NUTRITION GUIDE

FUELING FOR PERFORMANCE

TrueSport®

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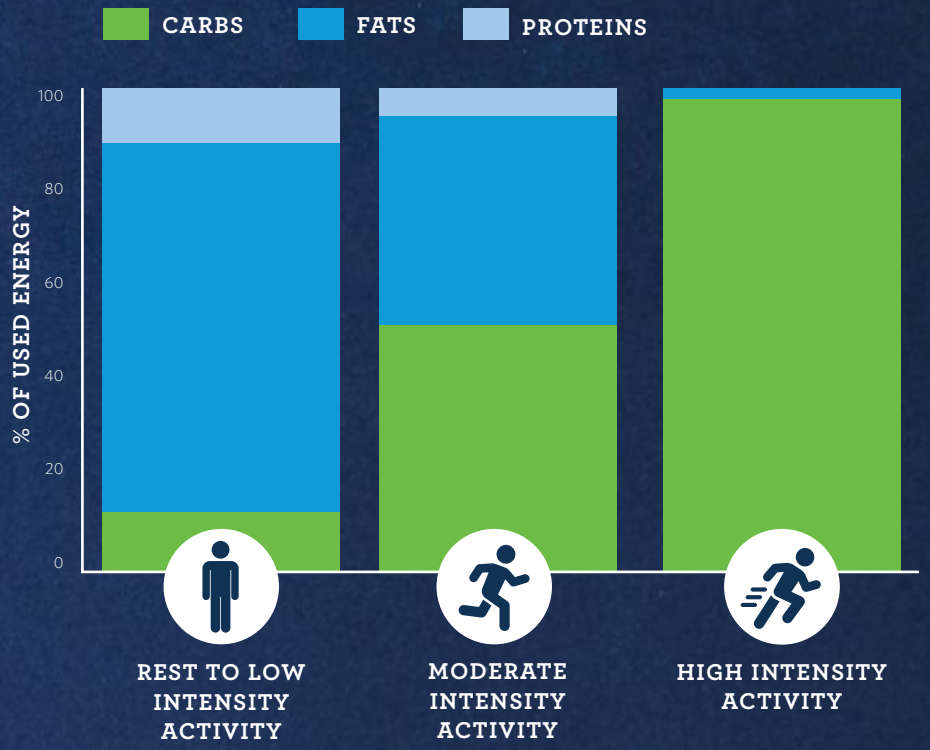
Competing in sport, recovering from daily training, and maintaining good health throughout seasons requires a daily nutrition investment for an athlete to be at their best. Fueling requirements can vary depending on an individual's energy expenditure, metabolism, state of health, sport, and other factors. Matching appropriate nutrition practices to an individual's needs leverages the power of nutrition to support health and performance. Unfortunately, there is a lot of misinformation available regarding a proper diet for athletes. In the quest for success, many athletes will try any dietary regimen or nutritional supplementation promising a new level of physical performance. However, an evaluation and modification of an individual's current dietary intake can typically help maximize peak performance.

This resource aims to provide sport-based nutrition guidelines and tips for both beginner and seasoned athletes. Whether you are looking for a starting place for your performance nutrition strategy, want to check in on where the latest sports nutrition research stands, or just need tips for optimizing your existing nutrition approach, this guide can be valuable for you.

WHERE WE GET FUEL FROM

The body relies on the three macronutrients for fuel – carbohydrates, fats, and protein. Everyone burns different amounts of each macronutrient depending on the duration and intensity of activity. The below table shows how macronutrients are generally used across varying types of activity. Compared to protein and dietary fat, carbohydrates are the most efficiently broken down and metabolized form of energy.



CARBOHYDRATES ARE THE PRIMARY FUEL SOURCES THAT POWER THE MAJORITY OF ACTIVITIES REQUIRED TO COMPETE IN SPORT.

CARBOHYDRATES
The Master Fuel

Carbohydrates are essential to fuel and refuel glycogen in the body. Glycogen, found in the muscles and liver, is how the body stores crucial carbohydrate energy for use in exercise. It can be thought of as a 'battery' that supports optimal performance when fully charged. On the other hand, if glycogen stores are low, performance can be impaired.

A diet rich in carbohydrates supports optimal performance of both endurance-based and intermittent, high-intensity activities. As a guideline, and depending on the training intensity and routine, athletes should consume anywhere from 3-12 grams of carbohydrates per kilogram of body weight throughout the day.

TYPE OF ACTIVITY	Carbohydrates in grams per kilogram of body weight	Example 120 lbs. (54.5 kg)	Example 180 lbs. (81.8 kg)
LIGHT Low intensity and skill-based activity	3-5 g/kg body weight	164-273 grams carbs	245-409 grams carbs
MODERATE Exercise ~1 hour at moderate intensity	5-7 g/kg body weight	273-382 grams carbs	409-573 grams carbs
HIGH Exercise ~1-3 hours at moderate to high intensity	6-10 g/kg body weight	327-545 grams carbs	491-818 grams carbs
VERY HIGH Exercise ~4-5 hours at moderate to high intensity	8-12 g/kg body weight	436-654 grams carbs	654-982 grams carbs

CARBOHYDRATE INTAKE BEFORE EXERCISE

While overall daily carbohydrate intake is the priority for proper fueling, strategic carbohydrate intake in the time leading up to activity also plays an important role in supporting performance. Not only do carbohydrates keep an athlete from feeling hungry before and during exercise, but the intake in the hours before activity aims to help maintain energy stores and provide fuel to exercising muscles in a way that minimizes the risk of gastrointestinal, or GI, upset related to foods consumed.

PROTEIN'S ROLE AS A TEAM PLAYER

Protein has always been a particularly popular nutrient with athletes because of its role in building and maintaining muscles. Indeed, athletes need to consume a wide variety of high-quality protein foods in their diets. However, while protein is necessary for rebuilding and repairing muscles, it is not the primary fuel, and consuming more protein than needed is not going to give athletes larger and stronger muscles.

Perhaps the biggest issue with consuming more protein than needed is that this habit tends to decrease intake of other foods like starches, fruits, or veggies since a person can only eat so much at one time. The goal is to meet protein needs and still allow enough space on the plate and in the stomach for other foods important for fueling and nourishing health and performance.

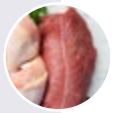
CONSIDER THESE PROTEIN GUIDELINES BASED ON BODY WEIGHT

BODY WEIGHT	Daily needs for muscle building and recovery 1.6-1.8 g/kg	Daily needs to maintain muscle and lose fat mass in a calorie deficit 2-2.2 g/kg	Protein goal in each meal/snack (minimum) 0.4 g/kg
120 LBS. (54.5kg)	87-98 grams	109-120 grams	22 grams
130 LBS. (59kg)	95-106 grams	119-130 grams	24 grams
140 LBS. (63.5kg)	102-115 grams	127-140 grams	26 grams
150 LBS. (68.2kg)	109-123 grams	136-150 grams	27 grams
160 LBS. (72.5kg)	116-131 grams	145-160 grams	29 grams
170 LBS. (77.3kg)	124-139 grams	155-170 grams	31 grams
180 LBS. (81.6kg)	131-147 grams	163-180 grams	33 grams
190 LBS. (86.4kg)	138-156 grams	173-190 grams	35 grams
200 LBS. (90.7kg)	145-163 grams	181-200 grams	36 grams

FOOD SOURCES OF PROTEIN

FOODS THAT ARE MOSTLY PROTEIN

4 OZ. FISH/SEAFOOD
30 g protein



4 OZ. MEAT/POULTRY
30 g protein

1 CUP GREEK YOGURT OR COTTAGE CHEESE
25 g protein

4 OZ. EXTRA FIRM TOFU
12 g protein

2 EGGS
12 g protein

3/4 CUP SHELLED EDAMAME
10 g protein

FOODS THAT ARE RICH IN OTHER MACRONUTRIENTS

1 BAGEL
10 g protein
55 g carbs

1 CUP QUINOA
8 g protein
40 g carbs

2 TBS. PEANUT BUTTER
8 g protein
16 g fat

1 CUP WHOLE WHEAT PASTA
8 g protein
40 g carbs

1 CUP COW'S MILK
8 g protein
12 g carbs

1 OZ. NUTS OR SEEDS
8 g protein
16 g fat

1 OZ. OR SLICE OF CHEESE
7 g protein
7 g fat

1 CUP BEANS
7 g protein
20 g carbs

FAT AS FUEL

Fat is the primary fuel for light to moderate intensity exercise. Fat is a valuable fuel for muscles during endurance exercise and performs many important functions in the body.

Stored fat provides an abundant source of energy. A 150-pound athlete with 6% body fat carries about 1,500-2,000 calories in the form of glycogen and up to about 40,000 calories in the form of stored fat. Fat stores play an important role in fueling athletes in situations where glycogen has been depleted and no food is being consumed.

However, in this situation, exercise intensity must decrease as power cannot be generated at the same rate with fat as it can with carbohydrates.

Research has shown that a very high fat and low carbohydrate diet results in metabolic adaptations that favor the use of fats for fuel. This downregulates the body's ability to efficiently use carbohydrates for fuel. When compared, a diet high in carbohydrates outperforms a high fat diet because it is more efficient and effective to burn carbohydrates for performance rather than fats.

It should be noted that a high fat diet is not recommended to support optimal performance for athletes that require bursts of power in their sport.

In a performance-focused diet, 20-35% of daily calories should come from fats. Too little fat intake can lead to issues such as low energy intake and availability, and even decreased production of hormones. Too much fat in the diet could contribute to energy intake beyond needs, leading to weight gain.

BASED ON AN INDIVIDUAL'S DAILY CALORIC INTAKE, HERE ARE EXAMPLES OF WHAT 20-35% FAT INTAKE NEEDS WOULD BE

1,500 CALORIES	33-48 grams of fat
2,000 CALORIES	44-78 grams of fat
3,000 CALORIES	67-117 grams of fat

DIETARY FATS – TYPE MATTERS

Foods that contain fat can generally be categorized as containing mostly saturated or unsaturated fat. To support optimal health and performance, focus on getting most dietary fats from unsaturated fat sources. Keeping saturated fats low in the diet is important for heart health and can help manage inflammation.

EXAMPLES OF **UNSATURATED** FAT SOURCES

Should be the *majority* of dietary fat intake

- Nuts
- Seeds
- Avocado
- Olives and olive oil
- Vegetable oils
- Sesame oil
- Oily fish like salmon, mackerel, trout, sardines, etc.

EXAMPLES OF **SATURATED** FAT SOURCES

Should be the *minority* of dietary fat intake

- Butter
- Ghee
- Cream
- Ice cream
- Palm oil
- Coconut and coconut oil
- Fatty meats like bacon, sausages, well-marbled beef, etc.

DIET QUALITY

Nutrition for health and performance is not all about macronutrients and timing. While those factors are important and impactful, there are other considerations to keep in mind when building meals and dietary habits. The tips below can help support foundational health and maintain a healthy body that can keep performing over many years.

- ***Consume veggies and/or fruits at every meal.***
- ***Eat the rainbow - consume a wide variety of colors of produce.***
- ***Aim to eat at least 25-30 grams of fiber daily, focusing on fiber-rich foods, such as fruits, veggies, whole grains, beans, nuts, and seeds, in meals and snacks other than those right before an activity.***
- ***Choose lean meats and lean poultry more often than meats and poultry rich in fat. For example, choose chicken thighs without the skin.***
- ***Keep intake of fried foods low.***
- ***Aim to keep intake of added sugars low to moderate, especially if not performing high volume and/or high-intensity activity regularly.***

KEEP IN MIND...

While needs for carbs, proteins, and fats are relatively straightforward to determine, figuring out total energy (calorie) needs can be more complex, especially for young athletes. Compared to adults, children and adolescents have higher energy needs relative to pound for pound of body weight because the body requires a large amount of calories over time to properly build and grow. Rather than estimate calorie needs for a young athlete, it is better to focus on balanced meals and portions of foods, and ensure the child or adolescent is tracking along healthy growth expectations. In situations where it seems a young athlete is struggling with balancing energy intake and energy output, qualified professionals, such as registered dietitians or physicians, can help.

FUELING BEFORE, DURING, AND AFTER ACTIVITY

PRE-EVENT EATING

Below are guidelines for structuring meals and snacks leading up to training or a competition lasting an hour or more. Events lasting less than an hour can be prepared for with slightly lower intake goals. It is usually good practice to have a meal 2-4 hours before an event and then a snack within 30-60 minutes of the event starting.

3-4 HOURS BEFORE THE EVENT

3-4 grams of carbohydrates per kilogram of body weight

- Consume moderate amounts of protein, fat, and fiber. These foods can slow digestion and increase the risk of GI upset.
- Avoid high-fat preparations like fried foods.
- Include fluids to support hydration.
- If the event is in a hot/humid environment and/or if an athlete tends to have salty sweat*, include beverages with sodium, such as sports drinks, and/or salty foods (or season foods with salt).

OR

2-3 HOURS BEFORE THE EVENT

2-3 grams of carbohydrates per kilogram of body weight

- Consume smaller amounts of protein, fat, and fiber. These foods can slow digestion and increase the risk of GI upset.
- Avoid high-fat preparations like fried foods.
- Include fluids to support hydration.
- If the event is in a hot/humid environment and/or if an athlete tends to have salty sweat*, include beverages with sodium like sports drinks and/or salty foods (or season foods with salt).

30-60 MINUTES BEFORE THE EVENT

30-60 grams of carbohydrates

- Choose carbohydrate-rich foods that are easily digested by the athlete.
- Include minimal to no sources of protein or fat to decrease the risk of GI upset.
- Include fluids to support hydration.
- If the event is in a hot/humid environment and/or if an athlete tends to have salty sweat*, include beverages with sodium, such as sports drinks, and/or salty foods (or season foods with salt).

**White markings on dried clothing used during training or a competition can indicate a salty sweater.*

PRE-EVENT EATING

SNACK IDEAS FOR 30-60 MINUTES BEFORE THE EVENT

These foods are great for pre-event fueling as they are rich in energizing carbohydrates and generally tend to be easily digested:

- Granola bar
- Dry cereal
- Pretzels
- Cheese crackers
- Fruit snacks/gummies
- Banana
- Dried fruits
- Fruit juice
- Sports drink
- Fig bar
- Crackers
- Applesauce
- Toast

MEAL AND SNACK EXAMPLES

TIME BEFORE EVENT	Example: 120 lbs. (54.5 kg)	Example: 180 lbs. (81.8 kg)
3-4 HOURS BEFORE *(meal)*	**Carbohydrate goal: 164-218 g** • 3 cups pasta with tomato sauce and 4 oz. meatballs • 8-12 oz. lemonade or sports drink • 1 cup mixed fruit	**Carbohydrate goal: 245-327 g** • 3 cups pasta with tomato sauce and 6 oz. meatballs • 2-3 slices garlic bread • 16-20 oz. lemonade or sports drink • 2 cups mixed fruit
2-3 HOURS BEFORE *(meal)*	**Carbohydrate goal: 109-164 g** • Sandwich on 2 slices of bread with 3 oz. turkey, 1 slice of cheese, light mayo, and veggies • 12-16 oz. 100% juice or sports drink • 1 cup pretzels	**Carbohydrate goal: 164-245 g** • Sandwich on bagel with 4 oz. turkey, 1 slice cheese, light mayo, and veggies • 16-20 oz. 100% juice or sports drink • 1 cup pretzels with hummus • 1 banana
30-60 MINUTES BEFORE *(snack)*	**Carbohydrate goal: 30-60 g** • 1 oz. dried mango • 8 oz. sports drink	**Carbohydrate goal: 30-60 g** • 2 oz. fruit gummy snacks

Note: *Sports drinks should not be confused with "energy" drinks. "Energy" drinks typically contain one or more stimulants (like caffeine), and their carbohydrate concentration is usually greater than 10%.*

FOOD SOURCES OF CARBOHYDRATES

CARBOHYDRATE CONTENT OF SOME COMMON FOODS

1 SLICE OF BREAD
20 g of carbs

1 CUP OF 100% FRUIT JUICE
26 g of carbs

1 MEDIUM BANANA
27 g of carbs

1.5 CUPS OF 'O' SHAPED CEREAL
29 g of carbs

1 CUP OF COOKED OATMEAL
30 g of carbs

1 8" FLOUR TORTILLA
35 g of carbs

1 CUP OF COOKED POTATOES
36 g of carbs

1 CUP OF COOKED PASTA
40 g of carbs

1 CUP OF COOKED RICE
44 g of carbs

1 BAGEL
55 g of carbs

EATING AT ALL-DAY EVENTS

It is important that athletes eat after competing to make sure that they will have enough energy in their muscles for the next race or competition. This is especially crucial for athletes competing in more than one event in a day. Similar principles used to plan the pre-exercise meals can also apply to foods eaten at all-day events. In a situation where there are just a few hours between events, easily digested foods, like fruits or crackers for example, help refuel the body while reducing the risk of GI upset.

Along with types of foods, the amount of food consumed is important to consider. It is best to consume a small, well-tolerated portion of food when little time is available before an activity to allow for digestion. The more an athlete eats, the longer it will take to digest, especially with any pre-competition nerves or stress.

THE FOLLOWING GUIDELINES CAN HELP ATHLETES MAKE WISE FOOD CHOICES AT ALL-DAY EVENTS

ONE HOUR OR LESS BETWEEN EVENTS OR HEATS

- Prioritize carbohydrates that are in liquid form, such as sports drinks that are easiest on the stomach.
- If something solid can be eaten, try easily digested foods like fruits, pretzels, crackers, or fruit snacks/gummies, etc.
- Continue to sip on fluids to support hydration needs.

TWO TO THREE HOURS BETWEEN EVENTS OR HEATS

- Prioritize foods containing carbohydrates.
- Some protein and fat can be eaten as there should be enough time to digest them before the next competition.
- Try consuming easy carbohydrate and protein combinations, such as cereal with milk, a granola bar, jerky and fruit, pretzels and a cheese stick, chocolate milk, or an English muffin with nut butter.
- Be sure to drink plenty of fluids like water or a sports drink for hydration, electrolyte replacement, and the restoration of glycogen stores.

FOUR OR MORE HOURS BETWEEN EVENTS OR HEATS

It may be a good idea to have a meal when four or more hours exist between events. Use the same guidelines for a pre-event meal in this situation. Choose a meal that is rich in carbohydrates, moderate in protein, and low-to-moderate in fat. Meal examples include:

- Turkey sandwich on two slices of whole wheat bread, Greek yogurt with fruit, and water or a sports drink
- Spaghetti with lean meatballs, bread, salad with dressing, and water or a sports drink
- Tortillas with grilled chicken, veggies, avocado, and salsa, along with fruit and water or a sports drink

While these guidelines work for most athletes, each person may respond differently to food choices for fueling. If an athlete feels their best with a certain meal pattern before competitions, or on long event days, then they should stick to it. The idea is to consume enough energy to support performance while doing so with the foods and timing that works best for the individual.

FUELING DURING ACTIVITY

In addition to fueling before and after activity, there are many situations where consuming energy, specifically carbohydrates, during the activity can support performance. Generally, the longer the training or competition lasts, the more that carbohydrate consumption can positively affect performance.

CARBOHYDRATE CONSUMPTION GUIDELINES

ACTIVITY DURATION	Amount of carbohydrate	Why
MODERATE TO HIGH INTENSITY ACTIVITY *lasting less than 45 minutes*	**Not Needed**	Proper pre-event fueling should have filled up glycogen stores enough to support performance.
MODERATE TO HIGH INTENSITY ACTIVITY *lasting ~45-75 minutes*	**Small amounts**	As above, glycogen should not limit performance with prior adequate fueling. Even small amounts of carbohydrates, like from a sports drink, can boost performance from 'sparking/energizing' the nervous system.
MODERATE TO HIGH INTENSITY ACTIVITY *lasting ~1-2.5 hours*	**30-60 grams per hour**	Even with good pre-event fueling, glycogen stores can start to get low enough to impair performance. Carbohydrate intake provides immediate fuel for muscles and spares the body's existing glycogen stores from being used.
MODERATE TO HIGH INTENSITY ACTIVITY *lasting ~2.5-3 hours*	**~90 grams per hour** *(more in some cases)*	Glycogen levels will get low and impair performance significantly if carbohydrates are not consumed to continue to provide fuel for the working muscles. It is a good idea to include both glucose and fructose forms to increase gut absorption capacity.

A NOTE ON SPORTS DRINKS

Sports drinks are beverages that contain electrolytes and carbohydrates to support energy and hydration needs around exercise.

Sports drinks are not the same as energy drinks, which typically have a much higher sugar content, contain stimulants like caffeine, and are often carbonated.

When looking at sports drink labels, look for those with a 6-8% carbohydrate solution, for example, 36-47 grams of carbohydrates in a 20-ounce serving or bottle. Avoid drinks with a carbohydrate solution of more than 10%, as this may lead to GI upset for some athletes.

Sports drinks should also contain sodium to help replenish the sodium lost through sweat and therefore support hydration. Look for sports drinks with at least 100 mg of sodium per 8 ounces and about three times as much sodium as potassium. This ratio of sodium to potassium is similar to that found in sweat for many people.

Sports drinks that are very low in carbohydrates or sodium are generally not recommended as they do not provide those important components to support energy and hydration needs. For more information on sports drinks and hydration, read the Fluids and Hydration section.

CALCULATING CARBOHYDRATE CONCENTRATIONS

To assess the concentration of carbohydrates in a sports drink, or any beverage, use the following calculation:

$$\frac{\text{AMOUNT OF CARHOBYDRATE IN GRAMS}}{\text{VOLUME OF SERVING IN mL}} \times 100 = \text{\% CARBOHYDRATE SOLUTION}$$

EXAMPLE

$$\frac{\text{25 G CARBS}}{\text{340 ML}} \times 100 = \text{7.4\% CARBOHYDRATE SOLUTION}$$

The above example would be a great sports drink to use because a 7.4% carbohydrate drink is within the desired concentration of 6-8% carbohydrates.

COOLER FUELERS: PLANNING AHEAD FOR SUCCESS

It can be hard to meet performance fueling needs with the types of foods often available at tournaments and sport venue concession stands. Typically, concession foods are high in fat, which can slow digestion and increase the risk of GI upset during competition. When you know that few performance-supporting options will be available, it's helpful to bring snacks, drinks, and even a cooler to have great fueling options readily available.

HERE ARE SOME ITEMS TO CONSIDER PACKING UP TO SUPPORT PERFORMANCE

CARBOHYDRATE-RICH ITEMS	PROTEIN-RICH ITEMS	PROTEIN & CARBOHYDRATE-RICH ITEMS
• Crackers	• Plain Greek yogurt	• Protein-energy bar
• Pretzels	• Cottage cheese	• Chocolate milk
• Fresh fruits	• Meat and poultry	• PB&J sandwich
• Dried fruits	• Protein shake	• Deli meat sandwich
• Cereal	• Protein bar	• Egg sandwich
• Granola	• Cheese	• Tuna sandwich
• Granola bars	• Jerky	• Trail mix
• Fig bars	• Edamame	• Flavored yogurt
• Marshmallow cereal bar	• Eggs	• Yogurt parfait
• Applesauce	• Tuna	• Hummus and crackers
• Breads, bagels		• Bagel with nut butter
• Pasta		
• Rice		
• Sports drink		
• Juice		

It is best not to try different and new foods before an important competition. Focus on trying new foods around training to see what works in preparation for competition.

IF AN ATHLETE IS COMPLAINING ABOUT GI DISTRESS OR STOMACH CRAMPING

- Ensure they are not consuming foods high in fat, fiber, or protein close to an activity.
- Consider having them keep a food log for a few training days to see if any food patterns are associated with the GI issues.

TRAINING THE GUT

It is common for some athletes to feel they can't tolerate any food or drink prior to activity. However, it is worth it to 'train the gut' to handle nutrition around activity to support performance. Aim to slowly introduce small amounts of carbohydrate-rich foods that are easy to digest, such as a few bites of cereal or fruit, and increase the amount over time. Carbohydrate-rich fluids, like sports drinks, can be another good tool to help consume fuel that doesn't feel 'heavy' in the stomach.

RECOVERY NUTRITION

Fueling after activity is beneficial for all athletes to help them recover more quickly in preparation for the next event or training session, as well as to maximize the adaptive benefits of exercise. Carbohydrates and protein are the two main macronutrients to focus on for optimal recovery. For most athletes, carbohydrates should be consumed in greater quantities than protein due to the need for glycogen restoration.

SOME GUIDELINES TO SUPPORT MUSCLE TISSUE REPAIR AND MUSCLE ADAPTATION INCLUDE:

Maximize muscle glycogen recovery after an intense or long training session or event with 1-1.2 grams of carbohydrates per kilogram of body weight per hour for the first 4 hours following the activity. This refueling strategy is most important after a very hard training session and with another important session or event in the next 24 hours.

Include a moderate amount of protein, about 20-40 grams, in the recovery meal or snack to best support muscle repair and adaptation to exercise. Continue to include protein in meals and snacks spaced out about every 3-4 hours following the activity.

Many athletes can benefit from a recovery meal or snack with a 3:1 ratio of carbohydrates to protein, such as 60 grams of carbohydrates and 20 grams of protein.

RECOVERY SNACK IDEAS

To be consumed within 60 minutes of the end of an activity

- A few cups of chocolate or flavored milk
- Greek yogurt with fruit and granola
- Trail mix and jerky
- Bowl of cereal with protein-rich milk
- Fruit and Greek yogurt smoothie
- Eggs with toast or bagel
- Bagel or toast with nut butter and fruit
- Crackers and cottage cheese
- Protein shake and a banana

RECOVERY MEAL IDEAS

To be consumed within 2 hours of the end of an activity

- Turkey sandwich, side of fruit, and chocolate milk
- Rice with chicken and veggie stir fry
- Baked potato with grilled steak and asparagus
- Pasta with sauce and meatballs
- Tacos with grilled chicken and toppings
- Bean, meat, and veggie chili
- Egg, cheese, and meat bagel sandwich
- Omelet with a side of potatoes/toast and fruit
- Wrap with turkey, hummus, and veggies
- Steamed rice, teriyaki chicken, edamame, miso soup

GUT HEALTH

Healthy gut function is essential to feeling good each day, avoiding GI-related distractions from training and competition, supporting immune function, and more. The two biggest dietary ways to support good gut health are to focus on regular intake of probiotics and prebiotics:

PROBIOTICS are live microorganisms that have positive effects on the gut when consumed. Probiotics are naturally found in fermented foods like yogurt, kefir, kombucha, sauerkraut, kimchi, tempeh, pickles, and miso. While there are supplemental forms of probiotics available, food-based probiotics are safe and effective.

PREBIOTICS are types of fiber found in many plants that act as food for beneficial gut bacteria. Great food sources of prebiotics include onion, garlic, pears, apples, bananas, whole wheat, asparagus, beans, mango, Brussels sprouts, and dairy. All fruits, veggies, whole grains, beans, nuts, and seeds contain fiber and are healthy for the gut, even if not particularly rich in prebiotic fibers.

BUILDING MUSCLE

It's common for athletes to want to add more bulk to their bodies in the form of muscle. Many supplement products claim to build muscles. However, athletes should take special caution when considering supplementation (please see Supplements and Your Health section for additional information and cautions). Due to the limited regulations of the dietary supplement industry, there is a considerable risk of products being contaminated with unknown substances or substances prohibited in sport with or without the manufacturer's knowledge.

Instead, good training and nutrition strategies are highly effective and should be the focus for building muscle. First, it is important to perform regular training that challenges the muscles, especially strength training.

USE THESE NUTRITION TIPS TO SUPPORT MUSCLE GROWTH

- Consume between 1.6-2 grams of protein per kilogram of body weight per day (see earlier section on protein needs to understand protein quantities based on body size).
- Add 500 to 1,000 more calories each day to current dietary intake. This provides the fuel needed for the body to build new muscle tissue and can prevent the body from using protein as fuel, allowing protein to be used as the 'building blocks' for new muscle. This can be accomplished by adding a hearty snack or a few servings of calorie-rich foods like nut butter or juice each day or increasing portion sizes at each meal.
- Eat regular meals and snacks each day. The combination of three meals and 1-2 snacks daily allows most people to have enough eating opportunities to meet nutrition needs for muscle building.
- Include protein in each meal and snack throughout the day. Aim for about 0.4 grams per kilogram of body weight, or around 20-40 grams of protein, every 3-4 hours.
- Busy days can make it difficult to keep up with the energy and macronutrients needed for muscle growth. Plan ahead to avoid missed meals and snacks or making less-than-ideal eating choices. Bring snacks with you, grocery shop to have your desired foods at home, and do meal prep to set yourself up for success.

FLUIDS AND HYDRATION

Approximately 60% of body weight is water. As an athlete trains or competes, fluid is lost through the skin in the form of sweat and through the lungs while breathing. If fluid is not replaced at regular intervals during practice or competition, it can lead to dehydration. A dehydrated athlete has a decreased volume of blood circulating through the body, and consequently:

- The amount of blood pumped with each heartbeat decreases.
- Exercising muscles do not receive enough oxygen.
- Exhaustion sets in and the athlete's performance suffers.
- By-products of exercise are not flushed out of the body as quickly.

Research has shown that losing as little as 2% of total body weight can negatively affect athletic performance. For example, if a 150-pound athlete loses 3 pounds during a workout or competition, their ability to perform at peak performance is reduced due to dehydration. Proper fluid replenishment is the key to preventing dehydration and reducing the risk of heat injury in athletes engaged in training and competition.

PREVENTING DEHYDRATION

The best way to prevent dehydration is to maintain body fluid levels by consuming plenty of fluids before, during, and after a workout or competition. Many times, athletes wait to drink until they are thirsty. Thirst is not an accurate indicator of how much fluid an athlete has lost nor a good indicator of how much fluid to drink to replace fluid losses.

Athletes who wait to replenish body fluids until feeling thirsty are likely already dehydrated. As a matter of fact, most individuals do not become thirsty until more than 2% of body weight is lost. When athletes only drink enough to quench their thirst, they may still be dehydrated. Preventing dehydration means being proactive in understanding fluid losses, being ready with needed hydration, and practicing intentional fluid consumption around training and competition.

UNDERSTANDING FLUID NEEDS

There are two techniques to monitor hydration during and following activity to determine fluid needs.

WEIGHING SELF BEFORE AND AFTER ACTIVITY

1. **Measure** body weight before training, ideally with as little clothing as possible to get an accurate measure.
2. **Keep track** of fluid consumption amount during training.
3. **Measure** body weight after training, again with little clothing.
4. **Calculate** the difference between pre- and post-training weight, add the amount of fluid consumed during training, and divide by the duration of the training (remember 16 ounces = 1 pound).

EXAMPLE

Pre-Training Weight: 140 lbs. Post-Training Weight: 138 lbs.
Fluid consumed during training: 16 oz. Length of training: 1 hour

1. Find difference between pre- and post-training weight **140 lbs. – 138 lbs. = 2 lbs.**
2. Convert training weight difference found in Step 1 to ounces (remember: 16 ounces = 1 pound) **2 lbs. = 32 oz.**
3. Add amount of fluid consumed during training to the training weight difference conversion found in Step 2. **16 oz. consumed during training + 32 oz. lost during training = 48 oz.**
4. Divide ounces determined in Step 3 by the duration of training. **48 oz. / 1 hour of training = 48 oz. fluid per hour consumption goal.**

USE URINE COLOR TO ESTIMATE HYDRATION STATUS

Check your urine color. Urine that is dark gold in color likely indicates dehydration. Urine similar in color to pale lemonade is a sign of a hydrated athlete.

FLUIDS WITH CARBOHYDRATES

Sports drinks containing between 6-8% carbohydrates can provide energy to the working muscles that water cannot, which increases exercise capacity and improves performance. Athletes who consume a sports drink can maintain blood glucose levels at a time when muscle glycogen stores are diminished. This allows energy production to continue at high rates. Beverages containing more than one kind of sugar (i.e., glucose and fructose) can increase carbohydrate absorption rates because each sugar is absorbed via different channels. This is especially helpful to ensure enough energy is consumed during events lasting a few hours.

FLUIDS WITH ELECTROLYTES

Ingesting sodium during exercise may help with the maintenance or restoration of blood volume during exercise and recovery. Consuming sports drinks containing sodium and carbohydrates can aid in hydration by helping retain water in the body and may increase water absorption in the gut compared to plain water. Some parents, coaches, and athletes feel that sports drinks may contain too much sodium. However, most sports or electrolyte drinks are not that high in sodium compared to other ways people may get sodium. Most Americans consume much more sodium through processed and convenience foods, not through sports or electrolyte drinks. Sweat sodium concentrations vary widely between people. Sports drinks typically provide sodium in quantities that match the lower end of sweat sodium concentrations and therefore potential sodium replacement needs for an individual. Athletes who lose a lot of sodium during exercise via high overall sweat volume and/or salty sweat may want to increase sodium intake during exercise beyond what typical sports drinks provide. Additional sodium intake may also be of greater importance for athletes who have a history of muscle cramps during activity, and when the training or competition takes place in a hot and humid environment.

FLUIDS WITH CARBOHYDRATES AND ELECTROLYTES

The ideal hydration beverage is one that tastes good, does not cause GI discomfort or distress when consumed in large volumes, promotes rapid fluid absorption and maintenance of body fluid, and provides energy to working muscles during intense training and competition. Research suggests that a 6-8% carbohydrate sport drink with at least 110 mg of sodium per 8-ounce serving empties from the stomach just as fast as plain water and provides helpful quantities of carbohydrates for energy and sodium for hydration support.

HYDRATION TIPS

- Don't wait until right before exercise to start hydrating. Maintaining good hydration throughout each day is not only important for overall health, but helps an athlete enter a training session or event well hydrated.
- Consider drinking 14-18 ounces of fluid 2-4 hours before the activity, and another 8-12 ounces in the hour before the activity. Spacing out fluid intake allows time for absorption and voiding excess fluids via urine before the activity.
- For intense training and longer workouts, a sports drink containing carbohydrates and sodium is likely more beneficial for energy and hydration support than plain water alone.
- Drink 4-8 ounces of fluid during the activity every 15-20 minutes.
- Don't wait to feel thirsty to start drinking. Be proactive about consuming fluids, even early in the timeline of the activity.
- Avoid carbonated drinks, which can cause GI distress.
- If you have never had a sports drink, don't drink one for the first time on competition day. Practice consuming fluids while you train until you discover the fluids that work well for you and encourage hydration.
- Aim to replenish fluid losses and rehydrate by consuming 1.5x the amount of fluid lost during exercise. For example, if 2 pounds were lost during exercise, aim to drink 48 ounces of fluid after training. ***Remember: 1 pound = 16 ounces***
- It can be difficult for many athletes, especially those with high sweat losses, to drink enough fluids during exercise to fully replace losses. In these cases, priority should be placed on replacing fluids as close as possible to their needs without the fluid consumption getting in the way of performance.
- Conversion reminders for fluid calculations:
  16 ounces = 1 pound
  28 mL = 1 ounce
  1 Liter = 36 ounces
  1 Liter = 1 kilogram

RESEARCH SHOWS AVERAGE SWEAT RATES RANGE FROM 0.3-2.4 LITER/HOUR AND SWEAT SODIUM CONCENTRATIONS RANGE FROM 0.5-1.8 GRAMS/LITER. WITH THIS LEVEL OF VARIATION, IT IS IMPORTANT FOR AN ATHLETE TO DEVELOP A PLAN FOR THEIR OWN NEEDS. PROFESSIONALS LIKE SPORTS REGISTERED DIETITIANS CAN HELP TO DETERMINE SODIUM AND FLUID REQUIREMENTS.

VITAMINS AND MINERALS

Vitamins and minerals, when not consumed in food form, are classified by the Federal Drug Administration (FDA) as dietary supplements. Many athletes believe they do not get enough vitamins and minerals in their diet and wonder if they should start taking some sort of supplement; while other athletes are on a constant quest to find the latest diet or supplement that will give them a competitive edge. The reality is that making wise food and beverage choices is crucial for peak performance and maintaining good health.

Athletes have increased energy needs, which allows for more opportunities to obtain the nutrients they need through a balanced diet composed of a variety of whole foods. Whole foods contain a matrix of various nutrients that researchers are continuing to discover and learn more about. Often, individual nutrients don't work as effectively when isolated in a pill or supplement form.

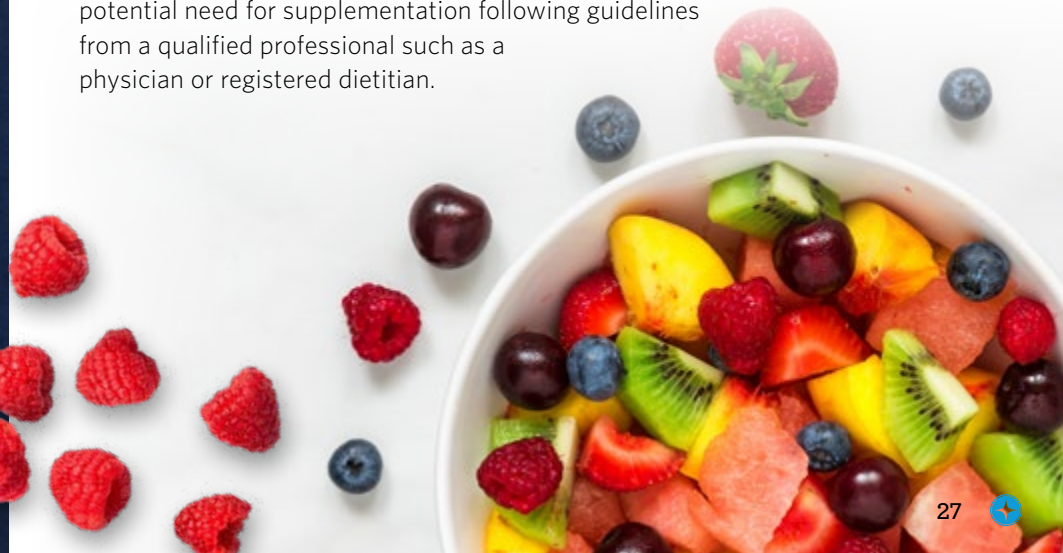
Beyond practicing a well-rounded and varied diet, athletes should consult with a sports dietitian, or other health care professional, to determine whether vitamin and mineral supplementation is needed.

MORE IS NOT ALWAYS BETTER

The Recommended Dietary Allowance (RDA)/Dietary Reference Intake (DRI), for vitamins and minerals are to be used as a guide in determining nutritional needs. These allowances have a large margin of safety built into the recommendations. It is true that a severely inadequate intake of certain vitamins and/or minerals can impair performance, but very few athletes actually experience such severe nutritional deficiencies. Even marginal deficiencies do not appear to markedly affect the ability to exercise efficiently. The goal for any athlete should be to meet DRI/RDA vitamin and mineral recommendations, as consuming more than these established quantities has not been shown to further improve performance and excess consumption can actually be harmful.

Self-prescribed supplement users should heed overdose warnings and look for symptoms of toxic levels of supplementation, such as diarrhea, skin rashes that do not fade, and unexplained joint pain. For example, fat-soluble vitamins (A, D, E, and K) can be toxic when overconsumed. Unlike water-soluble vitamins in which excess amounts are excreted in the urine, fat-soluble vitamins are stored in body fat and remain in the body.

One micronutrient of interest to many athletes, especially as sub-optimal levels can be common, is iron. Low dietary iron intake, having menstrual cycles, vegetarian diets, high sweat rate, and altitude exposure are all factors that can increase risk for low iron status. Low iron status can lead to negative health and performance effects such as fatigue, low mood state, and difficulty concentrating. While supplementation is not automatically recommended for athletes who are at higher risk, it is important to be aware of the risks for low iron status and potential need for supplementation following guidelines from a qualified professional such as a physician or registered dietitian.



FOOD SOURCES OF MICRONUTRIENTS

Vitamins and minerals are found in a wide variety of foods. Incorporating many types of foods, especially those in their whole forms, is the best approach to meeting health and performance needs for vitamins and minerals.

Use this chart to think about foods and food groups to consume regularly to ensure your micronutrient needs are met.

	VEGGIES	FRUITS	WHOLE GRAINS	DAIRY	MEATS, EGGS, NUTS, BEANS
B VITAMINS	Leafy greens, Asparagus, Mushrooms, Cauliflower, Potatoes	Banana, Prunes	All types	Milk, Yogurt	Meats, Poultry, Seafood, Eggs, Beans, Nuts, Seeds
CALCIUM	Leafy greens, Broccoli	Fortified orange juice		All types	Almonds
VITAMIN C	Tomatoes, Broccoli, Cabbage, Peppers, Leafy greens	Citrus, Berries, Kiwi, Mango, Papaya			
MAGNESIUM	Leafy greens, Potatoes	Banana, Avocado	Brown rice, Fortified items	Yogurt	Nuts, Seeds, Beans, Edamame
SELENIUM	Green beans, Broccoli	Banana	Many types	Milk, Yogurt, Cottage cheese, Cheeses	Brazil nuts, Eggs, Seafood, Poultry, Meats
IRON	Leafy greens, Potatoes	Dried apricot	Most types		Beans, Soy, Meats, Seafood, Poultry
FIBER	All types	All types	All types		Nuts, Seeds, Bean, Soy

SUPPLEMENTS & YOUR HEALTH

Athletes searching for a competitive edge often look to a supplement or a special combination of nutrients to find it. However, there are no quick-fix supplements for improving sports performance. Consuming a wide variety of foods and staying well hydrated are the basic cornerstones to reaching athletic potential.

For athletes subject to sport drug testing, taking nutritional or dietary supplements carries the risk of a positive test for a prohibited substance that may not be disclosed on the product label. In accordance with all applicable rules for a positive test result within a sport, a sanction may be imposed.

There are several 'third party' companies that perform supplement testing and certification, which supplement companies can then display on their product. These programs can reduce the risk that a supplement is contaminated or contains an undisclosed ingredient. However, it does not eliminate this risk. Athletes who take dietary or nutritional supplements, even those claiming to be "approved" or "verified," do so at their own risk of committing an anti-doping rule violation or suffering from negative health side effects.

Keep in mind, not all testing and certification programs are the same. Some don't test for substances prohibited in sport, while others don't test every batch of product. Read USADA's most up-to-date recommendation for the best third-party certification program to reduce your risk of positive anti-doping tests and adverse health effects. See ***USADA.org/Supplement-Connect*** for more information.

TAKING SUPPLEMENTS CAN NEVER MAKE UP FOR A DIET LACKING IN NUTRITIOUS FOODS. SCAN THE CODE TO TAKE A DEEPER DIVE INTO SUPPLEMENTS WITH OUR SUPPLEMENT GUIDE.

BACKGROUND ON SUPPLEMENTS

Dietary supplements are defined as products containing "dietary ingredients" intended to supplement the diet. These include vitamins, minerals, amino acids, botanicals, herbs, and substances like enzymes, organ tissues and glandulars, metabolites, etc.

Some argue that the increased visibility of many vitamins, minerals, herbals, and other dietary supplements can be attributed to the passage of the Dietary Supplement Health and Education Act (DSHEA) in 1994. Under DSHEA, the Food and Drug Administration (FDA) **DOES NOT** evaluate any supplements for safety or effectiveness before they are sold. The FDA will only step in and take regulatory action after a supplement has hurt someone or made them sick. Often, a supplement must sicken dozens or hundreds of people before the FDA takes action.

Additionally, the passing of DSHEA allowed manufacturers to publish only limited information about the benefits of dietary supplements. It is easy for products to get to the marketplace without pre-market controls, and if necessary, they are extremely difficult to remove, even when serious health concerns are raised about their safety.

The Anabolic Steroid Control Act of 2004 (SB 2195) took effect on January 20, 2005, as an amendment to the Controlled Substances Act. The Act classifies a number of prohormones or steroid precursors, previously manufactured as dietary supplements, as controlled substances, making their distribution illegal without a medical prescription. According to this Act, possession and/or distribution of these substances can be punishable by up to five years in prison.

DID YOU KNOW?

While some mainstream supplements are made by responsible manufacturers, a growing number of supplement products contain dangerous and undisclosed ingredients, including steroids, stimulants, and other dangerous drugs. One major issue is that unscrupulous companies are marketing supplements spiked with these dangerous substances, taking advantage of many consumers' desires for maximized sport performance or aesthetic improvements, and advertising them as healthy and safe products when they're not.

Most Americans are unaware that designer steroids and other dangerous drugs are intentionally being sold as dietary supplements and that current law makes it too easy for these products to get to the market. At any given time, there could be many thousands of dietary supplements for sale that contain these dangerous ingredients or other substances prohibited in sport. Initial evidence of supplement contamination was established in a 2004 market survey from an International Olympic Committee accredited lab, during which 15% (94) of the 634 supplements analyzed were found to contain hormones or prohormones not listed on the supplement label. Since the study, numerous other reports of contamination, mislabeling, and alteration of supplements have been observed.

CONTAMINATION CAN ALSO OCCUR

Athletes who test positive from contaminated or intentionally spiked supplements containing undisclosed prohibited substances can be made ineligible for competition.

Given the overall possibility of supplement contamination, the risk of taking a mislabeled supplement is a real threat to the careers of American athletes and the health of all consumers. Some products can be unintentionally adulterated with substances, such as pesticides or heavy metals, while others may be inadvertently contaminated with sport-prohibited substances due to cross-contamination. While there certainly are supplements that are safe and pure, it is possible for one batch of a product, for example, to become contaminated with a drug or other substance prohibited in sport when manufacturing equipment isn't cleaned properly and contains remnants of ingredients from a previous product. This is similar to what can happen in a factory that manufactures nut products along with other products like cereals and breads. If the machines aren't cleaned correctly or if particles or dust permeate manufacturing areas, the breads or cereals can contain remnants or traces of the nuts, which can be potentially dangerous to those with nut allergies.

HEALTH CONSEQUENCES ARE REAL

The consumption of dangerous hidden drugs, such as designer steroids, is a known cause of liver injury, stroke, kidney failure, and pulmonary embolism. The inclusion of stimulants in supplement products also has the potential for harmful effects. Some stimulants can cause increased blood pressure, irregular heart rhythm, stroke, or even death.

PROTECT YOURSELF

Rather than relying on advertisements from companies who are trying to sell you their product, as a consumer, you have the responsibility to educate yourself. In the world of anti-doping, strict liability applies, and athletes are responsible for what is in their systems at the time of a drug test. It is up to the athlete or consumer to research reliable sources of information that can point out the many substances that are known to be included in supplements and that may damage one's health or athletic career.

MORE INFORMATION

There is no risk-free way to choose a supplement, as the only way to have zero risk is to not use supplements. If using a dietary supplement is needed, the best way to reduce the risk of using a low-quality or contaminated product is to choose one that is certified by a USADA-recommended third party. See ***USADA.org/Supplement-Connect*** for more information.

BOTTOM LINE

Nutrition plays a critical role in athletic performance, and optimal athletic performance can be increased by consistently practicing good nutrition habits.

It is imperative that athletes stay current on accurate nutrition issues as they are ever-changing, and it is easy for athletes to fall prey to nutrition misinformation and fad diets in the search for a quick fix to improve performance. By making informed nutrition choices, athletes will have an advantage over those who do not leverage the power of nutrition for health and performance.

RESOURCES

USADA.org/Supplement-Connect USADA's Supplement Education Center
acsm.org American College of Sports Medicine
eatright.org Academy of Nutrition and Dietetics
fda.gov/food U.S. Food and Drug Administration
fda.gov/safety/recalls FDA Recalls, Market Withdrawals, & Safety Alerts
fns.usda.gov/cnpp Center for Nutrition Policy and Promotion
dietaryguidelines.gov Dietary Guidelines for Americans, 2020-2025
nutrition.gov National Agricultural Library, U.S. Department of Agriculture
health.gov/nhic National Health Information Center - U.S. Department of Health and Human Services
sportsrd.org Collegiate and Professional Sports Dietitians Association
scandpg.org Sports, Cardiovascular, and Wellness Nutrition, a dietetic practice group of the Academy of Nutrition and Dietetics, Sports, Cardiovascular, and Wellness Nutrition Dietetic Practice Group.

Sports Nutrition: A Handbook for Professionals. 6th ed., Chicago: Academy of Nutrition and Dietetics. 6th Edition. 2017.

ACKNOWLEDGEMENTS

A very special thanks to TrueSport Expert Stephanie Miezin, MS, RD, CSSD, as well as all past contributors for providing the content for this publication.

Note: *The content of this publication is provided for informational purposes only and is subject to change. This information is not intended to be a substitute for professional medical advice, diagnosis, or treatment. Individuals should always seek advice from a qualified health professional.*

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