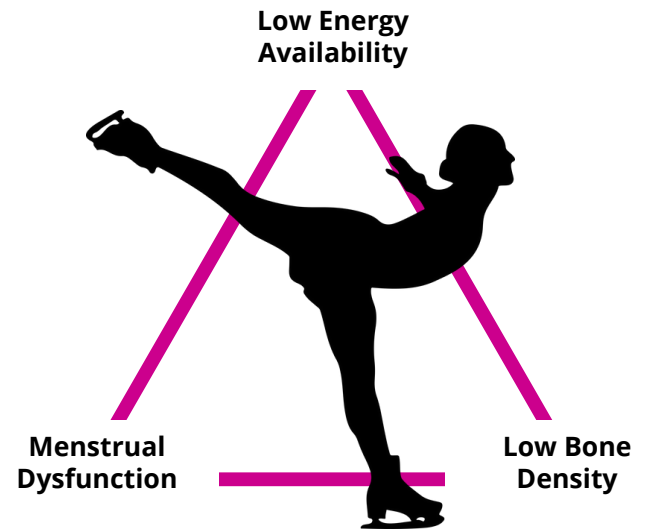


# THE FEMALE ATHLETE TRIAD

## What is the Female Athlete Triad?

The female athlete triad is a medical condition present in physically active females that consists of three components: low energy availability, low bone density, and menstrual dysfunction. Low energy availability can occur with or without disordered eating. Not all three components of the triad are necessary at one time for diagnosis. The female athlete triad fits into the scope or relative energy deficiency in sport (RED-S), which expands on the various physiological effects of low energy availability in all athletes



The female athlete triad involves three main components, although not all components are required at a single time for diagnosis.



While all female athletes are at risk of the female athlete triad, certain sports are at an elevated risk.

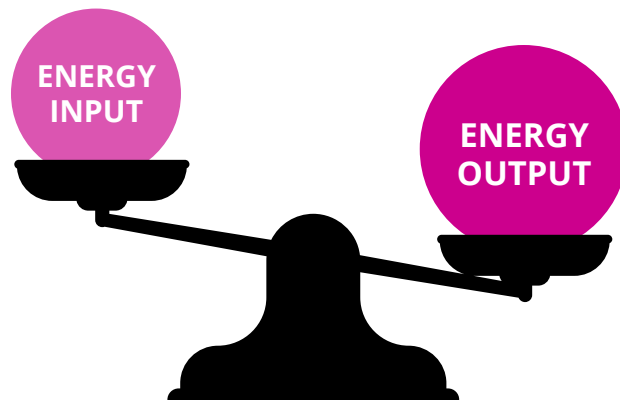
## Who is at risk of the Female Athlete Triad?

All females involved in exercise are at risk for the female athlete triad, including both organized and unorganized forms of exercise, at any age or level of sport. The triad most often is observed in females who participate in endurance sports, sports that involve aesthetic or subjective judging, and sports that emphasize leanness. Studies demonstrate athletes in track and field, cross country, dance, cheerleading, gymnastics, figure skating, and swimming have higher risk for development of the female athlete triad.

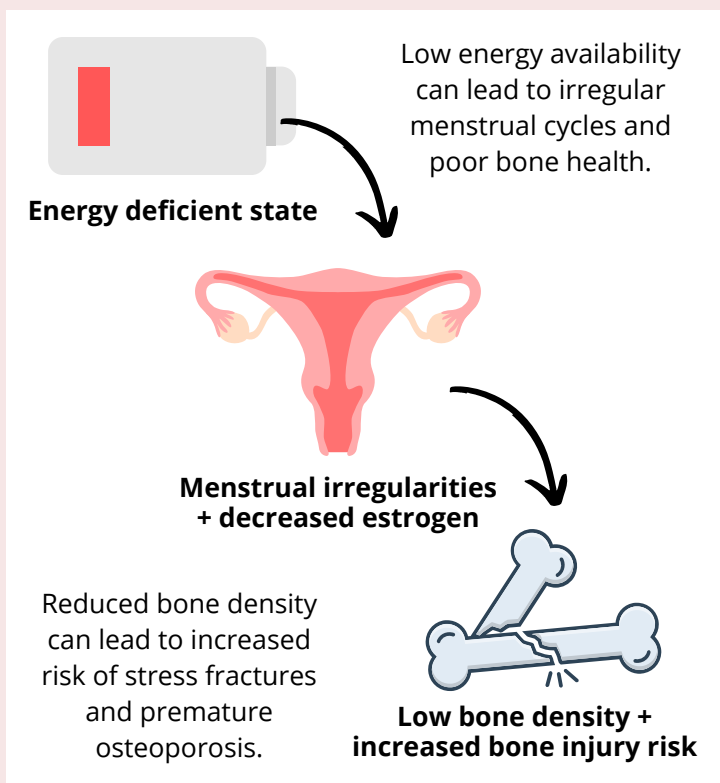
# THE FEMALE ATHLETE TRIAD

## What is energy availability, and why does it matter?

Energy availability is a balance between energy put into the body through nutrition and the energy the body expends through exercise and natural metabolic processes. Low energy availability refers to a negative balance between energy intake and output. This imbalance can occur by decreasing energy intake through dietary restriction or increasing energy expenditure through prolonged periods of training. Low energy availability acts as the primary etiology of the athlete triad, which can result in menstrual dysfunction and decreased bone mineral density.



Low energy availability can occur when energy output (energy used for daily activity, growth/development and sport) is more than energy input (energy from the consumption of food).



When the body is operating in an energy deficient state, it will suppress reproductive physiology to conserve overall energy. This results in menstrual dysfunction, as well as decreased estrogen production. Menstrual irregularity is often one of the first clues that the female body is operating in an energy deficient state. Menstrual irregularities can include menstrual cycles which occur less frequently at intervals of >35 days (oligomenorrhea) or cessation of menstruation for three consecutive months (secondary amenorrhea).

Low bone mineral density occurs as a result of low energy availability and menstrual dysfunction leading to estrogen deficiency. Low energy availability can also lead to deficiencies in vitamin D and calcium, both of which are required for good bone health.



## Diagnosis and Treatment of the Female Athlete Triad

Screening for low energy availability can be done through use of validated screening tools, including the Low Energy Availability in Females Questionnaire (LEAF-Q). Low energy availability is best diagnosed through assessment with a registered sports dietitian.

Treatment of the female triad is a multidisciplinary approach which may involve a primary care physician, registered dietitian, endocrinologist, coach, certified athletic trainer, and mental health professionals. First line treatment includes modification of diet and exercise behavior to modify energy expenditure and increase energy availability. Return to sport decisions take into account several factors including the degree of low energy availability, the presence of disordered eating, menstrual history, and history of bone stress injuries and low bone mineral density, and is made with the athlete and their treatment team.

Written by Catherine Hegedus

## Citations

Coelho AR, Cardoso G, Brito ME, Gomes IN, Cascais MJ. The Female Athlete Triad/Relative Energy Deficiency in Sports (RED-S). *Rev Bras Ginecol Obstet.* 2021 May;43(5):395-402. English. doi: 10.1055/s-0041-1730289. Epub 2021 Jun 2. PMID: 34077990.

Daily JP, Stumbo JR. Female Athlete Triad. *Prim Care.* 2018 Dec;45(4):615-624. doi: 10.1016/j.pop.2018.07.004. Epub 2018 Oct 4. PMID: 30401345.

DynaMed. Female Athlete Triad. EBSCO Information Services. Accessed October 12, 2022. <https://www-dynamed-com.proxy.rvu.edu/condition/female-athlete-triad>

Logue DM, Madigan SM, Melin A, Delahunt E, Heinen M, Donnell SM, Corish CA. Low Energy Availability in Athletes 2020: An Updated Narrative Review of Prevalence, Risk, Within-Day Energy Balance, Knowledge, and Impact on Sports Performance. *Nutrients.* 2020 Mar 20;12(3):835. doi: 10.3390/nu12030835. PMID: 32245088; PMCID: PMC7146210.