, mental toughness. Discipline. Grit and “Stickwithit-ness”. It taught me resilience. And it gave me the confidence to try and the foundational resilience necessary to constructively interpret and rise from failure. It instilled the energizing and powerful feeling of improving or succeeding in something simply because you made the decision, showed up and consistently put in the effort.”

–Chimsom T. Oleka, MD, Pediatric and Adolescent Gynecologist, Texas Children’s Hospital

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## There is a lot we do not yet know...

- Despite a decreasing gender gap in exercise participation, there still remains a significant under-representation of women included in sport and exercise medicine research studies

### WHY?

- The complexities of the menstrual cycle are considered major barriers to the inclusion of women in sport and exercise medicine research
- Much of the research on exercise physiology has primarily included men, making it hard to generalize findings to women

G.Bruinvels; Sport, Exercise and the menstrual cycle: where is the research? *Br J Sports Med* March 2017

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## The Importance

Female athletes can experience unique mild or severe effects on their pubertal development and reproductive function.

There is a clear need to gain better understanding of female physiology and to define the effects of the cyclical variations in hormones, both positive and negative, on athletic performance.

G. Bruinvels; *Sport, Exercise and the menstrual cycle: where is the research?* *Br J Sports Med* March 2017

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## Topics

- Puberty Delay in Female Athletes
- Menarchal Delay or Irregularities in Female Athletes: The Triad and REDs
- Use of the Menstrual Cycle to Enhance Athletic Performance
- Menstrual Suppression/Manipulation in Female Athletes
- As a Pediatrician

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## Puberty Delay in Female Athletes

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 **Definition of Puberty**

- Puberty is a 4-5 year process during which adolescents reach sexual maturity and become capable of reproduction
- Marks the beginning of adolescence
- Ultimate purpose of puberty is growth and reproduction or sexual maturation



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## Definition of Puberty

Pubertal development **after 8 years old** is generally considered normal pubertal development

### Puberty is delayed if there is:

- No breast development by the age of 13 years
- Absence of menarche at 15 years with secondary sex characteristics
- No menarche greater than 3 years after breast development

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## Stages of Puberty – Boobs. Pubes. Spurts. Squirts.

### Boobs: thelarche; breast development

- Signified by breast budding and marks the onset of breast development
- It is also the most common physical sign that puberty is starting and typically begins around 9-12 years old

### Pubes: pubarche; development of pubic hair

- The development of thick, coarse hair in the pubic area that typically follows breast development
- In 15% pubic hair growth can be the first sign of puberty

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## Stages of Puberty – Boobs. Pubes. Spurts. Squirts.

### Spurts: growth spurt, peak height velocity, vertical growth

- Typically an acceleration in the rate of growth, also known as, “the growth spurt”
- The limbs accelerate before the trunk which is also why adolescent in early puberty seem to be, “all hands and feet”
- Later puberty, the growth is mainly truncal

### Squirts: menarche; menses; menstrual cycle

- When fluid containing mostly blood and tissue flows out of the body from the uterus, through the vagina
- Usually occurs 2 years after the onset of puberty, which is most commonly 2yrs after breast development
- The average age for menarche is 12yo

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## Pubertal Delay in Female Athletes

- Physical maturation and growth is a complex, and dynamic process that requires elaborate orchestration of the hypothalamic-pituitary-gonadal axis
- Genetic predispositions, related to puberty, can only fully be expressed under favorable environmental conditions
- Individual sports exert unique influences on biological maturation:
  - The sport-related specific character
  - Technical skills and training methods
  - The stage of growth and sexual maturation of the individual athlete

*"Elite Athletes and Pubertal Delay" Minerva Pediatrica 2017 October;69(5):415-26*

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## Pubertal Delay in Female Athletes

Which came first? The delay or the sport?



Specific sports favor the early maturing, whereas other sports, such as gymnastics, offer an advantage to the later or delayed individuals

*"Elite Athletes and Pubertal Delay" Minerva Pediatrica 2017 October;69(5):415-26*

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## Pubertal Delay in Female Athletes

- Possible unfavorable environmental conditions include intensive physical exercise and stress
  - The impact of stress and intensive physical training on growth depends on the combined effects of intensity, frequency, and duration of exercise
  - Girls training for approximately 12 hours per week in sports like rowing, track, and swimming for an average of 4 years during puberty, revealed (with exception of slightly later peak height velocity) no difference in height velocity compared to the population means
  - Female swimmers training for 8 hours per week showed normal heights and normal height velocities after a 2–3 year follow-up, compared to their population means
- Gymnasts now train much more intensely than prior years
- Rhythmic gymnasts and artistic gymnasts start their training at the age of 6.4–7.7 years of age with more than 30 hours of training per week
  - 80s: 20h per week
  - 70s: 15h per week

*"Elite Athletes and Pubertal Delay" Minerva Pediatrica 2017 October;69(5):415-26*  
Tanner, J.M. ed. 1962. Growth at Adolescence, 2nd Ed. Blackwell. Oxford

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## What to Watch Out for in Female Athletes

Intensive athletic training of 18 hours/week

↓

Capable of attenuating growth

<15 hours/week

**do not show** menstrual disturbances or delay in sexual maturation

If menstrual disturbances or a delay in sexual maturation is observed

↓

Evaluation by a Pediatric & Adolescent Gynecologist or an Ob-Gyn is strongly encouraged and recommended

Bonen, A. 1992. Recreational exercise does not impair menstrual cycles: a prospective study. Int. J. Sports Med. 13: 10– 120

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### Differential Diagnosis of Delayed Puberty

Hypergonadotropic Hypogonadism	Hypergonadotropic Hypogonadism
<p>CNS Causes</p> <ul style="list-style-type: none"> <li>▪ Physiologic delay</li> <li>▪ Chronic disease (especially those associated with undernutrition)</li> <li>▪ Weight loss and eating disorders</li> <li>▪ Competitive athletics</li> <li>▪ Inadequate nutrition from lack of access to food</li> <li>▪ Inherited defects in GnRH, RnRH receptors, kisspeptin and leptin</li> <li>▪ Genetic syndromes</li> <li>▪ CNS tumors</li> <li>▪ Depression, stress, substance abuse</li> <li>▪ Drugs (especially those associated with hyperprolactinemia)</li> <li>▪ Pituitary causes (tumor, genetic mutations, infiltrative disease, panhypopituitarism, hemochromatosis, etc)</li> </ul>	<p>Ovaries</p> <ul style="list-style-type: none"> <li>▪ Primary Ovarian Insufficiency (POI)</li> <li>▪ Turner Syndrome</li> <li>▪ Mutations in X Chromosome</li> <li>▪ Fragile X Premutation Carriers</li> <li>▪ Pure Gonadal Dysgenesis (46,XX or 46 XY)</li> <li>▪ Radiation or chemotherapy</li> <li>▪ Oophorectomy</li> <li>▪ Autoimmune Oophoritis</li> <li>▪ Galactosemia</li> <li>▪ Other (myotonia dystrophica, trisomy 21, sarcoidosis, ataxia telangiectasia, ovarian torsion, removal or destruction, tuberculosis, mumps or VMP oophoritis, etc)</li> </ul>
<p>Thyroid</p>	<p>Hypothyroidism</p>
<p>Adrenal</p>	<p>Cushing Syndrome Addison Disease</p>

adapted from, Laufer, et al. "Delayed Puberty" Pediatric and Adolescent Gynecology 2012

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## Pubertal Delay in Female Athletes

- The differential diagnosis of delayed puberty is extensive and broad
- It is necessary to refrain from the assumption that pubertal delay in a female athlete is due solely to competitive athletics without first ruling out other possible causes

Laufer, et al. "Delayed Puberty" Pediatric and Adolescent Gynecology 2012

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## Pubertal Delay in Female Athletes

- Despite the broad differential:
  - Pubertal development and sexual maturation has been observed in a variety of sports, mainly gymnastics, dancing, and long-distance running
- The delay is in **initiation** of puberty, **not the progression** through puberty
- It is more pronounced in sports requiring strict dietary restrictions that result in higher energy expenditure in the presence of a **deficient energy input**



*Onset of energy deficiency, length of energy deficiency and severity of energy deficiency determines the degree of involvement or delay in pubertal development*

"Elite Athletes and Pubertal Delay" Minerva Pediatrica 2017 October;69(5):415-26

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## Topics

- Puberty Delay in Female Athletes
- Menarchal Delay or Irregularities in Female Athletes: The Triad and REDs
- Use of the Menstrual Cycle to Enhance Athletic Performance
- Menstrual Suppression/Manipulation in Female Athletes
- As a Pediatrician

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## Menstrual Absence or Irregularities in Female Athletes

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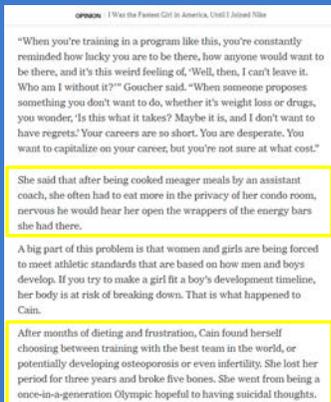
## Menstrual Absence or Irregularities in Female Athletes

- **Absence of the menstrual cycle (amenorrhea) in a female athlete (that has otherwise all the organs and hormones necessary for a menstrual cycle to occur) is unhealthy, abnormal and dangerous**
- Sports that require strict control and regulation of energy intake (food) while also demanding high energy output are of particular concern
- Primary amenorrhea is defined as no menarche by age 15 years
  - Only 3 in 1000 girls will experience menarche after 15.5yrs
  - Primary amenorrhea in collegiate athletes was found to be 7% overall, compared to 22% in cheerleading, diving and gymnastics.
- Secondary amenorrhea refers to an absence of three consecutive cycles post-menarche
  - 2% to 5% of collegiate women will have secondary amenorrhea as compared to 65-69% in dancers and long-distance runners

It happens. But it is not normal.

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## Mary Cain



- Mary Cain is a professional American Middle Distance Runner
- At the World Championships in Moscow in 2013 she became the youngest American athlete ever to represent the United States at a World Championships meet.
- She was 17yrs
- In November 2019, she wrote a New York Times Opinion piece, highlighting her experience with Nike's Oregon Project (now closed)

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## Menstrual Absence or Irregularities in Female Athletes

There is a minimum weight-for-height and a critical lean-to-fat mass ratio that is required for menarche

- According to Frisch theory (1987), attainment of a critical percentage of body fat lowers the metabolic rate and induces a sensitization of the hypothalamus to gonadal steroids
- The HPO system is intact by 14 weeks of gestation, but is downregulated during the prepubertal childhood years
- We *do not* yet know exactly what awakens a quiet HPO axis from its early childhood slumber.
- We *do* know that the pulsatile release of gonadotropins is responsible for ovarian stimulation, maturation and the synthesis of gonadal or sex steroid hormones

Frisch, R.E. & J.W. McArthur; Menstrual cycles; fatness as a determinant of minimum weight for height necessary for their maintenance or onset. Science 1974. 185: 949–951  
R.E.Frisch. "Body Fat, Menarche, Fitness and Fertility" Hum Reprod Aug 1987

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## Absent Menses and Broken Bones

Undernutrition and low body fat, or an altered ratio of lean mass to body fat can delay normal sexual maturation, growth and development as well as onset of menarche



- Adequate nutrition leads to adequate available energy
- Inadequate nutrition, leads to an energy deficiency
  - There is not enough energy left over after purposeful exercise has occurred, for vital and basic physiological processes

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## Absent Menses and Broken Bones

Energy deficiency, leads to functional hypothalamic hypogonadism in female athletes.

- Hormonal production within the HPO axis is low, decreased or absent

### Why?

- Low availability of metabolic fuel or energy causes the body to move fuel and focus away from reproduction and growth in order to maintain basic physiological processes in an effort to conserve fuel
- It is literally in survival mode
- The movement or repartitioning of metabolic fuel results in the suppression of reproductive function and growth and this is clinically seen as menstrual cycle dysfunction and subsequent low bone mineral density or mass

This is why Mary Cain lost her period for 3 years and broke 5 bones

- Her body did not have the fuel it needed to power both her basic physiologic needs and her intense training and workouts

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## Low Energy Availability

- Overt signs of low EA can be indicated by:
  - Low energy stores
  - BMI <17.5 kg/m<sup>2</sup>
  - Adolescents <85% of expected body weight.
- If body weight is not particularly low, more detailed information regarding food intake and energy expenditure is necessary to diagnose low EA
  - Physiologic signs of adaptation to chronic energy deficiency, such as:
    - Reduced resting metabolic rate (RMR)
    - Low triiodothyronine (low T3)
    - Ratio of measured RMR/predicted RMR less than 0.90
      - An experienced sports dietitian or an exercise physiologist can help provide expertise on completing these assessments

Female Athlete Triad and Relative Energy Deficiency in Sport: A Focus on Scientific Rigor Nancy I. Williams; The American College of Sports Medicine

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## Female Athlete Triad (The Triad) vs Relative Energy Deficiency in Sport (RED-S)

The two are similar

Both:

- Call attention to the importance of adequate energy intake to prevent negative health outcomes associated with the participation in sport and exercise
- Include point system algorithms for risk stratification and decision-making on clearance and return to play
- Note that early intervention is essential to prevent progression to serious problems

Female Athlete Triad and Relative Energy Deficiency in Sport: A Focus on Scientific Rigor Nancy I. Williams; The American College of Sports Medicine

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## Female Athlete Triad (The Triad) vs Relative Energy Deficiency in Sport (RED-S)

Female Athlete Triad (The Triad)	Relative Energy Deficiency in Sport (RED-S)
Girls and Women	Women and Men (and calls for more research on the impact of race, ethnicity, and disability)
Focused on low energy availability and associated clinically relevant outcomes	Focused on energy deficiency relative to the balance between dietary energy intake and the energy expenditure required to support homeostasis, health and the activities of daily living, growth and sporting activities
Disordered eating, Menstrual dysfunction, Bone loss	Not a "triad", but rather a syndrome that affects many aspects of physiological function, health, and athletic performance.

De Souza MJ, et al.; 2014 Female Athlete Triad Coalition Consensus Statement on Treatment and Return to Play of the Female Athlete Triad. Br J Sports Med 2014

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## Female Athlete Triad (The Triad)

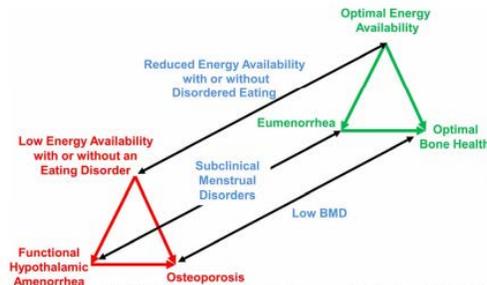


Figure 1. Illustration of the Spectra of the Female Athlete Triad. The three inter-related components of the Female Athlete Triad are energy availability, menstrual status, and bone health. Energy availability directly affects menstrual status, and in turn, energy availability and menstrual status directly influence bone health. Optimal health is indicated by optimal energy availability, eumenorrhea, and optimal bone health, whereas, at the other end of the spectrum, the most severe presentation of the Female Athlete Triad is characterized by low energy availability with or without an eating disorder, functional hypothalamic amenorrhea, and osteoporosis. An athlete's condition moves along each spectrum at different rates depending on her diet and exercise behaviors. BMD, bone mineral density. [Adapted from (3). Copyright © 2014 Wolters Kluwer Health and BMJ Publishing Group Ltd. Used with Permission.]

**Low energy availability**  
Altered hormone release, which may lead to a low estrogen state

**A low estrogen state**  
Can contribute to menstrual cycle irregularity and decreased bone mineral density

**Sustained low energy impacts cardiovascular, endocrinologic, reproductive and skeletal health.**

De Souza MJ, et al.; 2014 Female Athlete Triad Coalition Consensus Statement on Treatment and Return to Play of the Female Athlete Triad. Br J Sports Med 2014

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## Relative Energy Deficiency in Sport (RED-S)

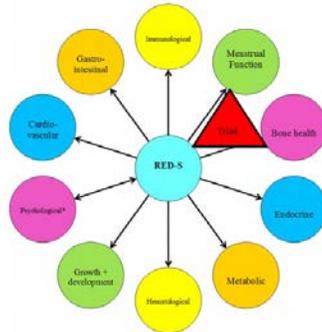


Figure 2. Proximal health consequences of Relative Energy Deficiency in Sport (RED-S) depicting an expanded view of the Female Athlete Triad to illustrate a wider range of outcomes and the application to male athletes. (\*Psychological consequences can either precede RED-S or be the result of RED-S. [Adapted from (9). Copyright © 2014 BMJ Publishing Group Ltd. Used with permission.]



Figure 3. Illustration of potential performance effects of Relative Energy Deficiency in Sport (\*Aerobic and anaerobic performance). [Adapted from (5). Copyright © 2014 BMJ Publishing Group Ltd. Used with permission.]

De Souza MJ, et al.; 2014 Female Athlete Triad Coalition Consensus Statement on Treatment and Return to Play of the Female Athlete Triad. Br J Sports Med 2014

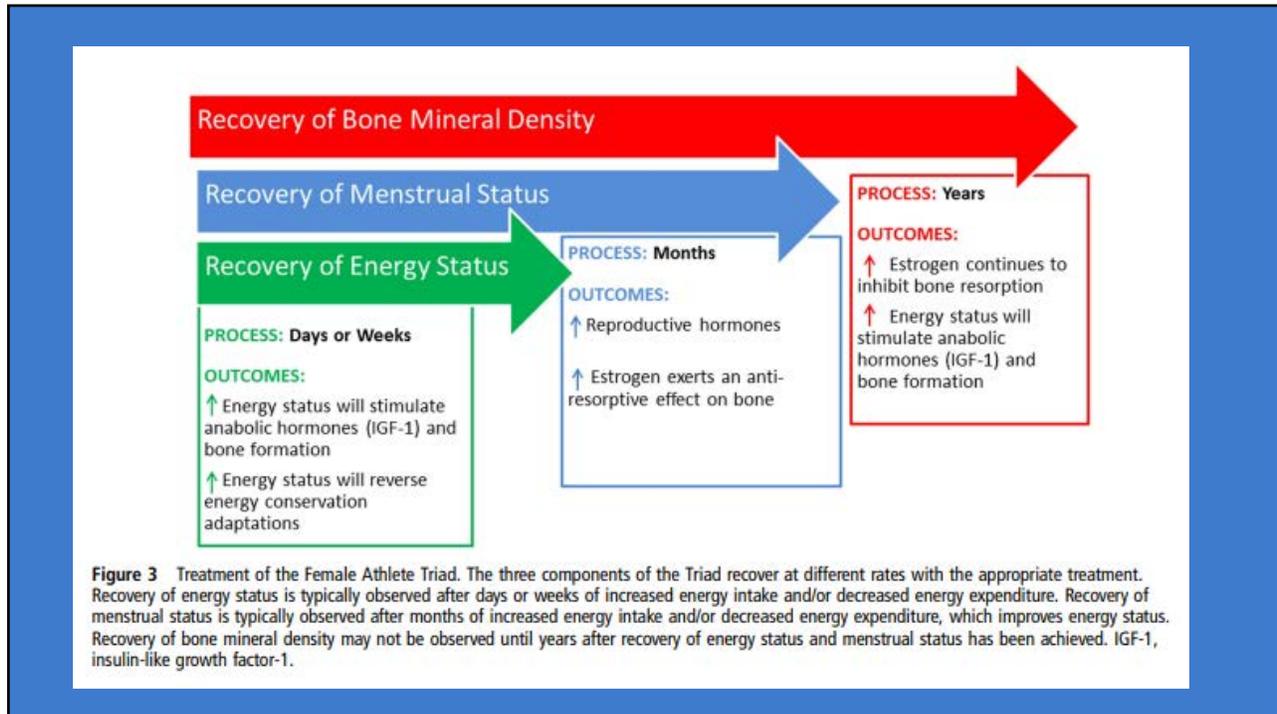
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## Treatment of Energy Deficient Female Athletes

- Energy status must be normalized primarily through modifications of diet and exercise
- Restoration or normalization of body weight is the **best** strategy for successful resumption of menses and improved bone health training, via:
  - An increase in dietary energy intake
  - A decrease in exercise energy expenditure
  - Both
- Sports Dietician, +/- Mental Health Provider
- If sexually active, risk of unplanned pregnancy is high and thus contraception should be strongly recommended
  - This may mask spontaneous resumption of normal menses

De Souza MJ, et al.; 2014 Female Athlete Triad Coalition Consensus Statement on Treatment and Return to Play of the Female Athlete Triad. Br J Sports Med 2014

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## Use of the Menstrual Cycle to Enhance Athletic Performance

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> J Pediatr Adolesc Gynecol 2019 Oct 31[Online ahead of print]

## Use of the Menstrual Cycle to Enhance Female Sports Performance and Decrease Sports-Related Injury

Chimsom T Oleka <sup>1</sup>

Affiliations + expand

PMID: 31678355 DOI: 10.1016/j.jpag.2019.10.002

### Abstract

The impact of the menstrual cycle on female sports performance is a growing interest area in sports and athletics. In March 2017, the British Journal of Sports Medicine, published the article, "Sport, Exercise and the Menstrual Cycle: Where is the Research?", highlighting the significant under-representation of women included in sport and exercise medicine research studies. Dr. Georgie Bruinvels, a research scientist, is focused primarily on menstruation in female athletes and use of the menstrual cycle to optimize training and performance, while decreasing injury. Bruinvels, states, "There is a body of research emerging that highlights that strength training is more advantageous in the first half of the menstrual cycle because the body adapts and recovers better." Pediatric and Adolescent Gynecology has a place in this emerging interest area, given our level of expertise in menstruation, female physiology and the often-avoided female pubertal physiology.

**Keywords:** Adolescent; Anterior cruciate ligament injuries; Athletes; Athletic performance; Exercise; Follicular phase; Luteal phase; Menstrual cycle; Menstruation; Weight loss.

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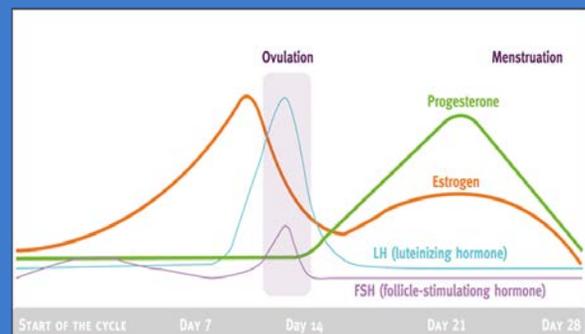
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## Menstrual Cycle Tailored Workouts

### Follicular phase training leads to:

- Greater effect in muscle mass, strength and power
- Higher pain tolerance, max voluntary force generation capacity and endurance
- When estrogen increases, recovery is efficient and the ideal environment for muscle growth is created



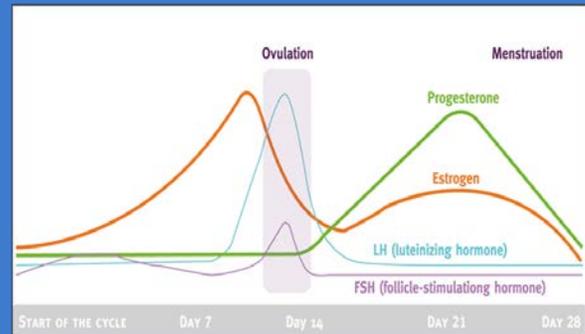
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## Menstrual Cycle Tailored Workouts

### Ovulation

- Warmer. Hungrier. Strength levels high
- High shear force generation capacity
- Attempt your PR now!



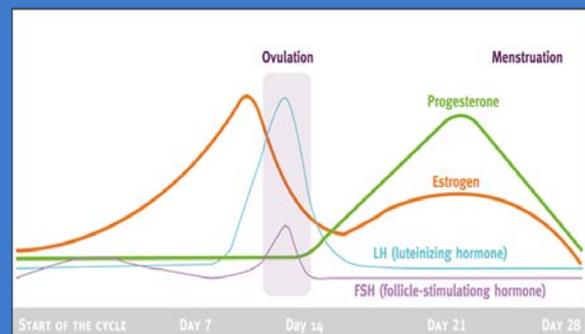
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## Menstrual Cycle Tailored Workouts

### Luteal Phase Training

- Energy levels decrease
- Appetite enhanced
- Craving carbs but body is burning fats
- Muscles fatigue easier
- Ligaments and tendons are lax, increased injury
- Not the best time to start a diet or healthy lifestyle change, because most women tend to have a hard time sticking with it during this time period



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# Champions: U.S. Women's Soccer Team

**GMA** VIDEO WELLNESS STYLE FAMILY FOOD CULTURE LIVING TRAVEL NEWS SHOP ...

WELLNESS — August 9, 2019

## How tracking their periods helped USA women's soccer team win the World Cup

By Katie Kindelan

In the weeks leading up to the U.S. women's national soccer team winning its fourth World Cup, the team's players were tracking not only their diets and workouts but also their period cycles.

Dawn Scott, high performance coach for both the USWNT and the National Women's Soccer League, credited the breakthrough use of period tracking as one of the strategies the team "deployed that helped us win."

Meghan Markle sheds light on menstrual hygiene

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## Menstrual Suppression/ Manipulation in Female Athletes

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## Menstrual Suppression/Manipulation in Female Athlete

- Over the past year, several notable female athletes have publicly discussed the impact of their menstrual cycles on athletic performance
- At the 2016 Summer Olympics, Chinese Olympic medalist, Fu Yuanhui a swimmer from China remarked that her race was impacted by having her period because she felt tired and weak
- At the 2016 Australian Open, the number one British tennis player, Heather Watson cited, “girl things” as a reason she was feeling fatigued during competition
- USA gymnast Aly Raisman discussed the impact of her period on competition in a *Cosmopolitan* story, describing how she had to compete in gymnastics tournaments while battling her sometimes debilitating periods, that would sometimes make it hard to get out of bed

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## Menstrual Dysfunction in Female Athletes

- There are two types of groups who request birth control or hormonal therapy to help regulate or suppress menses.
  - Preference: no menstrual dysfunction, but would prefer to be without or to manipulate it
  - Need: presence of menstrual dysfunction or for contraception
- Menstrual difficulties have been described in:
  - 5% to 20% of vigorously exercising females
  - 12% of swimmers and cyclists
  - 44% of ballet dancers
  - 50% of female triathletes
  - 51% of endurance runners

Pediatr Clin North Am, 2002

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## Menstrual Suppression/Manipulation in Female Athlete

- There is no medical indication for menstruation to occur monthly
- There is no evidence that suppression of menses affects athletic performance
- 1/3<sup>rd</sup> of adolescents who use COCs do so for non-contraceptive reasons
- Menstrual suppression is becoming more common among contracepting adolescents

Kantartzis, K.L., Sucato, G.S. (2013) "Menstrual Suppression in the Adolescent" J Pediatr Adolesc Gynecol

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## Menstrual Suppression/Manipulation in Female Athlete

- Menstrual Suppression/Manipulation can be achieved with:
  - Continuous combined hormonal contraception
    - Combined oral contraceptive pills in 42, 63 or 84 day cycles with or without a hormone free interval
    - Continuously
  - Vaginal ring as above or continuously
  - Depo Provera injection
  - Levonorgestrel intrauterine device
- Progestin only pills and etonogestrel implant are not typically recommended for suppression due to breakthrough bleeding and low amenorrhea rate
- Transdermal patch has an increased systemic estrogen level 1.6x higher than low dose COC pills which leads to an increased VTE risk
  - Rarely first line

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## As a Pediatrician

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## As a Pediatrician

- Be knowledgeable regarding the positive benefits of sports involvement for adolescent girls
- Watch for concerning weight loss and disordered eating
- Be leery of excessive weekly exercise over 15-18h per week, especially in the setting of menstrual dysfunction
- Refrain from the assumption that pubertal delay in a female athlete is due solely to competitive athletics without first ruling out other possible causes
- Know that it is not normal for female athletes to have absent or irregular menstrual cycles, simply because they are athletes

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