Female Athlete Triad: Disordered Eating, Amenorrhea, and Osteoporosis

What We Know

› Female athlete triad (FAT) refers to a group of disorders—amenorrhea, disordered eating, and osteoporosis—that have been observed with increasing frequency, especially among young female athletes, elite athletes, and those who practice endurance sports\(^{(1,3,4,7)}\)
• Although previously recognized by medical professionals, FAT was first recognized by the American College of Sports Medicine (ACSM) in 1992\(^{(2,8)}\)
• The development of FAT is thought to follow a progressive pattern in which the athlete changes eating habits in an attempt to lose weight. The resulting energy restriction and weight loss predisposes her to menstrual dysfunction and subsequent decreased bone mineral density (BMD)\(^{(2,3,7)}\)
• Participating in competitive or recreational sports, especially those that emphasize appearance (e.g., having a lean body shape or size and a low body weight), is a risk factor for FAT. These sports include gymnastics, track and field, diving, swimming, and figure skating. Female ballet dancers are also at risk for FAT\(^{(1,2,7,8,9)}\)
  – Additional risk factors for FAT include having a poor body image; having low self-esteem; being pressured by coaches, teammates, or family members to lose weight; having a history of depression; and frequently having to weigh oneself, especially in public\(^{(2,8,10)}\)
• The exact prevalence of FAT is unknown, and although researchers in some studies have reported that the number of athletes suffering from all three components of the triad is low, the frequency of individual components (e.g., eating disorders, menstrual irregularities, and low bone mass) among elite athletes could be high\(^{(2)}\)
  – Although the prevalence of FAT among female high school and collegiate athletes in the U.S. is thought to be ≤ 1.2%, 23.5% of these athletes experience menstrual dysfunction, 18.2% exhibit disordered eating patterns, and 4.1% have low BMD\(^{(7)}\)
  – Among female athletes at all levels, up to 15.9% have all 3 components of FAT, while 2.7–27% have any 2 and 16–60% have any 1 of the components\(^{(7)}\)
  – Athletes in “lean sports” are affected by FAT 2–3 times more often than athletes in sports that do not emphasize weight categories or aesthetics\(^{(2)}\)
• FAT and its components are associated with reduced athletic performance, stress fractures and other musculoskeletal injuries, depressed immune function, and increased risk for early-onset cardiovascular disease\(^{(1,3,5,2,9)}\)
  – Researchers who conducted a prospective study of 259 female adolescents and young adults reported a dose-response relationship between FAT risk factors and risk of stress fractures\(^{(1)}\)
› The 1997 ACSM Position Stand on FAT focused on disordered eating, which ranges from a mild preoccupation with calories and body image to formal eating disorders (i.e., anorexia nervosa, bulimia nervosa, and eating disorders not otherwise specified [EDNOS]); the 2007 revised Position Stand replaces the term ‘disordered eating’ with ‘low energy availability’ (i.e., energy intake inadequate to meet energy expenditures and other physiologic needs)\(^{(2,5,8,10)}\)
• Low energy availability may occur secondary to restrictive eating; fasting; binging and purging; excessive exercising and training; and using laxatives, diuretics, enemas, or diet pills (e.g., stimulants)\(^2,5,7,8,9\)

– Between 1% and 62% of female athletes have disordered eating patterns, with the highest rates seen in sports that rely on weight categories or emphasize lean build\(^3\)

• Physical symptoms may include significant weight loss, frequent extreme weight fluctuations, fatigue, muscle weakness, hair loss, dry skin/brittle hair and nails, lanugo, callus or abrasion on back of hand (due to skin contact with teeth from inducing vomiting), dental and gum problems, bradycardia, hypotension, GI problems (e.g., constipation, diarrhea, bloating, postprandial distress), swollen parotid glands, hypoglycemia, menstrual dysfunction, and stress fractures\(^8\)

• Amenorrhea is the absence or cessation of menses for 3 or more consecutive months; amenorrhea is classified as primary in cases in which adolescent girls older than 15 years of age have never had menses, and secondary in cases in which females with a history of menses do not experience menses for 3 or more months\(^7,8\)

– The reported prevalence of amenorrhea in athletic women is 12–79%, compared with 2–5% in the general population\(^7,8\)

• Menstrual dysfunction in active women is thought to result from disruption of the pulsatile secretion of luteinizing hormone (LH) by the pituitary gland; the threshold of energy availability below which menstrual dysfunction is likely to occur is 30 kcal/kg lean body mass per day\(^2,9\)

– The revised ACSM Position Stand expands the bone health component from a focus solely on osteoporosis to a recognition of a spectrum of bone health ranging from low bone mass and stress fractures to osteoporosis\(^2,4,10\)

• Reduced BMD is seen in 10.7–21.8% of female athletes\(^6\)

• Healthy female athletes have higher BMD than their nonathletic counterparts; however, those with menstrual dysfunction have significantly lower BMD than their eumenorrheic counterparts\(^2,11\)

– Altered BMD is primarily related to a deficiency of estrogen and progesterone, but also to caloric deprivation, including inadequate calcium intake\(^2,9\)

In the “2014 Female Athlete Triad Coalition Consensus Statement on Treatment and Return to Play of the Female Athlete Triad,” an expert panel proposed a 3-tiered, evidence-based risk stratification point system to assist the clinician in quantifying risks and making decisions regarding sports participation, clearance, and return to play\(^3\)

**What We Can Do**

› Learn about FAT, including each component disorder, risk factors, prevention, and treatment; share this knowledge with colleagues

› When possible, provide information to patient/patient’s family on FAT. Include information on specific conditions, if possible

› Screen physically active females. Patient history should include menstrual, dietary, and exercise history\(^10\)

• Inquire about age at which menarche occurred, duration and flow of menses, number of days between menstrual cycles, date of last menses, and history of hormonal therapy

• Inquire about type and quantity of food consumed within last 24 hours, history of weight, perception of weight, and perception of ideal weight. Inquire about any history of binging, purging, or restrictive eating and use of laxatives, diuretics, or diet pills

• Inquire about type of sport/exercise, duration and intensity (number of days/week and number of hours/day), excess training, and history of fractures or injuries

› Assist the treating clinician with conducting laboratory/diagnostic tests, which may include CBC; BUN/creatinine; electrolyte panel; serum prolactin, follicle-stimulating hormone (FSH), LH, thyroid-stimulating hormone (TSH), thyroxine, testosterone, dehydroepiandrosterone sulfate, progestin, and estradiol; and bone mineral densitometry (dual energy X-ray absorptiometry [DEXA]) test\(^3,2\)

› Request referral to a mental health professional, if indicated; referrals to eating disorder treatment centers, nutritionists, cardiologists, orthopedic specialists, substance abuse treatment centers, and support groups may also be helpful

› Discuss proper exercise and nutrition with patient, and assist patient in setting an appropriate weight goal. Referral to a nutritionist/dietitian should be considered
Inform patient to reduce frequency and intensity of exercise in order to resume menstruation and to take daily calcium supplements to prevent bone loss.

Inform patient/patient’s family that disordered eating may require long-term inpatient treatment and psychotherapy.

Discuss prevention with school/college coaches, nurses, and parents—emphasize good nutrition and adequate sleep, and discuss the avoidance of diet pills, laxatives, and other substances. Educate on avoiding emphasis on body weight or type/size.

More information can be obtained from the National Osteoporosis Foundation at http://nof.org/ and the National Eating Disorders Association at www.nationaleatingdisorders.org.
Coding Matrix

References are rated using the following codes, listed in order of strength:

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<th>Code</th>
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<td>SR</td>
<td>Published systematic or integrative literature review</td>
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<td>RCT</td>
<td>Published research (randomized controlled trial)</td>
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<td>R</td>
<td>Published research (not randomized controlled trial)</td>
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<td>C</td>
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References


