ALEX KRAVTSOV / SHUTTERSTOCK

Many female athletes are at risk but not screened for female athlete triad—a condition that leads to menstrual dysfunction and low bone density, with prevention being key. It's been estimated that up to 16% of female athletes present with all three components of the disorder. Focusing on high school athletes, 4% to 18% present with two components of the triad and 16% to 54% present with one component. However, due to the multiple components that make up this disorder, estimating the prevalence is a challenge. This article provides an overview of female athlete triad, including signs and symptoms, diagnosis, treatment, and nursing interventions.

What's female athlete triad?

Female athlete triad is a condition seen in physically active women experiencing an energy imbalance. Interestingly, this disorder can be seen in men. The three components of female athlete triad are decreased energy availability, menstrual dysfunction, and low bone density.

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Get to know female athlete triad

Nurses can play a significant role in the prevention, identification, and treatment of this disorder affecting physically active girls and women.

By Amanda Perkins, DNP, RN

Although there are three components associated with female athlete triad, it's important to understand that an athlete may not develop all the components. However, low energy availability is often the catalyst.

Decreased energy availability refers to the amount of energy from the diet remaining after exercise and normal physiologic functions. To determine a person's total energy availability, compare calories in and calories out. If more calories are expended than consumed, it can lead to decreased energy availability, which may be intentional or unintentional. The decreased energy availability seen in female athlete triad may also be associated with an eating disorder. When a patient has an eating disorder, the decreased energy availability is intentional.

The eating disorders that may be present in the patient with female athlete triad are anorexia nervosa, bulimia, and binge eating. Eating disorders are associated with depression, decreased

self-esteem, and anxiety disorders, highlighting the importance of screening for these disorders when conducting a health history on the patient at risk for female athlete triad. Although eating disorders may be associated with this condition, it's important to understand that this isn't always the case. For example, some athletes increase their activity levels without increasing caloric intake, leading to the development of this disorder. This can happen when an athlete moves from a middle school sports program to a high school sports program.

The decreased energy availability associated with this condition can negatively affect the reproductive system by inhibiting hormonal release in the hypothalamus, pituitary gland, and ovaries. This hypothalamic dysfunction can lead to menstrual problems, such as amenorrhea and irregular periods, as well as decreased bone density. It's important to pay attention to menstrual problems because they can lead to decreased circulating estrogen, which, in turn, leads to problems with bone density.

Risk factors

Individuals at the greatest risk for developing female athlete triad are those with a low body weight, such as dancers, gymnasts, and runners. In general, sports that classify athletes based on weight have the highest incidence of female athlete triad. The sports most commonly associated with this disorder include:

- figure skating
- gymnastics
- synchronized swimming
- running
- lightweight rowing.

Although not necessarily classified as a sport, individuals who participate in dance also have a higher risk of developing this disorder. When attempting to identify sports associated with this disorder, keep in mind that activities relying on endurance, aesthetics, or weight classes or those that reward leanness pose an increased risk. Individuals who participate in these sports also have an increased risk of developing an eating disorder.

Additional risk factors include the following:

- menstrual irregularities
- depression
- stress fractures
- frequent injuries
- dieting
- vegetarianism
- weight loss
- weight cycling
- body mass index (BMI) less than 18.5
- history of extended exercise periods
- increase in athletic training.

When assessing for female athlete triad, ask questions about the patient's personality, such as perfectionism and obsessiveness. These personality traits are associated with the disorder. We also see an increased risk when athletes start sports early, come from a home with family dysfunction, and are survivors of abuse.

Signs and symptoms

Menstrual dysfunction often presents as amenorrhea, which, in some cases, may be the initial symptom. Many individuals have the misconception that amenorrhea is the result of exercise and completely normal, but this isn't the case. Amenorrhea isn't a normal result of exercise; it's a warning sign that the body may be struggling to meet energy requirements. When amenorrhea occurs,

did you know?

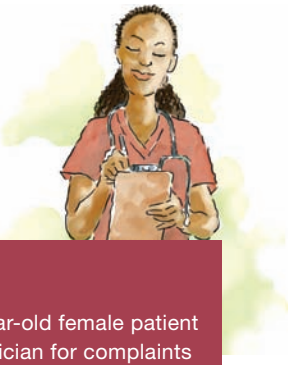
The name of this disorder is deceiving because men can also develop it. Male athletes may show a suppression of reproductive function, similar to female athletes with female athlete triad. With male athletes, decreased testosterone levels and bone mineral/mass density may be observed. Although this disorder is being recognized as one that can affect men, more research needs to be conducted to fully gain an understanding. Some organizations and medical professionals are recommending that the disorder be renamed relative energy deficiency in sport.

it can be primary or secondary. With primary amenorrhea, the patient never starts menstruating. With secondary amenorrhea, the patient starts menstruating but stops for at least 3 months. Primary amenorrhea can be diagnosed at age 15 if the adolescent hasn't started menstruation but has developed secondary sexual characteristics. Basically, when the energy availability in the body becomes low, estrogen levels deplete, leading to menstrual dysfunction, as well as a variety of other complications.

Although amenorrhea is the most common menstrual disorder seen, you may also see menstrual irregularity and oligomenorrhea—menstrual periods that are greater than 35 days apart. When in a low-energy state, menstrual dysfunction can occur after 5 days. Symptoms of estrogen deficiency include vaginal dryness, dyspareunia (painful intercourse), infertility, and impaired bone health.

When conducting a physical exam on a patient with female athlete triad, you may observe some of the following signs and symptoms:

- hypotension
- bradycardia
- orthostatic vital sign changes
- complaints of fatigue
- pallor
- dry hair
- hair loss
- dry mucous membranes
- dry skin
- lanugo
- dental caries
- gastrointestinal discomfort
- constipation
- muscle weakness
- bone pain
- joint pain
- peripheral neuropathy
- edema
- decreased BMI
- low weight
- weight fluctuations
- delayed puberty.



consider this

You're caring for a 15-year-old female patient who's visiting her pediatrician for complaints of leg pain. She tells you that she's very busy with sports in the summer. She plays basketball and soccer, and has attended both a basketball and soccer camp. She tells you that she plays sports 5 to 7 days per week depending on the schedule. When you ask about her eating schedule, she tells you that she snacks while traveling from one sport to the other, but typically only has time to sit down and eat one meal per day. You ask about her menstrual cycle and she reports that she hasn't had her period for approximately 3 months. What are your next steps? How would you care for this patient?

In athletes presenting with bradycardia, a thorough health history is essential, because bradycardia can be a normal finding in athletes. You may also observe signs and symptoms associated with an eating disorder if one is present. Patients with female athlete triad may also present to a health clinic with stress fractures or reports of recurrent injuries or injuries that don't heal.

Diagnosis

Before diagnosis, obtain a health history, including:

- weight, including the patient's maximum, minimum, and ideal weight
- menstrual history and pattern, including the age when menarche started and secondary sex characteristics developed
- body image
- exercise routine
- medication use, especially hormones such as birth control pills
- eating habits
- diet history
- history of eating disorders
- history of stress fractures
- laxative use
- diet pill use
- sexual history
- substance abuse
- depression.

It's important to obtain a menstrual history because menstrual dysfunction may be the first sign of this disorder. A thorough dietary and medication history is also essential because we may see athletes restrict food; purge; or use medications, such as diet pills, diuretics, and laxatives, to maintain or achieve their desired weight. Additionally, ask patients if they're being pressured by coaches, parents, or peers to lose weight because this type of pressure can lead to intentional and unsafe weight loss.

In addition to a health history, the following lab tests may be ordered:

- complete blood cell count with differential
- ferritin
- serum iron
- vitamin B12
- folate
- complete metabolic panel
- erythrocyte sedimentation rate
- urinalysis
- pregnancy test
- follicle-stimulating hormone
- thyroid-stimulating hormone
- prolactin.

When determining bone mass/mineral density, a dual-energy X-ray absorptiometry scan may be ordered. If a patient has a history of stress fractures, this test should be completed.

Signs and symptoms

cheat sheet

In addition to the triad of decreased energy availability, menstrual dysfunction, and low bone density, you may observe:

- hypotension
- bradycardia
- orthostatic vital sign changes
- complaints of fatigue
- pallor
- dry hair
- hair loss
- dry mucous membranes
- dry skin
- lanugo
- dental caries
- gastrointestinal discomfort
- constipation
- muscle weakness
- bone pain
- joint pain
- peripheral neuropathy
- edema
- decreased BMI
- low weight
- weight fluctuations
- delayed puberty.

Treatment

Early intervention for the patient with female athlete triad is important because early intervention can prevent or decrease associated complications. The treatment of choice is relatively simple: Create a balance between energy expenditure and energy availability. Basically, we want the energy availability to meet the total daily expenditure. Maintaining this balance is better for overall health. An important intervention for these patients is education about nutrition and energy expenditure to enable weight gain.

We may see that adolescents don't eat well due to time constraints. Many adolescents are going to school, playing sports, working part-time jobs, and completing their homework, leaving a limited amount of time for healthy meal choices. In these patients, we may see a low intake of calcium and vitamin D, which are both necessary for bone health. In patients with female athlete triad, we need to restore nutrition and caloric needs. It's preferred that patients obtain the necessary nutrients from their diet as opposed to supplements, although supplements may be used in some cases. Healthy eating is associated with weight gain, which has been associated with the return of menses.

Encourage the patient to consume calcium-rich foods, aiming for a daily intake of 1,000 to 1,300 mg of calcium. For patients who aren't deficient in vitamin D, it's recommended that they consume 600 international units daily, with higher doses needed for deficiencies. In some instances, it may be beneficial for the patient to see a registered dietitian. Another important aspect of treatment may be daily weights, or weights taken at predetermined intervals. Weighing should be done on the same scale, with minimal clothing to avoid weights that appear higher than normal.

Additional interventions for the patient with female athlete triad include family therapy and cognitive behavioral therapy. Both types of therapy can help

increase adherence to the dietary plan in patients with this disorder. Mindfulness has also been shown to be a beneficial intervention.

Pharmacologic treatment may be used to address underlying conditions, such as depression or anxiety. In some cases, oral contraceptives may be used to help regulate menstruation; however, they should be used cautiously because withdrawal bleeding can be mistaken for a return of menses. Nasal calcitonin may be used for decreased bone mass/mineral density. This should also be used cautiously because long-term use can increase cancer risk.

When caring for a patient with female athlete triad, it's important to take a multidisciplinary approach by including the healthcare provider, sports dietitian, and mental health professional (if an eating disorder is present). In some instances, it may also be recommended that the patient see a sports medicine specialist, exercise physiologist, athletic trainer, and/or medical consultants. Developing a therapeutic relationship with the patient will help improve adherence and the treatment outcome. It may be beneficial to develop a treatment contract with the patient (see *Treatment contract*).

It may be necessary for patients to take a break from play. Patients with female athlete triad shouldn't participate in sports until they're medically cleared. When determining the ability of the patient to return to play, consider the sport being played and the patient's competitive level, such as junior varsity, varsity, or college athlete. It's also important to consider the patient's age because preadolescent and adolescent athletes have an increased risk of complications. Because exercise has been shown to increase self-esteem, decrease risk-taking behaviors, increase bone mineral density, and decrease obesity, patients should be allowed to return to play as soon as safely possible.

Treatment contract

For some athletes, treatment contracts may be useful. It's best practice to develop a written, not verbal, contract because written contracts tend to be associated with increased adherence to the treatment plan. These contracts should specify the criteria necessary for return to play or ability to play, expectations of the patient, and treatment goals. Treatment contracts are beneficial because they create a shared understanding between the patient, parents/coaches, and the healthcare team.

Complications

The two main complications associated with female athlete triad are osteoporosis and fracture. It can also negatively impact reproductive and cardiovascular health. Generally, athletes have a high bone mass density, which is a protective factor for the development of osteoporosis. In patients with female athlete triad who have a low bone mass density, we see an increased risk for the development of osteoporosis. Low bone density also increases the risk of stress fractures, bone stress injuries, and other musculoskeletal injuries. When stress fractures develop, they can progressively become worse, turning into complete fractures.

In some cases, this disorder can lead to life-threatening arrhythmias. If the patient has risk factors for arrhythmias, closely monitor cardiovascular status and intervene as necessary. Infertility can also be a complication because in low-energy states the body will decrease reproductive functions in an attempt to prevent pregnancy.

Athletic performance may decline, which is the opposite of the patient's goal. Patients and coaches should have an understanding of the complications associated with female athlete triad and know that once complications develop, they may not be reversible. Due to this fact, prevention and early diagnosis are very important.

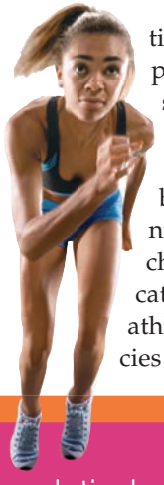
Prevention

Many athletes don't know what female athlete triad is and, as a result, won't be able to effectively prevent it. Education goes a long way in preventing female athlete triad. Assess what patients know and what information they're lacking. Teaching children and adolescents about stress management is important because stress can play a role in the development of eating disorders, which can cause negative changes to energy availability. We should also screen all female athletes before they play sports and any time they display symptoms of female athlete triad.

When it comes to prevention, another factor to consider is that peak bone growth occurs between ages 11 and 14, with approximately 90% of peak bone mass developed by age 17. For this reason, we want to ensure that girls don't develop female athlete triad during this developmental stage.

It's interesting to note that some coaches are required to learn about this disorder, although many aren't. Parents and coaches need to be educated to more effectively prevent female athlete triad, playing a pivotal role in the identification of at-risk athletes. Coaches should be able to identify red flags for female athlete triad and promote healthy eating and exercise.

School nurses often encounter athletes who are at risk for, or already showing signs and symptoms of, the disorder. With this in mind, it's alarming to know that many school nurses aren't aware of this condition or how to screen for it. A study conducted by Kroshus, Fischer, and Nichols in 2015 showed that less than one-third of the school nurses in the study knew what female athlete triad was and less than one-fifth could identify its components. It indicated that school nurses found it useful if athletes completed a survey before participating in sports that asked about eating, bone health, and menstrual irregularities.



The school nurse can play an essential role in the education of athletes, parents, and coaches. Emphasis should be placed on parents and coaches to avoid pressuring the athlete to lose weight or keep a low body weight. Additionally, school nurses can advocate for school policy changes, leading to mandatory educational programs for all coaches and athletes. Many schools don't have policies in place that address the components of female athlete triad such as eating disorders. The school nurse can also help raise awareness about the disorder in the community.

> The treatment of choice is relatively simple: Create a balance between energy expenditure and energy availability.

In addition to school nurses, nurses who work in pediatrician offices are in a unique position to aid in the prevention, identification, and treatment of female athlete triad. Due to their ability to reach so many young athletes, nurses working in pediatrician offices should be well educated about this disorder. Currently, screening for female athlete triad isn't mandatory, so we don't see this happening in all pediatrician offices. Nurses in these positions can help push for screening before beginning sports. It's recommended that screening occurs before the

start of a sport and yearly after the initial screening.

Both school nurses and nurses working in pediatrician offices can help address eating disorders in female athletes by ensuring that a strong support system is in place to assist in the development of healthy coping strategies and offering counseling to patient and families.

A positive change

Nurses who come in contact with female athletes must be able to recognize female athlete triad, including causes, risk factors, and signs and symptoms, to assist in the identification and treatment of patients at risk for or with this disorder and prevent long-term, potentially irreversible complications. Armed with this knowledge, nurses can positively change the quality of life for these athletes. ■

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The author and planners have disclosed no potential conflicts of interest, financial or otherwise.

DOI-10.1097/01.NME.0000585064.96043.88