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## Female Athlete Triad Review

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## Female Athlete Triad Review

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### Abstract

This article defines the female athlete triad and discusses long-term consequences for adolescents and women symptoms related to the triad. The pillars of the female athlete triad consist of menstruation disruption, decreased bone mineral density, and disordered eating (energy availability). We will discuss the problems that can arise from each of the three pillars of the female athlete triad and the relationships among them. There are different treatments for the triad based on the needs of the individual and new treatments are being researched. Finally, the need for more informed coaches, parents, and medical professionals is discussed.

### Introduction

More girls than ever are participating in athletics since Title XI (1) (federal law mandating equal opportunity in sports). With this increase in participation, there have been an increase in female athlete triad cases. As intensity of youth athletics increase, so do the pressures put on young girls playing sports. However, if the approach to athletics is not healthy, both physically and mentally, there can be serious consequences. Despite the concerns, many athletes and coaches are either uninformed on or unaware of the triad (2).

In 1992, an association was discovered among low energy availability, disrupted menstrual function, and low bone density in female athletes playing sports that emphasize leanness (3). In 1993, the American College of Sports Medicine Task Force on Women's Issues convened and coined the phrase "female athlete triad" to represent the three pathologies common in female athletes (4). Low energy availability is caused by disordered eating in which exercise (energy expenditure) is greater than dietary energy intake, whether it be inadvertent or intentional (3). Disrupted menstrual function and low bone density occurs concurrently with the disordered eating because as the energy available decreases, the skeletal and reproductive systems become impaired. Disrupted menstrual function can lead to primary amenorrhea, secondary amenorrhea, and oligomenorrhea (5). Low bone density can lead to stress fractures and osteoporosis which can be irreversible (5).

### Description

Low energy availability is a result of an expenditure of energy through exercise without a proper replenishment of energy through diet. When the triad was first being defined, the American College of Sports Medicine used the term eating disorder rather than disordered eating (6). Now the term disordered eating is used because eating disorders are mental illnesses, such as anorexia nervosa and bulimia, and not all athletes with low energy availability have an eating disorder (3). Some athletes have low energy availability unintentionally because they may be eating a normal diet but with exercise, they end up with an energy deficiency. With the pressures to perform and achieve in sports coupled with societal pressures all females face, female athletes are at a higher risk of developing disordered eating than non-athletes (7). This is most common in athletes participating in sports that emphasize a lean physique (8). The sexualizing of female athletes in the media takes the focus off of the athletes' physical ability and onto her physical appearance (9). Whether the disordered eating resulting in low energy availability is deliberate or unintentional, it is important that it is detected by a coach, parent, or physician before it results in amenorrhea or osteoporosis.

The reproductive organs are the first to be affected by a negative energy intake because they are not necessary for survival (non-vital). Women enter into a hypometabolic state in which menstrual function is altered to promote energy conservation (5, 6). This can manifest as primary or secondary amenorrhea or oligomenorrhea (5). A decreased resting expenditure and suppressed triiodothyronine have been documented as having a correlation with amenorrheic athletic women with and energy deficiency (6). As many as 69% of female athletes that participate in a lean sports experience an irregular menses as opposed to 5% of the general population (5).

Another way the body conserves energy is by increasing bone resorption. The skeletal system is the next to suffer decreased activity after the reproductive system (5). Osteoporosis is not only caused by bone mineral loss in adulthood but also by not achieving optimal Bone mineral density (BMD) in adolescence (3). According to Elizabeth Horn in "The Female Athlete Triad", "In healthy menstruating females, estrogen suppresses osteoclastic activity, promoting bone development and normal BMD." Women acquire almost half of their bone mass from age 12 to 16 and start to lose bone mass in the beginning of the third decade of their life (6). Therefore, it is important to develop the most bone mass possible in women's adolescence in order to prevent osteoporosis later in life.

## Long Term Consequences

The benefits of athletics include better health and higher self-esteem (1). However, every athlete deals the pressure that accompanies competitive sports differently. For the select women and girls that develop energy deficiency, amenorrhea, or low BMD, the long-term consequences can be severe. The triad was first identified in the early 1990s and the young women who had it then are now in their 30s and 40s (1). Observations of these adult women has shed some light on the consequences of developing symptoms of the triad as an adolescent.

The most negative consequences are a result of low bone development in adolescence. By age 18, 95% of a woman's total bone mass will have been developed (1). The amount of bone mass acquired in adolescence is the biggest indicator of whether a person will develop osteoporosis and their risk for future stress fractures (1). Even in the absence of amenorrhea, energy deficiency is associated with low BMD (1). Not acquiring the optimal BMD in adolescents can lead to permanent deficits. Adults that suffered from disordered eating in adolescence are 2-7 time more likely to developing osteoporosis or osteopenia (1). Even if

the disordered eating is overcome and the subject returns to a healthy body weight, they may never be able to acquire the sufficient levels of bone mass that will take them out of the range of risk for osteoporosis or osteopenia.

Besides developing osteoporosis later in life, adolescent females who suffer from disordered eating also suffer from psychological problems and premature death (1). Some psychological problems associated with eating disorders are low self-esteem, anxiety and depression (3). Athletes with eating disorders are 5.4% more likely to attempt suicide than athletes without eating disorders (3). Females that suffered from anorexia nervosa are 6x more likely to die prematurely (3). Only 33% of women that recover from an eating disorder record sustained healthy weight, menstrual function, and eating behaviors (3). Women that suffer from eating disorders are also more likely to become infertile (10).

## Discussion

As societal and sport pressures increase on young athletic women today, it is increasingly important to inform coaches, parents, medical professionals, and athletes about the risk of the Female Athlete Triad. Parents and coaches should pay close attention to the athletes' eating habits and training regimen in order to prevent disordered eating or detect an eating disorder. When medical professionals see young athletes, they should have a thorough discussion regarding the patients' menstrual cycle, eating habits, and previous Dual-energy X-ray absorptiometry (DXA, formerly DEXA) scans (1). Increased screening for the triad will help identify symptoms earlier and possibly prevent long-term consequences, such as osteoporosis, through treatment.

Treatment for the triad begins with increasing energy availability by increasing energy intake through diet and decreasing energy expenditure through exercise (6). This approach is supported by over 30 years of research (6). The result of this weight gain and increased energy is the return of spontaneous menses and the return of spontaneous menses results in increased BMD.

Future research may lead to hormone replacement therapy to re-establish menstrual function and bone development (5). Oral contraceptive pills have been used to treat menstrual dysfunction in young women, but this treatment has not yet been studied on the athletic population, and there is little information on whether oral contraceptives increase bone health (5, 11). Transdermal estrogen is another possible treatment that is being studied (5). Transdermal estrogen may be preferable over oral contraceptive pills which inhibit a trophic hormone that stimulates bone development (12, 13). Transdermal estrogen has decreased the risk of fractures in post-menopausal women but has not yet been well studied on young female athletes (5).

## Conclusion

The increasing participation of young girls in athletics is being followed by an increasing number of young girls with the female athlete triad. Therefore, it is important that we screen all adolescent females for symptoms of the triad. More screening may decrease the risk of osteoporosis for these girls later in life. Also, informing coaches, parents, and athletes about the triad will help to detect symptoms earlier. Tried and true treatments, such as increasing energy intake and decreasing energy output, are well researched and have positive results. New treatments involving hormone replacement are still being researched but could possibly be another treatment option in the upcoming years.

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