

# AMENORRHEA IN THE FEMALE ATHLETE

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# Disclosures

- Nothing to Disclose

# Learning Objectives

1. What defines the female athlete?
2. What are the different types of amenorrhea?
3. What should we be concerned about?
4. What holistic (Osteopathic) interventions should be implemented first?
5. Lifestyle predicting diet and training modifications
6. Pharmacologic intervention
7. A touch on eating disorders
8. Future prognosis for female athletes and reproduction

# Purpose

- Overall goal is to restore regular menses to maintain energy balance
- Provide the most recent components to define the female athlete triad
- Discuss examination and diagnosis of the Female Athlete Triad
- Discuss how amenorrhea is a key component of the Triad and the role we play as the primary caregivers to female athletes
- Provide a possible multidisciplinary treatment approach to provide care for the adolescent female athletes who suffer from the Triad components

# History of Female Sports

- Title IX (1972) increased female sports participation by providing equal opportunity for females to participate in sports and extracurricular activities
- 1980's-1990's
  - *American College of Sports Medicine discovered the unique condition of female athletes called the Female Athlete Triad (1997)*
- 2014-2015
  - *7.8 million high schoolers played sports*
  - *females composed 42% of the population*



# Key Terms

- *Amenorrhea*: an abnormal absence of menstruation
- *Anorexia Nervosa*: eating disorder where distorted body image leads to a person dieting excessively
- *Bone Loss*: gradual loss of calcium and protein from bone, making it brittle and more likely to fracture
- *Bulimia*: eating disorder where a person binges on food and then forces vomiting or laxative abuse
- *Calories*: units of heat used to express the fuel or energy value of food
- *Diuretics*: drugs that increase production of urine
- *Estrogen*: female hormone produced in the ovaries

# Key Terms

- *Immune System*: body's natural defense system against foreign substances and invading organisms like a bacteria that causes disease
- *Laxatives*: products used to empty bowels
- *Menstrual Cycle*: monthly process of changes that prepare a woman's body for possible pregnancy and is from the the first day of menstrual bleeding in one cycle to the first day of menstrual bleeding of the next
- *Osteoporosis*: condition where bones become so fragile that they break more easily
- *Progesterone*: female hormone that is produced in the ovaries and that prepares the lining of the uterus for pregnancy
- *Thelarche*: onset of female breast development
- *Eumenorrhea*: refers to normal monthly menstruation without exogenous hormones

# Common Considerations

- The reason for discussing Amenorrhea in female athletes is (1) male athletes do not experience the menstrual cycle and (2) Amenorrhea is more prominent in athletes due to the effect of intense physical activity
- Yes, males can have low bone mass, eating disorders, or excessive weight loss
- All athletes are at risk of the female athlete triad
- Only restoring energy balance offers the full reversal of low Bone Mineral Density in this population and restoration of spontaneous menses



# 1. What defines the female athlete?

- Women who participate in regular physical activity
- Women who participate in any type of sport
- Must differentiate between types of physical activity
- BMI considerations
- Amount of weight bearing associated with sport/activity
- Energy expenditure associated with the activity
- Diet, mental health and support all play a role



## 2. What is Amenorrhea?

- an abnormal absence of menstruation
- Different types:
  - *Primary*
  - *Secondary*
  - *Hypothalamic*
  - *Oligomenorrhea*



# Primary Amenorrhea

- Any adolescent who has not had a period by 15-years-old or has not had a period within 3 years of thelarche.
- Lack of thelarche by 13 years should be evaluated
- An examination should occur if the individual has not had a period by 14 and has a history of an eating disorder or excessive physical activity

# Secondary Amenorrhea

- Lack of menses exceeding 90 days in a female who has started menstruating
- Menstrual dysfunction warrants a complete assessment of secondary amenorrhea evaluation for pregnancy
- Prevalence of Secondary Amenorrhea is not clearly defined but is reported to be as high as 65% in long distance runners and 69% in dancers, compared to 2-5% in the general population of female athletes
- Pregnancy, lactation, menopause, and other hormonal causes are common, physiologic causes of secondary amenorrhea



# Evaluation of Secondary Amenorrhea

- Urine Pregnancy Test
  - *If the pregnancy test is negative, this can suggest Polycystic Ovarian Syndrome if in combination with acne, irregular menses, and hirsutism.*
  - *Additional testing is needed for diagnosis in special situations*
- Effects 5-10% of reproductive women

# Hypothalamic Amenorrhea

- Estrogen levels are low, resulting on a negative effect on bone density
- Low bone density is 22-50% for elite female athletes compared to 12% in general female population
- Estrogen inhibits bone turnover by maintaining a balance between bone formation and resorption in osteoclast and osteoblast
- Hypothalamic pituitary failure

# Oligomenorrhea

- Menstrual cycles occur regularly but are over 35 days apart

# Benefits of playing organized sports

- Exercise that benefits the body and mind
- Playing sports allows for the development of social skills and innate animal competitiveness
- Decreased risk of heart disease and diabetes
- Improved body image and self esteem
- NOTE: benefits of sports far outweigh the risks





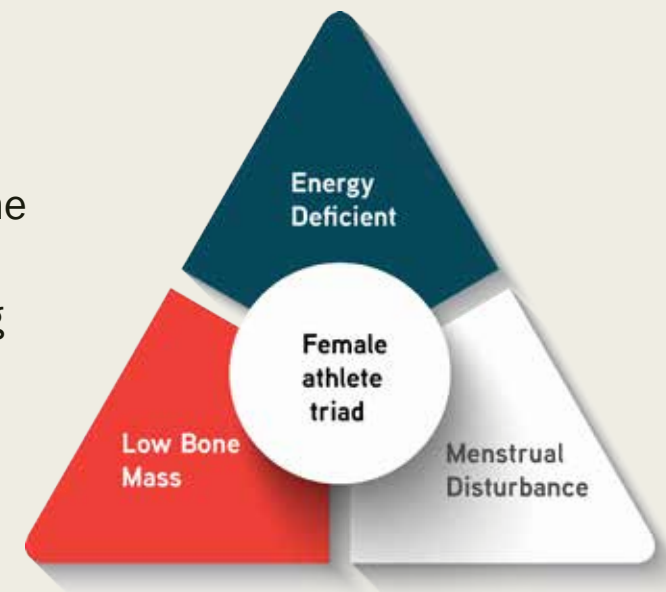
# Effect of Menstrual Cycle in Sports

- Low energy availability is associated with hypothalamic dysfunction and will negatively affect menstrual function and bone health



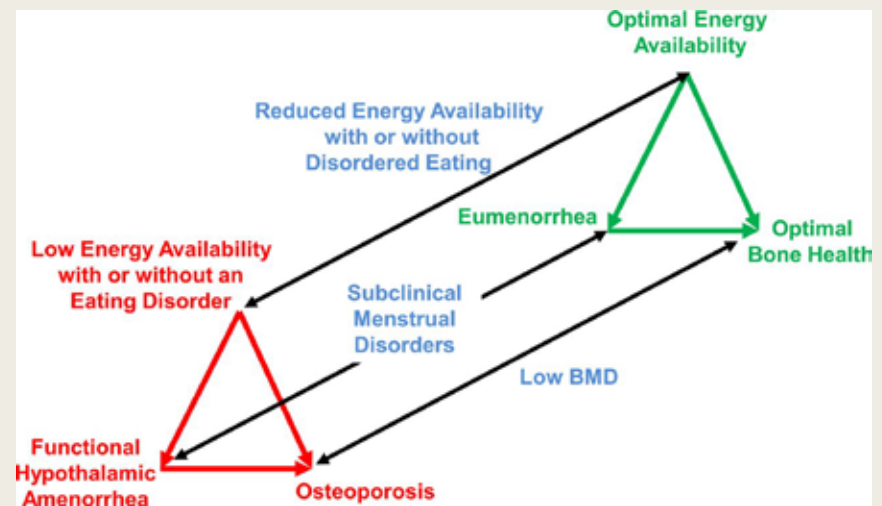
# What is the Female Athlete Triad?

- Results of energy imbalance
- All components are interrelated and all affect the immune system
- 1. Low energy availability with or without disordered eating
- 2. Menstrual dysfunction
- 3. Low bone density
- Often lead to disordered eating behaviors, menstrual irregularity, and stress fractures
- If one condition is identified, it is imperative to clinically screen for the other conditions



# Symptoms of Triad

- Irregular or missed periods
- Change of weight or significant weight loss
- Feeling tired
- Excessive focus on weight
- Feelings of guilt if you aren't exercising
- Limiting food intake, fasting, or purging
- Eating in secret
- Stress fractures



# Low Energy Availability

- Energy is first used for exercise then for bodily functions
  - *Cardiovascular functions*
  - *menstruation*
- If there is not enough EA, then the body reacts by reducing the amount of energy needed for bodily functions
  - *Cellular maintenance*
  - *Thermoregulation*
  - *Reproduction*
- Cause:
  - *lack of knowledge from the athlete; she is unaware of how many calories she needs to intake to balance how many she uses when exercising*
  - *Purposely restricting your caloric intake*
  - *Excessive exercise*



# Signs of Low EA

- Physical examination of:
  - *Bradycardia*
  - *Lanugo (fine soft hair) on extremities*
  - *Evidence of dehydration*
- Exercising excessively lowers EA
  - *In a study of 300 high school athletes, 60% of the females reported to train outside of practice sessions*
  - *Can be associated with suicidal behaviors*



# Menstrual Dysfunction (MD)

- Ranges from eumenorrhea (normal menses) to amenorrhea (lack of menses)
- Excluding 2 years after onset menses, where normalization of cycle occurs, high school female athletes have a prevalence of MD from 18.8% to 54%
- Aesthetic athletes, like gymnasts or dancers, are at 26.7 – 28.2% of MD
  - *Additionally, these athletes have a delay in skeletal maturation showing that bone effects may go beyond decreased BMD*



# Effects of MD

- Some athletes consider lack of menstruation is “being in shape”, but in reality it has many negative consequences including:
  - *Luteal deficiency*
  - *Infertility (poor follicle development or failure of implantation of fertilized egg)*

# Diagnosis of MD

- Functional hypothalamic amenorrhea is due to low EA from diagnosis of exclusion
- Disruption of hypothalamic or pituitary function can be evaluated by the following tests to assess thyroid dysfunction, hyperprolactinemia, primary ovarian insufficiency, hypothalamic and pituitary disorders, and polycystic ovary syndrome:
  - *Serum luteinizing hormone*
  - *Follicle-stimulating hormone*
  - *Prolactin*
  - *Total and free estradiol*
  - *Total and free testosterone*
  - *TSH and free T4*
  - *Dehydroepiandrosterone and DHEAS*
- Hence, the diagnosis is from a medical condition over a negative energy balance



# Bone Mineral Density (BMD)

- Ranges from optimal bone health to osteoporosis
- Athletes in weight bearing sports have a 5-15% higher BMD than nonathletes
- Diagnosis from dual-energy X-ray absorptiometry (DXA)
- Affected by:
  - *Energy availability*
  - *Genetic composition*
  - *Menstrual status*
  - *Environmental factors*



# Low BMD

- Often first identified when athlete has a stress fracture
- To treat:
  - *DXA scan that includes BMI, onset of menses (>16 years of age), history of diagnosed eating disorder, history of stress fractures*
- a base line BMD should be established for at risk athletes

# Possible Concerns

- Mental health disorders
- Disordered Eating vs. Eating disorders
- Bone Mineral Density
- Hormone deficiencies
- Birth control problems
- Symptoms of triad
- Changes in period
- Long term risks



# Mental Health Disorders



- Cause
  - *peers or coaches believe that the female needs to be a certain weight or shape to be successful in a particular sport*
- Effect
  - *The female develops a negative perspective on how she looks*
- Harmful result
  - *The female starts to disordered eat in order to maintain a certain weight or figure*

# Disordered Eating

- Clarification: not all athletes with female athlete triad have disordered eating
- defined as a unhealthy way of eating that can happen when people try to lose weight
  - Examples:
    - Fasting
    - Skipping meals
    - Extreme dieting
    - Use of diuretics, laxatives, or stimulants
    - Forcing yourself to vomit
    - Effects: could lead to the mental health issue of an eating disorder that includes *bulimia* and *anorexia nervosa*



# Symptoms of disordered eating behaviors

- Sudden weight loss
- Delay onset of menstruation (primary amenorrhea)
- Cessation of menstruation (secondary amenorrhea)
- Depression, anxiety
- Fatigue
- Chest pain with/without palpitations
- G.I irregularity (diarrhea/constipation)
- Stress fractures
- Delayed healing in any musculoskeletal injury

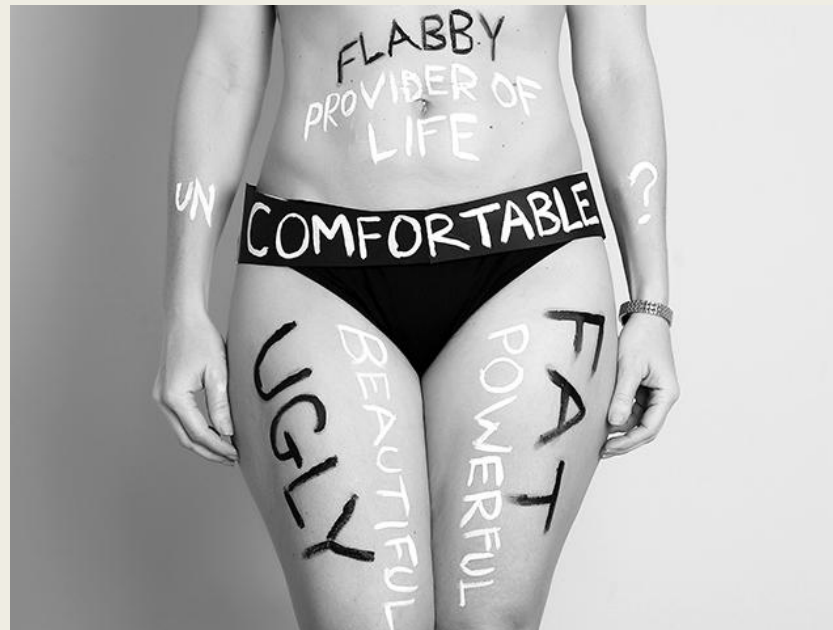


# Statistics of disordered eating

- Prevalence of clinical disorder eating has been reported as 16-47% in slender build female athletes compared to 0.5-10% in general male/female population
- Can cause deficiencies in essential macronutrients and low energy availability with or without an eating disorder can affect psychological health and increase depression, low self-esteem, and anxiety

# Eating Disorder

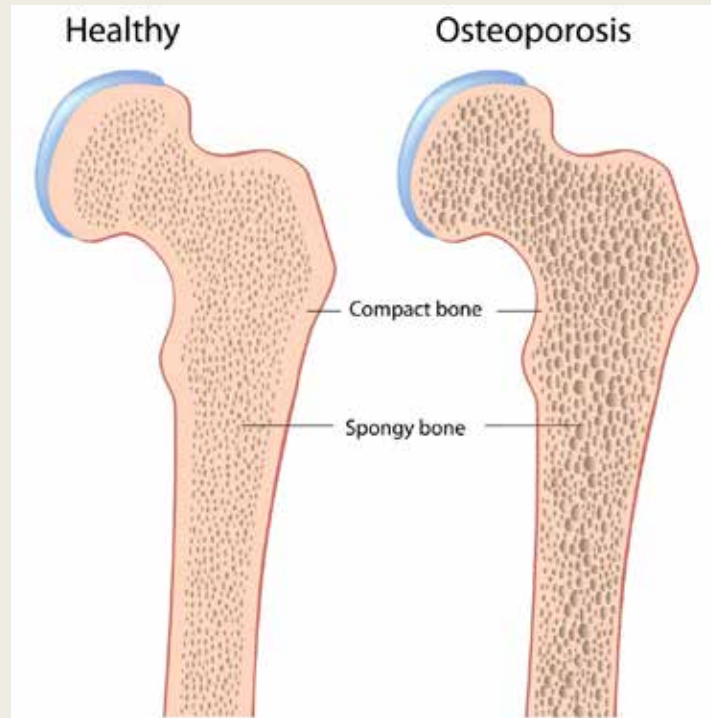
- Not enough nutrients are consumed to strengthen and develop bone tissue
- Effect
  - *Can propose an issue with Bone Mineral Density*





# Long Term Effects

- Osteoporosis
- Possible psychological effects if an eating disorder is present

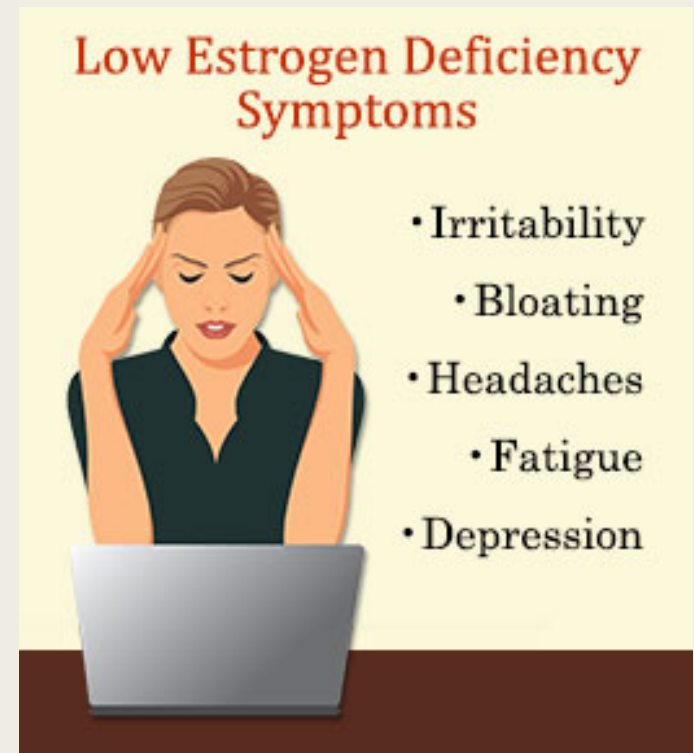


# Long Term Effect: Osteoporosis

- Currently, there is a limited number of studies that examine BMD in adolescent females
- Z-scores represent BMD in a population and less than -2.0 is defined as low bone density
  - *Studies show BMD scores are lower in amenorrheic athletes than eumenorrheic athletes or nonathletes*
  - *Bone microarchitecture is impaired, as well*
- Since adolescence is a time of maximal bone mass accrual, lack of maximal bone acquisition can cause osteoporosis later in life

# Hormone Deficiencies

- Young female athletes are more likely to injure themselves because their body isn't fully developed
- Estrogen and progesterone fluctuate during strenuous physical activity, affecting menstrual cycle, bone health, *osteoporosis*, and overall body development
- Low body fat and estrogen levels inhibit the start of her period and can cause permanent damage in reproductive health in the future.



# Changes of Period Warnings

- Note: periods may be irregular when off the pill or when you are a young teenager
- Period cycle less than 21 days or more than 45 days
- Period flow lasting longer than 7 days
- Periods go from regular to irregular
- Period absent for 3 months



# Previous Actions

- Research of relevant databases from July 2016 was performed searching keywords of:
  - *Female athlete triad*
  - *Adolescent female athlete*
  - *Disordered eating*
  - *Eating disorder*
  - *Low energy availability*
  - *Relative energy deficit*
  - *Anorexia*

# Previous Actions

- *Bulimia*
- *Menstrual dysfunction*
- *Amenorrhea*
- *Oligoamenorrhea*
- *Bone mineral density*
- *Osteopenia*
- *Osteoporosis*
- *Stress fracture*
- *Stress reaction*

# Treatments

- Sport physical evaluation at high school and collegiate levels
- Athletic screening



# Treatments

- Lifestyle modifications
- Pharmacological intervention
- OBGYN intervention
- Diet modifications





# Athletic Critical BMD Screening

- American College of Sports Medicine and the International Society for Clinical Densitometry have different criteria for BMD screening
- BMD may stabilize and improve after nutritional needs are met, so it is important for athletic coaches and parents to cooperate to improve the health of the athlete
- Amenorrheic athletes have 2-4-fold increase risk of stress fracture and a 10-20% less lumbar spine BMD compared to eumenorrheic athletes

# Athletic Critical BMD Screening

- *First, athletes are questioned about weight, menstrual history, body image, exercise, diet, medications, pill abuse, sexual history and possible symptoms of depression/health issues*
  - Athletes can be questioned any time if they suspect development of Triad
- *Second, a physical examination should include BMI, and symptoms of low body temperature, dry skin, hair loss, acrocyanosis, mitral valve prolapse, constipation, and ankle and leg edema.*
  - Assessment of orthostatic hypotension can be valuable because it is common in women who are anorexic or is present in the female triad

# Screening Questions

- Have you ever had a menstrual period?
- How old were you when you first menstruated?
- When was your last period?
- How many periods have you had in the last 12 months?
- Are you currently taking any female hormones?
- Do you worry about your weight?
- Are you trying to or has anyone recommended you to lose weight?
- Are you on a special diet?
- Have you ever had a stress fracture?
- Have you ever had an eating disorder?
- Have you ever been told you have low bone density?

# Sports Physicals

- Menstrual cycle should be an integral part in a sports physical and all active females should be assessed for components of the triad
- Evaluate BMI and EA levels
- After physical examination, provider may perform the following labs:
  - Serum electrolytes
  - Renal function (BUN, Cr)
  - Calcium
  - Liver function tests
  - Thyroid-stimulating hormone (TSH)
  - Complete blood count, differential, and platelets



# Lab Screening for Amenorrheic athlete

- Evaluated by pregnancy test, follicle stimulating hormone, thyroid-stimulating hormone, prolactin levels, and sexually transmitted infections if sexually active
- If she has a potential eating disorder, her doctor needs to evaluate blood count, electrolyte and glucose testing, urinalysis, and electrocardiogram

# Lab Screening for disordered eating

- Critical for treating an individual with the triad
- Look to a mental health care provider
- Evaluate symptoms of psychological problems including low self-esteem, depression, and anxiety disorders

# Steps to treat the Triad

1. Adequate caloric consumption to restore a positive energy balance
2. Determining cause of menstrual dysfunction and eventual resumption of menses is very important
3. Nonpharmacological interventions are the first choice - pharmacologic treatment for Menstrual Dysfunction is reserved only for those patients with symptoms of estrogen deficiency or infertility
4. Adequate intake of calcium and vitamin D is critical for lifelong bone health

# Lifestyle Modifications

- The optimal approach is to involve the patient, OBGYN, sports nutritionist, coaches, parents, and mental health care provider to treat the triad





# Nonpharmacologic Treatment

- Communication with families and coaches regarding an athlete's ineligibility to participate until treatment is encouraged and writing down goals
- family-based therapy and cognitive behavioral therapy
- If failed, female athletes can consider estrogen therapy with cyclic progesterone or low-weight amenorrheic athletes can use transdermal estradiol with cyclic progesterone



# Roles

- Athlete
  - *Abides by guidelines, communicates concerns*
- Family members
  - *Supports athlete*
  - *Provides healthy, positive environment*
- Family practice physician (sports medicine)
  - *Oversees team, orders medication, provides appropriate studies*
- Dietitian/nutritionist
  - *Educates athlete on health, oversees restoring positive energy balance, may use 3-day diary for food consumption*
- Gynecologist/Endocrinologist
  - *Determine menstrual dysfunction and other aspects that have been ruled out by pediatrician*
- Physical Therapist
  - *Provides rehabilitation*
- Athletic trainer
  - *Provides daily support and manages injuries for team*
- Psychologist/Psychiatrist
  - *Determines if there is an underlying diagnosis that triggers the Triad conditions, provides support*

# Pharmacologic Intervention

- Controversial
- Pharmacologic treatment may be considered when nonpharmacologic treatment has failed
- Issues
  - No pharmacologic intervention have been shown to fully restore BMD like oral contraceptives



# Diet Modifications

- One of the most important aspects of treatment
- Sports nutritionist can help determine the quantity and quality of food the female athlete should have to meet her bodily functions, replace energy output from training, and enhance bone health.
- The female athlete should speak to a doctor if they are a 14-year-old that has never had a period or if they are experiencing any of the triad symptoms that can lead to Amenorrhea

# Diet Modifications

- Making sure the female athlete is getting enough calories and nutrition to support the amount of activity she does. This helps bone development by receiving at least 1,300 mg of calcium and 600 international units of vitamin D a day
- Female athlete should speak to a doctor/dietitian about a healthy weight specific to the individual and then making a plan to maintain that health.
- The female should not stop playing sports or exercising, but should just change her level of activity and eating habits

# Osteopathic Interventions

- Athletic Critical Screening
- Advancing Sports Physicals
- Lab Screening
- OBGYN should know that athletes may not be amenorrheic but still may have low energy availability and suboptimal bone health
- A worksheet to help OBGYN's determine an athlete's cumulative risk has been developed to help the health care provider determine risk using evidence-based criteria and risk stratification

# How to improve Low EA: Role of the athlete

- Write down caloric consumptions and have a nutritionist plan out a 3-day plan



# Restoration of Menses

- Have a plan to manage caloric consumption to gain 1 pound/week
- This is a gradually slow increase, so the restoration of menses will take some time
- Athlete needs to be educated by gynecologist or endocrinologist about her cycle because she could be ovulating, although not menstruating
- Pharmacologic treatment for MD is used for patients with symptoms of estrogen deficiency or infertility



# Problem with “The Pill”?

- Birth control is inhibiting the restoration of bone mass density and is making it difficult to use menstruation to recover
- By using oral contraceptive pills, studies show a trend of reduced bone loss and improve BMD in athletes

# Problems with “The Pill”?

- If there is not a desire for pregnancy, some form of contraceptive is needed
  - *Oral and nonoral contraceptives for MD are not recommended*
  - *Hormone containing contraceptives induce withdrawal bleeding, but they do NOT restore ovulatory cycles or improve endocrine parameters*
  - *This may provide false reassurance for improving health*
  - *While not indicated for Amenorrhea, providers should not restrict hormone-containing contraceptives for contraception when needed*

# How to improve BMD: Roles of outsiders

- Pharmacological issues
  - *Estrogen-containing oral contraceptives are not effective for improving BMD (no evidence of so)*
  - *No evidence for the benefit of biphosphates, but could be a last result if nonpharmacological techniques do not work*
- Dietitians
  - *Vitamin D supplementation is recommended to maintain serum 25-hydroxyvitamin D levels between 32 and 50 ng/mL*
- Athletic trainers
  - *Weight gain has a positive effect on BMD*
  - *Using resistance training to build muscle*



# How to improve BMD

- 20-35 micrograms of ethinyl estradiol and OCPs may maintain BMD in people with low BMD
  - *Optimal dose of ethinyl estradiol has not been determined, but a non athletic adolescent taking a 20-microgram ethinyl estradiol with OCP decreased BMD compared to controls*
  - *However, oral estrogen does not increase BMD in female athletes and does not replace diet and activity modifications.*
- Overall, mixed results on BMD levels with pharmacologic intervention
  - *However, 17 Beta Transdermal estradiol patch with medroxyprogesterone has maintained BMD in adolescents with anorexia and can be considered*

# What happens if Amenorrhea is ignored?

- If Amenorrhea is untreated, females will lose bone mass at a rate of 2-3% per year
- Since bone mass grows during adolescence, if a female ignores a lack of menstruation for as little as 6 months, she can lose bone mass of 1-2%



# Future Prognosis

- By using oral contraceptive pills, studies show a trend of reduced bone loss and improve BMD in athletes
- Cyclic oral progesterone in the the recommended dosage to treat the female athlete triad is not effective to prevent pregnancy
- Biphosphates for treatment of osteoporosis in postmenopausal women have not been shown to be efficacious in women of childbearing age and the long-term effect on the developing fetus in future pregnancy is unknown



# Reproductive Prognosis in Amenorrheic women

- Amenorrheic women experience infertility because they do not develop ovarian follicles or ovulate
- However, with proper treatment, ovulation can continue before menstruation
- A female athlete may be ovulating but is unaware since she has not resumed menstruating, making her amenorrheic
  - *Hence, this can lead to an unexpected pregnancy if birth control is not used*

# Acknowledgements

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- Olivia Orris, Pre-Medical Student at the University of Miami



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