



Powered by Protein



## RELATIVE ENERGY DEFICIENCY IN SPORT (RED-S)

While it should be every athlete's goal to fuel their body to match the volume of training being performed on a regular basis, there are times when energy demands are not met. When this energy imbalance occurs, on purpose or on accident, an athlete can suffer health-related and performance-related consequences.

This energy imbalance is called "energy deficiency" and can be thought of as under-fueling.

In the past, the focus of this energy deficiency was primarily on female athletes and often characterized as the Female Athlete Triad, which encompassed low energy availability, hormonal imbalances resulting in amenorrhea, and bone mineral density imbalances resulting in low bone mineral density, osteopenia, and osteoporosis.

Due to the fact men and post-menopausal women also often struggle with energy deficiency, there was a need to expand beyond the Female Athlete Triad. As a result, the acronym RED-S was developed by the International Olympic Committee (IOC) in 2014 to replace the Female Athlete Triad name.

Relative Energy Deficiency in Sport (RED-S), is "a syndrome that refers to impaired physiological function, bone health, immunity, protein synthesis, and cardiovascular health caused by relative energy deficiency." It occurs when energy intake is too low to support the demands of performance and health. While disordered eating is a common reason for low energy availability, there are times when athletes under-fuel subconsciously.

## RELATIVE ENERGY DEFICIENCY IN SPORT (RED-S)

### Why do athletes under-fuel?

- In an effort to lose weight to perform at a higher level and go too far with energy restriction
- In an effort to look leaner for a specific competition, performance, or try-out
- Decline in appetite due to over-training
- Nervousness around a competition or big event
- Pressures put on them by self, family, coaches, peers, etc.

### How can you tell if an athlete is under-fueled?

There are a variety of signs and symptoms of low energy availability that could be a sign of or result in RED-S:

- Reports of disordered eating
- Past history of eating disorder
- Weight loss
- Poor growth and development
- Menstrual dysfunction in female athletes
- Recurrent injuries and illness
- Decreased performance
- Fatigue
- Mood changes



However, to truly determine if an athlete is suffering from low energy availability, it can be calculated as shown below, but this requires knowing the athlete's energy (calorie) intake, exercise energy expenditure, and fat-free mass (determined by a body composition test). Because it is difficult to accurately calculate all three values for an athlete, energy availability can be challenging to assess.

### Energy Availability (EA) =

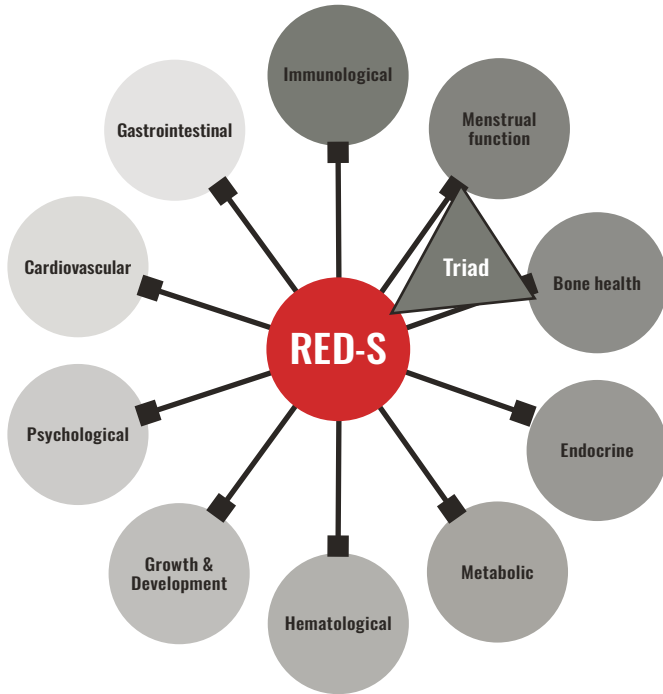
Energy Intake (EI) - Energy Expenditure (EE)  
of exercise relative to Fat-Free Mass (FFM)

- Energy balance (in women) = 45 calories/kg of FFM/day
- Energy balance is not well-studied in men, so there is no baseline set
- Reduced muscle protein synthesis
  - » Seen at an EA of 30 calories/kg of FFM/day



# RELATIVE ENERGY DEFICIENCY IN SPORT (RED-S)

## RED-S Health Consequences



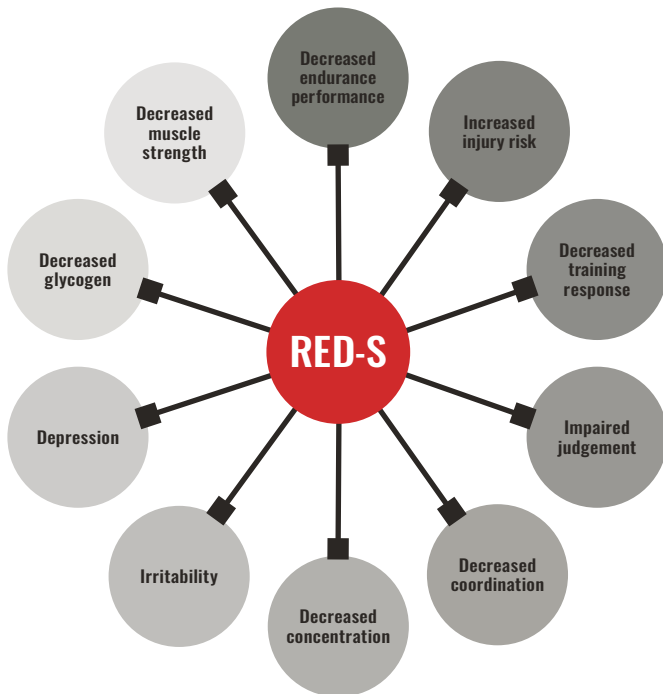
## RED-S Treatment

Goal	Application
Increase energy intake	Increase calorie intake by 300-600 calories per day
Evaluate if practices or training sessions interfere with fueling possibilities	Work with coach or trainer to allow for optimal fueling opportunities, including providing snacks mid-practice/training session
Decrease energy expenditure if needed	Work with sports medicine physician/team to adjust training volume and intensity

## RED-S Treatment Examples

Ways to Add ~100 Calories/Meal	Snacks that Add 300 Calories/Day
1 Tbs. peanut butter	1 large apple, 2 Tbs. peanut butter
15 almonds	½ cup trail mix
30 pistachios	¼ cup nuts, ¼ cup granola
1 oz regular cheese	2 oz cheese, 1 fruit
8 oz low-fat milk	16 oz low-fat chocolate milk
2 ½ oz lean meat	1 slice bread, 2 ½ oz meat, 1 slice cheese
1 egg and 2 egg whites	1 hard-boiled egg, 1 banana, 18 almonds
¼ cup hummus	15 whole grain pita chips, ½ cup hummus
⅓ medium to large avocado	10-15 pretzels, ½ cup guacamole
½ cup grain (quinoa, rice, pasta, etc.)	½ cup grain with ⅓ cup cheese, 1 oz meat
1 banana	Energy bar, 1 fruit

## RED-S Performance Consequences



Mountjoy M, Sundgot-Borgen J, Burke L, et al. Br J Sports Med 2014;48:491-497.  
The IOC consensus statement: beyond the Female Athlete Triad—Relative Energy Deficiency in Sport (RED-S)