

### **The Female Athlete Triad: A Statement of the Problem**

Tara Tietjen-Smith, Assistant Professor, Texas A & M University – Commerce, [Tara.Tietjen-Smith@tamuc.edu](mailto:Tara.Tietjen-Smith@tamuc.edu)

Jim Mercer, TCA Volleyball Club Coach, Fountain Valley, CA

#### **Abstract**

Almost 3 million high school girls are currently competing in sports, and female participation in collegiate athletics has risen over 137%. Fierce competition in some sports is potentially dangerous for adolescent girls who are especially vulnerable to an obsession with thinness. The Female Athlete Triad (FAT) consists of disordered eating, amenorrhea, and osteoporosis. Coaches, athletic trainers and other health professionals should gain an understanding of FAT in order to adequately care for the well-being of female athletes.

#### **Introduction**

Proper nutrition is an important element of training to achieve maximum performance in athletics. The body must be well-fueled to be effective, and nutrition can mean the difference between winning and losing. Unfortunately, athletes frequently fail to plan for the best possible fuel intake for performance. Compounding this inadequate intake further are athletes' perceptions of nutritional intake and effect on performance (Clark, 2006). Some athletes are not meeting the necessary energy requirements, which may result in a decrease in performance and negative effects on health (Sport Medicine & Science Council of Saskatchewan; SMSCS, 1999). Disordered eating may follow, especially among female athletes (Gottschlich & Young, 2006).

In 2005 almost 3 million young women were competing in sports at the secondary level. From 1981 to 2004 female participation in collegiate athletics had risen 137% (Women's Sport's Foundation, 2007). Many benefits can be accrued from sport participation including a decrease in the likelihood of obesity, improved mental and emotional health, and an improved quality of life (Bailey, 2006). Some studies (Alfredson, Nordstrom, & Lorentzon, 1996; 1997) revealed that physical activity has led to increases in female bone density in the sports of both soccer and volleyball.

Kilbourne (2000) noted that competition in some sports is potentially a dangerous situation for adolescent girls who are especially vulnerable to an obsession with thinness. Today's culture may glorify thinness and make thinness seem necessary to have fun and be successful (Otis & Goldingay, 2000). The media may intimate to young women that if they are not thin, they should be unhappy and dissatisfied with their lives. Calderson, Yu, and Jambazian (2004) reported that 60% of high school students were on diets. Sixty-seven percent of the female students on diets had normal body mass indexes (BMI); while 18.5% of them actually had BMI's below normal and were underweight. Physiological changes from malnutrition in female athletes may include dry skin, brittle hair and nails, cold intolerance, amenorrhea, delayed menarche, lightheadedness, and constipation. Physical signs may include decreased subcutaneous fat and muscle, hypothermia, bradycardia, lanugo (fine baby-like hair covering the body), orthostatic blood pressure changes (due to dehydration), and cold and discolored hands and feet. Stress fractures, premature osteoporosis, disturbances of reproductive function, irreversible bone loss, psychological problems, and cardiovascular and gastrointestinal problems may also occur (Levy & Williams-Wilson, 2006).

#### **What is the Female Athlete Triad (FAT)?**

In 1992 the American College of Sports Medicine (ACSM) identified the *Female Athlete Triad* (FAT) as a health problem. FAT consists of disordered eating, amenorrhea, and osteoporosis. FAT may occur because young women

feel they have to maintain or achieve an unrealistically low body weight. Adolescent girls and women training in sports that emphasize low body weight or thin appearance are at a greater risk. Competing in some sports such as ballet, diving, figure skating, gymnastics, running, and swimming may make an athlete more susceptible to FAT (Kirchner & Cohen, 2002). Athletes suffering from one component of the Triad should be screened for the others. Alone, or in combination, each component of FAT can decrease physical performance and cause morbidity and mortality (Gottschlich & Young, 2006). Many women athletes are engaging in disordered eating habits combined with athletic behavior due to a current emphasis on extreme thinness. Too much physical activity, without proper nutritional intake, may lead to the cessation of menses (amenorrhea) and a weakening of the skeletal system (Putukian, 2001).

### ***Disordered Eating***

The first phase of FAT, disordered eating, affects approximately 15 to 62 percent of collegiate female athletes (Beals & Manore, 2002). Disordered eating has been defined as “a wide variety of irregularities in eating behavior that do not warrant a diagnosis of a specific eating disorder such as anorexia nervosa or bulimia nervosa” (Wikipedia, 2007, p. 1). Athletes participating in disordered eating may exhibit compulsive behaviors including “ritualized eating, food restriction, and obsessive training” (Kirchner & Cohen, 2002, p. 1417). Hausenblaus and Carron (1999) identified 4 risk factors for disordered eating in female athletes. These risk factors included societal pressure to be thin; body type expectations for an athlete’s sport; excessive exercise while training; and psychological characteristics of athletes (e.g. perfectionism).

Disordered eating can eventually manifest itself into an actual eating disorder such as anorexia or bulimia, so early detection is vitally important. What many athletes do not understand is that disordered eating can lead to low energy availability which in turn can lead to the suppression of “physiological functions that are essential for growth, development, and health” (IOC Medical Commission Working Group Women in Sport (IOC-MCWGWS), 2006, p. 4).

### ***Amenorrhea***

Women undergoing intense physical exercise have also been known to experience amenorrhea, the cessation of menses (Hobart & Smucker, 2000). Thirty percent of female college athletes reported they had stopped menstruating at some time during their training (Putukian, 2001). Amenorrhea, decreases bone mineral density when bone growth should be forming (Otis, Drinkwater, Johnson, Loucks, & Wilmore, 1997). ACSM (1997) noted that amenorrhea: (1) is no longer thought to be a reversible condition with little health consequences; (2) is not an advantageous, normal condition associated with intense physical training; and (3) may be caused by another condition that should be evaluated and treated. Hobart & Smucker (2000) stated that the prevalence of amenorrhea among female athletes was 3 to 66 percent, while the prevalence in the general female population was 2 to 5 percent. Investigators suspected that menstruation ceased because the female athletes were not getting enough energy through food. Amenorrhea is neither desirable nor a normal result of physical training. Amenorrhea is an indication that an athlete is nutritionally imbalanced and may need a medical evaluation (Dotinga, 2001).

Cobb et al. (2003) studied 91 female, cross-country athletes between ages 18 and 25. The researchers found menstrual irregularities in 65% of the 23 runners who scored high on an eating disorder inventory. Only 25% of the remaining runners exhibited menstrual irregularities. Loucks, Verdun, and Heath (1998) found that female athletes who did not exhibit disordered eating, but who had “low energy availability” resulting from a negative energy balance, may still develop amenorrhea.

### ***Osteoporosis***

Osteoporosis is a chronic bone disease that is characterized by low bone mass and bone deterioration resulting in bone fragility and a high risk of fractures. In 1999 the World Health Organization (WHO) upgraded osteoporosis to an international problem that is becoming more prevalent. At one time, osteoporosis was a disease of mostly aged women; however, that is no longer the case (Pouilles, Tremoillieres, & Ribot, 2005). Statistically, female athletes are at a greater risk for osteoporosis. According to Hame, Lafemina, McAllister, Schaadt, and Dorey (2004) female athletes sustained a significantly greater quantity of stress fractures than male athletes. Intense exercise combined with inadequate food consumption is likely to lead to premature osteoporosis.

In the United States, 44 million adults have or are at risk for developing osteoporosis. Eighty percent of those currently affected were women (National Osteoporosis Foundation, 2007). Bone is living tissue mostly made of calcium. Women's bodies renew bone regularly until about the age of 30. At approximately age 30, new bone is no longer renewed at the same rate that old bone is removed. Once women reach menopause, somewhere between the ages of 45 and 55, the level of estrogen is reduced. With decreased production of estrogen, which maintains healthy bone, osteoporotic-related fractures may occur. The Surgeon General's Report on Bone Health and Osteoporosis estimated that 1.5 million osteoporosis-related fractures occur each year (U.S. Department of Health & Human Services, 2004).

A female athlete who exhibits disordered eating and amenorrhea may produce insufficient estrogen; and therefore, may be at higher risk for osteoporosis (ACSM, 1997; Erickson & Sevier, 1997). Eisman (1999) reported that osteoporosis can also affect pre-menopausal women experiencing menstrual irregularities. Osteoporotic symptoms have been seen in college aged women (Adams-Hilliard & Deitch, 2005). The results of this trend have led to an increasing number of young women who have the bone density of postmenopausal women. Scientists have found that over 50 percent of young women with anorexia had bone loss equal to that of menopausal women (Patrick, 2000). Warren and Shantha (2002) indicated that young women could begin losing 5% of bone mineral content per year. In 1997 the President's Council on Physical Fitness and Sports first recognized that once bone loss has occurred, there may be no cure. Therefore, efforts should focus on prevention.

### **Risk Factors for FAT**

The IOC-MCWGWS (2006) identified several factors that increase female athletes' risk of developing FAT: non-sport-related factors and sport-related factors. Non-sport-related factors include dieting as well as social pressure including family, friends and society as a whole. Sport-related factors include the following: personality of the athlete, pressure to lose weight to improve performance (weight cycling), overtraining, injuries, coaching pressures, and "early start of sport-specific training" (p. 7).

### **Diagnosing FAT**

The IOC-MCWGWS (2006) made recommendations for identifying, managing, and treating individuals with FAT. This committee recommended that athletes should be evaluated by a physician and referred to a dietician. If an athlete does not follow the recommendations of the dietician, she should be referred to an "eating disorder treatment specialist" (p. 10) who has experience working with athletes. Athletes would then have to comply with the treatment plan in order to continue participating in their athletic endeavors. If the athlete refused treatment, then she would not be allowed to participate in her sport. This committee also recommended that steps should be taken in order to prevent disordered eating.

### **Possible Solutions**

The American College of Sports Medicine (ACSM, 1997) and the IOC-MCWGWS (2006) called for coaches, athletes, and others to be educated about the dangers of FAT. At the international, professional level, Aebersold-Schutz (1997) advocated that female athletes needed medical facts about sport training and nutrition in order to avoid amenorrhea and subsequent stress fractures. At the collegiate level, nutritional programs have been designed and implemented to educate college athletes and coaches (Picard, 1999). However, such programs need to also be designed for younger athletes to help sponsor awareness and prevent occurrence in the future. The Committee on Sports Medicine and Fitness of the American Academy of Pediatrics (2001) recommended that athletes, parents, and coaches receive education on "eating disorders, menstrual dysfunction, decreased bone mineralization, and adequate calorie and nutrient intake to meet energy expenditure and maintain normal growth and development" (Preboth, 2001, p.1239). In addition, the United States Olympic committee and the ACSM convened to create a Consensus Statement (Manore et al., 2001). The statement advocated that coaches take the lead in providing educational programs and informational material to their athletes. The experts placed the educational responsibility on the coaches to provide effective prevention programs.

## Summary and Conclusions

Healthy People 2010, a United States government initiative, recommends physical exercise to keep our population healthy. Competitive sports can fulfill this function. However, female athletes face the risk of FAT if they are unaware of the dangers of improper nutrition, dieting, and excessive exercise. The ultimate risks of disordered eating, amenorrhea, and osteoporosis include preventable injury, loss of childbearing capabilities, and possibly death (Otis & Goldingay, 2000). An awareness of the cultural bias that promotes this behavior and an awareness of the value and advantages of varied body types can help female athletes avoid the dangers that confront them. According to the IOC Medical Commission Working Group, Women in Sport (2006), coaches and health professionals should gain an understanding of FAT in order to adequately care for the well-being of female athletes. More research is needed on its causes, prevalence, treatment, and consequences. All individuals working with physically active girls and women should be educated about the FAT and develop plans to prevent, recognize, treat, and reduce the risks.

## References

- Adams-Hilliard, P. J. & Deitch, H. R. (2005). Menstrual disorders in the college age female. *Pediatric Clinics of North America*, 52(1), 179-97.
- Aebersold-Schutz, G. (1997). Do endurance sports lead to osteoporosis in women? *Orthopade*, 26(11), 955-60.
- Alfredson, H., Nordstrom, P., & Lorentzon, R. (1997). Bone mass in female volleyball players: A comparison of total and regional bone mass in female volleyball players and nonactive females. *Calcified Tissue International*, 60, 338-342.
- Alfredson, H., Nordstrom, P., & Lorentzon, R. (1996). Total and regional bone mass in female soccer players. *Calcified Tissue International*, 59, 438-442.
- American College of Sports Medicine [ACSM] (1997). ACSM position stand: The female athlete triad. *Medicine and Science in Sports and Exercise*, 29.
- Bailey, R. (2006). Physical education and sport in schools: A review of benefits and outcomes. *Journal of School Health*, 76(8), 397 – 401.
- Beals, K. A. & Manore, M. M. (2002). Disorders of the female athlete triad among collegiate athletes. *International Journal of Sport Nutrition and Exercise Metabolism*, 12, 281 – 293.
- Calderson, L. L., Yu, C. K., & Jambazian, P. (2004). Dieting practices in high school students. *Journal of the American Dietetic Association*, 104, 1369-1374.
- Clark, N. (2006). The meat & potatoes of sports nutrition (nutritional requirements of athletes). *Palaestra*, 22.4, 44 – 45.
- Cobb, K. L. et al. (2003). The ‘female athlete triad’ confirmed. *Medicine and Science in Sports and Exercise*, 35, 711 – 719.
- Dotinga, R. (2001). Periodic heart trouble. *Nurse Week*. Accessed November 19, 2005 at <http://www.nurseweek.com/news/01-06/622athletes.html>
- Eisman, J. A. (1999). Genetics of osteoporosis. *Endocrine Reviews*, 20(6), 788-804.
- Erickson, S. M. & Sevier, T. L. (1997). Osteoporosis in active women: Prevention, diagnosis, and treatment. *The Physician and Sportsmedicine*, 25(11), 1 – 8.
- Gottschlich, L. M. & Young, C. C. (2006). Female athlete triad. Retrieved from [www.emedicine.com/sports/topic163.htm](http://www.emedicine.com/sports/topic163.htm) on September 11, 2006.

- Hame, S. L., Lafemina, J. M., McAllister, D. R., Schaadt, G. W., & Dorey, F. J. (2004). Fractures in the collegiate athlete. *American Journal of Sports Medicine*, 32(2), 446-451.
- Hausenblaus, H. A., Carron, A. V. (1999). Eating disorder indices and athletes: An integration. *JSEP*, 21, 230 – 258.
- Hobart, J. A. & Smucker, D. R. (2000). The female athlete triad. *American Family Physician*, 61, 3357 – 3364. Retrieved September 11, 2006 from <http://www.aafp.org/afp/20000601/3357.html>.
- Hoch, A. Z. (2001). Stress fractures in female athletes. *HealthLink: Medical College of Wisconsin*. Retrieved on October 26, 2007 from <http://healthlink.mcw.edu/article/979332792.html>
- IOC Medical Commission Working Group Women in Sport (IOC-MCWGWS) (2006). *Position Stand on the Female Athlete Triad*. Retrieved on October 26, 2007 from [http://www.olympic.org/uk/utilities/reports/level2\\_uk.asp?HEAD2=1&HEAD1=1](http://www.olympic.org/uk/utilities/reports/level2_uk.asp?HEAD2=1&HEAD1=1).
- Kilbourne, J. (2000). *Can't buy my love: How advertising changes the way we think and feel*. New York: Simon & Schuster.
- Kirchner, J. T., & Cohen, D. (2002). Medical problems of the athlete: The female athlete triad. *Consultant*, 1417 – 1427. Retrieved from <http://www.consultantlive.com/showArticle.jhtml?articleID=172303760&pgno=1> on March 16, 2007.
- Levey, R. & Williams, B. (2006). Anorexia nervosa. Retrieved from <http://www.emedicine.com/MED/topic144.htm> on March 16, 2007.
- Loucks, A. B., Verdun, M., & Heath, E. M. (1998). Low energy availability, not stress of exercise, alters LH pulsatility in exercising women. *Journal of Applied Physiology*, 84, 37 – 46.
- Manore, M., Nattiv, A., O'Brien, R., Rolley, L., Smith, B., Varechok, S., et al. (2000). *The female athlete triad: A responsible approach for coaches: A consensus statement*. The United States Olympic Committee and the American College of Sports Medicine.
- National Institute of Arthritis and Musculoskeletal and Skin Diseases [NAIMS] (2000). *Health topics Osteoporosis: Progress and promise*. Retrieved November 19, 2005 from <http://www.niams.nih.gov/hi/topics/osteoporosis/opbkgr.htm>
- National Osteoporosis Foundation (2007). *Fast Facts*. Retrieved October 26, 2007 from <http://www.nof.org/osteoporosis/diseasefacts.htm>.
- Otis, C.L., Drinkwater, B., Johnson, M., Loucks, A., & Wilmore, J. (1997). American College of Sports Medicine position stand: The female athlete triad. *Medicine and Science in Sports and Exercise*, 29, i-ix.
- Otis, C. L., & Goldingay, R. (2000). *The athletic woman's survival guide*. Champaign, Illinois: Human Kinetics.
- Patrick, L. (2002). Eating disorders: A review of the literature with emphasis on medical complications and clinical nutrition. *Alternative Medicine Review*, 7(3), 184-200.
- Picard, C. L. (1999). The level of competition as a factor for the development of eating disorders in female collegiate athletes. *Journal of Youth and Adolescence*, 28, 583-594.
- Pouilles, J. M., Tremolieres, F. A., & Ribot, C. (2005). Osteoporosis in otherwise healthy perimenopausal and early postmenopausal women: Physical and biochemical characteristics. *Osteoporosis International*. Retrieved on November 19, 2005 from [http://www.springerlink.com/media/2724fr9exhdkrg5ckyvm/contributions/m/j/2/1/mj214511v8303265\\_html/fulltext.html](http://www.springerlink.com/media/2724fr9exhdkrg5ckyvm/contributions/m/j/2/1/mj214511v8303265_html/fulltext.html)

- Preboth, M. (2001). Medical concerns of the young female athlete. *American Family Physician*, 63(6), 1239-40.
- President's Council on Physical Fitness and Sports (1997). *Physical activity & sport in the lives of girls*. Minnesota: University of Minnesota.
- Putukian, M. (1998). The female athlete triad. *Clinics in Sports Medicine*, 17, 675-96. Retrieved on March 16, 2007 from <http://www.usask.ca/sportmedsci/nutr/disorderstrategies.htm>.
- U. S. Department of Health and Human Services (2004). *Bone health and osteoporosis: A report of the Surgeon General 2004*. Retrieved September 11, 2006 from [http://www.surgeongeneral.gov/library/bonehealth/Executive\\_Summary.html](http://www.surgeongeneral.gov/library/bonehealth/Executive_Summary.html).
- Warren, M. P., & Shantha, S. (2000). The female athlete. *Best Practice & Research Clinical Endocrinology & Metabolism*, 14(1), 37-53.
- Wikipedia (2007). Disordered eating. Retrieved from [http://en.wikipedia.org/wiki/Disordered\\_eating](http://en.wikipedia.org/wiki/Disordered_eating) on March 16, 2007.
- Women's Sports Foundation (2007). Women's Sports & Physical Activity Facts & Statistics. Retrieved on October 26, 2007 from [http://www.womenssportsfoundation.org/binary-data/WSF\\_ARTICLE/pdf\\_file/106.pdf](http://www.womenssportsfoundation.org/binary-data/WSF_ARTICLE/pdf_file/106.pdf).
- World Health Organization [WHO] (1999). Interim report and recommendation of the World Health Organization task-force for osteoporosis. *Osteoporosis International*, 10, 259-264.