

Nutrition and the Female Athlete

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On many levels, working with female athletes to enhance performance is similar to that of working with their male counterparts. However, there are aspects of working with female athletes that are worth distinguishing by gender. Providing education and assistance with behavior change concerning the following topics may require a different approach in females: ensuring adequate total energy and nutrient intake, identifying symptoms of inadequate intake, developing awareness of nutrients female athletes may need to consume in higher amounts, and identifying the challenges female athletes face in achieving changes in their body composition.

It is critical that female athletes consume sufficient energy to refuel the energy cost of daily living, training or competition and repair and regeneration of tissue. Young female athletes also need additional energy to support growth; adult female athletes of reproductive age must cover the energy cost of reproductive functions. The challenge for many female athletes is to balance these energy costs with the frequent desire to change body composition - either losing body fat or gaining muscle mass. Female athletes often struggle to consume the additional calories required to synthesize muscle mass because they do not want to appear 'masculine' or gain body fat in addition to muscle mass. To alleviate these apprehensions and subsequent reluctance, it is important for these athletes to know their energy requirements to maintain body weight first. Gradual recommendations to increase calories, accompanied by body composition assessments to understand the type of weight gain occurring and a focus on changes in energy levels and training capacity will result in more positive outcomes. When athletes are trying to lose body fat, it is critical to first identify how the loss will influence performance. It is important to plan the timing of fat loss within a season and manage expectations regarding degree/rate of body fat change in order to optimize training capacity and avoid compromising performance. Ensuring the athlete makes nutrient dense choices to maintain satiety, obtain adequate micronutrients, to prevent deficiencies, and optimize consumption of lean protein to prevent muscle loss are all key to a successful outcome. All of these issues are particularly important in female Paralympic athletes who have smaller body sizes or muscle mass such as spinal cord injuries, spina bifida and double leg amputees as their total energy requirements can be relatively low.

Female athletes who consume too few total calories (energy) or individual nutrients can suffer a variety of consequences. If total energy intake is too low-usually defined as less than 30 kcal/kg fat free mass - it is difficult to obtain adequate levels of macro and micro nutrients including carbohydrate, essential fatty acids, protein, vitamins, and minerals required for their activity level. Some symptoms to be cognizant of are:

- Hunger, irritability, difficulty concentrating, and increased reaction time due to low carbohydrate consumption
- Inability to sustain high intensity training due to low muscle glycogen stores or low iron stores



- Inadequate tissue repair and inability to increase strength or hypertrophy due to inadequate protein or total calorie intake (in a young female athlete, growth may be compromised)
- A decrease in ability to absorb fat soluble vitamins and essential fatty acids if dietary fat intake is too low
- Rating of perceived exertion is higher than expected during moderate training sessions (may indicate low muscle glycogen stores, low iron stores, dehydration, and inadequate recovery time between training sessions)
- Amenorrhea (loss of menstrual cycle) - often a sign the body does not have enough energy to support training and reproductive function
- Unintentional or significant weight loss - can indicate there is not enough fuel for exercise and weight maintenance (often due to too low calorie consumption) (both muscle and fat can be used as a fuel source during this time). Conversely, some athletes may experience increasing difficulty losing weight or even weight gain if metabolism is falling in response to insufficient energy intake
- Higher injury rate and longer recovery time due to inadequate nutrients required for tissue repair or maintenance

Female Athlete Triad refers to the relationship between energy availability, menstrual status and bone health, which are three of the symptoms listed above. Each component spans a continuum from healthy to disease status. Female athletes may have symptoms of one or all aspects of the triad. Often, the triad manifests itself through inadequate calorie intake from an eating disorder, disordered eating, or inadvertent or deliberate inadequate calorie consumption to support training volume. The low energy availability leads to a disruption in the menstrual cycle and, ultimately, poor bone health. Sports that emphasize leanness or thin body may put young athletes at an increased risk for the female athlete triad.

Micronutrients are commonly deficient in female athletes with low energy intake and may be due to too little total energy or poor food choices. Calcium, vitamin D, iron, magnesium, zinc, and B-complex vitamins frequently come up short when analyzing food logs and 24-hour recalls of female athletes. Many of these nutrients play an important role in energy production, oxygen transport, bone health and maintenance and immune function. All of these represent critical physiological functions for the active female (see table below for functions and food sources). Exercise appears to increase needs above the Dietary Reference Intake (DRI) for several of these micronutrients including iron, vitamin D, calcium, and magnesium.



Micronutrient	Function	Rich Food Source
Calcium	Important for bone health, muscle signaling, and contraction	Dairy products, almonds, sesame seeds, fortified products such as soymilk, almond milk, juice, tofu
Vitamin D	Required for optimal intestinal absorption of calcium, muscle strength, immune function, mood state	Sunlight Fortified milk, juice, breakfast cereal/bars; eggs, fatty fish
B vitamins (folate, B6, riboflavin, B12 if vegan)	Necessary for energy production during exercise and prevention of anemia	Whole grains, beans, fortified cereals, dark leafy greens, meat poultry, fish
Zinc	Building and repairing tissue	Meat, eggs, seafood (oysters), poultry, yogurt, cashews, chickpeas
Magnesium	Important for energy production and protein synthesis	Bran cereals, brown rice, almonds, peanuts, Swiss chard, fish
Iron	Critical for hemoglobin synthesis and oxygen transport to working muscle and energy metabolism	Beef, chicken, oysters, molasses, kidney beans, lentils, tofu, cashews, dark leafy greens

Incorporate Key Performance Nutrients into Daily Training Meals and Snacks

What follows is an example of training meals and snacks for a day designed to incorporate the critical macro and micronutrients mentioned above for the female athlete. No quantities are provided because each athlete will require different amounts based on individual body composition, sport, position or specialty in sport, type of training day and season. It is also not a complete list – simply an example. When there is a fine balance of consuming adequate calories to support training but not too many to avoid unwanted weight gain, choosing nutrient dense foods becomes even more important so calories are not wasted on foods that provide little benefit to performance and recovery.

Breakfast: whole grain bread, scrambled eggs with spinach, tomatoes, and mushrooms, bowl of fruit (cantaloupe, berries)

Morning snack (drink outside if possible to obtain vitamin D from the sun): smoothie with dairy, frozen fruit, leafy greens

Lunch: tofu, long-grain brown rice, stir-fry vegetables

Afternoon snack: trail mix including cashews, almonds, walnuts, dried mango, sunflower seeds, roasted chickpeas



Dinner: grilled fish, mashed sweet potatoes, salad with Swiss chard, kale, romaine and veggies

Evening snack (if appropriate for energy intake): Greek yogurt with berries

Supporting Female Athletes

- Encourage athletes to eat a wide range of foods in order to obtain adequate macro and micro nutrients from their meals
- Educate athletes on the importance of macro and micro nutrients to performance that is specific to their sport and position or specialty
- Highlight nutrient dense foods as the best option to support training adaptations and performance especially during body composition changes
- If an athlete is trying to change body composition by decreasing body fat, assist with identifying an appropriate caloric restriction based on fat free mass and training demands and ensure the time frame is realistic
- If an athlete is trying to change body composition by increasing muscle mass, assist by adding an appropriate amount and type of nutrients to support synthesis of new tissue without adding excess calories, contributing to unwanted body fat
- Identify any symptoms an athlete may be experiencing related to poor nutrient intake
- Create an environment, whenever possible, that ensures optimal nutrients are available in dining halls, team meals, and hotels

A professional team including a sport dietitian, sport psychologist, sport medicine doctor and athletic trainer is essential to enhance education, prevention, quick treatment or management of any situation that may prevent a female athlete from training or competing. Recognizing symptoms or issues as soon as they appear and referring the athlete to the appropriate team of professionals ensures a proactive approach and the least amount of time lost from training and competition.

