NUTRITION GUIDE

FUELING FOR PERFORMANCE

TrueSport®

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THE PURPOSE OF THIS BOOK

This nutrition guide provides general guidelines to help optimize dietary intake for sports competitors. Fueling requirements can vary depending upon an individual's energy expenditure, metabolism, state of health, sport, etc.

Now more than ever, athletes need accurate sports nutrition information. Optimal nutrition is an integral part of peak performance while an inadequate diet and lack of fuel can limit an athlete's potential for maximum 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 current dietary intake can typically be employed to help maximize peak performance.

The human body must be supplied with energy to perform its many complex functions. As an athlete's training and competition level increases, the body's energy demands also increase. Several energy systems in the body can provide athletes with fuel as long as they are consuming the proper foods. One energy system relies totally on carbohydrates while another uses carbohydrates as well as fats. When an athlete works near or at maximal intensities, carbohydrates are the prime fuel the body can use. During prolonged exercise, such as cycling, triathlons, and long-distance swimming, the amount of fats and carbohydrates used may rise and fall depending upon:

- *Duration and intensity of the exercise*
- *An individual's fitness level*
- *Food and drink consumed prior to and during the exercise*

Carbohydrates – The Master Fuel

A diet rich in carbohydrates can support optimal performance of both endurance and intermittent high intensity activity through fueling and refueling internal carbohydrate stores, or glycogen, found in the muscles and liver. It is well documented that during times of intense training or competition, such as during tournaments or with two-a-day practices, replenishing muscle glycogen is essential to maintaining a high level of performance. Consuming carbohydrates during workouts lasting more than one hour can also benefit performance and delay onset of fatigue. Studies have shown that athletes who participate in intermittent sports, such as basketball and soccer, should also focus on consuming more carbohydrates during training and competition. This is not surprising since it is well-known that carbohydrates, when compared to protein and dietary fat, are the most efficiently broken down and metabolized form of energy for the body.

Recommended Intake of Carbohydrates

Depending upon the training routine, athletes should consume anywhere from 3-12 grams of carbohydrates per kilogram of bodyweight throughout the day. This percentage is only a guideline for estimating carbohydrate needs. Depending upon the length and type of training sessions, an athlete's carbohydrate intake should adjust, with longer times and more intense trainings reflecting the higher number of grams needed. See Table 1 to calculate grams of carbohydrates needed.

Table 1: *DETERMINING GRAMS OF CARBOHYDRATE FOR ATHLETES' NEEDS*

The following example shows how to calculate the recommended grams of carbohydrate needed per pound of body weight.

Weight in Kilograms		Carbohydrates in Grams		Daily Carbohydrate Intake
68 (150 lbs.)	x	4	=	272 grams

Now calculate your own needs. Remember to divide your body weight in pounds by 2.2 to get your weight in kilograms. Then multiply your body weight by a number of carbohydrate grams (from the 3-12 range) based on the time and intensity of the training. For example, an hour per day of moderate intensity exercise may warrant using 5 grams.

Weight in Kilograms		Carbohydrates in Grams		Daily Carbohydrate Intake
	x		=	

Carbohydrate Intake Before, During, and After Exercise

Before Exercise: The pre-exercise or pre-training meal serves two purposes:

- *It keeps the athlete from feeling hungry before and during exercise.*
- *It maintains optimal levels of energy for the exercising muscles.*

Consuming a small, well-tolerated carbohydrate rich snack like a granola bar, pretzels, or dried fruit within about 30 minutes of activity can help top off carbohydrate stores to enter training or competition with optimal muscle glycogen.

Because the pre-event meal plays a key role in optimizing glycogen stores, managing satiety entering the activity, and minimizing any gastrointestinal upset from foods, it is important to be strategic about types and amounts of foods in this meal.

The following are guidelines for the pre-event meal:

- *The meal should be eaten 3-4 hours before an event.*
- *It should provide 3-4 grams of carbohydrate per kilogram of body weight.*
- *To avoid stomach upset, the carbohydrate content of meals should be reduced the closer the meals are to the event (1-2 grams per kilogram 1-2 hours before the event).*
- *Include a small to moderate portion of lean protein. Protein takes longer to be digested, which increases satiety after eating. It also supports energy regulation, as protein can slow absorption of carbohydrates for a more steady energy release from a meal.*
- *If competing in hot/humid climates, or if an athlete is a salty sweater, be sure food is well seasoned with salt and/or include a beverage containing sodium, like a sports drink.*
- *Avoid high fiber and high fat foods and preparations. Too much of these foods can lead to gastrointestinal upset during an event or training.*

[For example, four hours before the event, it is suggested that the athlete consume 1.5 grams of carbohydrates per pound of body weight, whereas one hour before the competition, the athlete would consume 0.5 grams of carbohydrates per pound of body weight.]

Table 2: *SUGGESTED MEALS FOR PRE-EVENT EATING*

Use these meal and snack ideas to fuel appropriately with carbohydrates based on the time between eating and the event.

1 hour or less	Serving size	Grams of carbohydrates
Fresh fruit (chopped apple)	1 cup	19 g
Dried mango	3 oz	28 g
Raisins	small box (2.5 oz)	34 g
Banana	7 oz	31 g
Granola bar	2 bar pack	29 g
Pretzels	20 pieces	22 g
Fig bar (2)	1 oz	20 g
Applesauce	4 oz	14 g
Sports drink*	8 oz	14 g
Toast	1 slice	14 g
Crackers	5 crackers	10 g

SUGGESTED MEALS FOR PRE-EVENT EATING (continued)

2-3 hours before	Serving size	Grams of carbohydrates
Cereal (whole grain)/ low-fat milk (1%)	cereal: 1 cup milk: 1/2 cup	cereal: 47 g milk: 6 g
Bagel (whole grain) with peanut butter	1 bagel peanut butter: 2 tbsp	bagel: 47 g peanut butter: 8 g
Fruit smoothie	12 fl oz	47 g
Fruit and nut food bar	1 bar	43 g
Oatmeal (instant)/ low-fat milk (1%)	oatmeal: 1/2 cup milk: 1 cup	oatmeal: 13 g milk: 12 g
Flavored Greek yogurt (nonfat)	1 cup	27 g
Pancakes/waffles	2 pancakes (5" diameter)	20 g

4 or more hours before	Serving size	Grams of carbohydrates
Spaghetti with meat sauce	2-3 cups	75-100 g
Pasta/ Chicken/ Vegetables	pasta: 1 cup chicken: 4 oz vegetables: 1 cup	pasta: 40 g chicken: 0 g vegetables: 6 g
Salmon, halibut, or shrimp/ rice/ fruit (grapes)	chicken: 3 oz rice: 6 oz fruit: 1 cup	chicken: 0 g rice: 44 g fruit: 25 g
Snack bar (oatmeal raisin walnut)/ sports drink*	1 bar drink: 8 oz	bar: 25-45 g drink: 14 g
Ready-to-drink high protein shake	12 fl oz	40 g
Turkey sandwich made with deli turkey, whole wheat bread, light mayo, tomato, and lettuce, baby carrots on the side	turkey: 3 oz. or slices mayo: 1 tbsp bread: 2 slices 7 carrots	turkey: 0 g mayo: 0 g bread: 30 g carrots: 3 g
Tuna sandwich (2 slices whole wheat bread)/ nonfat mayo	tuna: 2 oz drained bread: 2 slices mayo: 1 tbsp	tuna: 0 g bread: 30 g mayo: 0 g
Fruit and nut trail mix	1/3 cup	20 g

**Remember that sports drinks are beverages that contain electrolytes and carbohydrates, not caffeine and other stimulants. For more information on sports drinks and hydration, read the Fluids and Hydration section.*

Eating At All-Day Events:

It is important that athletes eat after competing to make sure that they will have enough energy in the muscles for the next race or competition, whether it be in the same day or the following days. The same dietary intake principles used to plan the pre-exercise meal can also apply to foods eaten at all-day events. If an athlete races at 10 a.m. and again after 2 hours, foods that are high in protein and fat will more than likely still be in the stomach, potentially causing stomach or gastrointestinal (GI) distress. The following guidelines have been recommended to help athletes make wise food choices at all-day events.

One hour or less between events or heats:

- *Stick with carbohydrates that are in liquid form, such as sports drinks.*
- *If something solid needs to be eaten, try fruits like oranges, watermelon, cantaloupe, peaches, pears, applesauce, or bananas.*

These foods consist of mostly carbohydrates and water. They are digested very fast and therefore, will not cause as much of a problem with stomach cramping or GI distress.

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

Two to three hours between events or heats:

- *Foods containing carbohydrates and some protein can be eaten, as there is enough time to digest them before competition.*
- *Easy carbohydrate and protein containing combinations include cereal with low-fat milk, a granola bar, jerky and fruit, pretzels and a cheese stick, chocolate milk, or an English muffin with a little nut butter.*
- *Be sure to drink plenty of fluids, like water or a sports drink, for hydration, electrolyte replacement, and restoration of glycogen stores. Avoid drinks that contain caffeine, carbonation, and other stimulants.*

Four or more hours between events or heats:

It may be necessary 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 higher in carbohydrates, moderate in protein, and low to moderate in fat. Meal examples include:

- *A turkey sandwich on two slices of whole wheat bread, Greek yogurt with fruit, and water or a sports (fluid replacement) drink*
- *Spaghetti with lean meatballs, bread, salad with dressing, and water or a sports (fluid replacement) drink*

If there is a certain meal pattern before competition that an athlete thinks is a winning combination, then they should stick to it.

Athletes who make food choices at concession stands need to know how to make the best choices. *Most concession stands are filled with high-fat, high-calorie foods that are not designed to maximize performance.* It is always wiser for athletes to pack a cooler from home with winning combinations, than to rely on the food at a concession stand. Table 3 has a list of nutrient-dense foods that are easy to pack in a cooler and will help supply energy throughout the day.

During Exercise:

Consuming carbohydrates during exercise lasting longer than 60 minutes ensures that the muscles receive adequate amounts of energy, especially during the later stages of the competition or workout. This has also been found to improve performance. The form of carbohydrates consumed does matter. Some athletes prefer to use a sports drink, whereas others prefer to eat solid or gel forms of carbohydrates. Use the following guidelines when consuming sports drinks with carbohydrates.

- *Consume 6-12 ounces of a sports drink with 6-8% carbohydrate concentration every 15-30 minutes during exercise (see Table 4). One gulp is about 2 ounces.*
- *Water is needed to aid in absorption of the carbohydrate. Drinks with a concentration greater than 10% are often associated with abdominal cramps, nausea, and diarrhea.*
- *For high intensity activities, sports drinks and gels containing multiple forms of sugar can increase absorption and delivery of carbohydrates.*

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

**Sports drinks are beverages that contain electrolytes and carbohydrates, not caffeine and other stimulants.*

IT IS BEST NOT TO TRY DIFFERENT AND NEW FOODS BEFORE AN IMPORTANT COMPETITION. IF AN ATHLETE IS COMPLAINING OF GI DISTRESS OR STOMACH CRAMPING, HE OR SHE SHOULD TRY DIFFERENT FOODS OR USE THESE GUIDELINES. ATHLETES SHOULD KEEP A FOOD LOG IN ADDITION TO THEIR TRAINING LOG. THEY SHOULD TRACK WHAT THEY'RE EATING BEFORE, DURING, AND AFTER TRAINING AND HOW IT AFFECTS THEIR PERFORMANCE, BOTH MENTALLY AND PHYSICALLY.

— FYI (focus on your intake) —

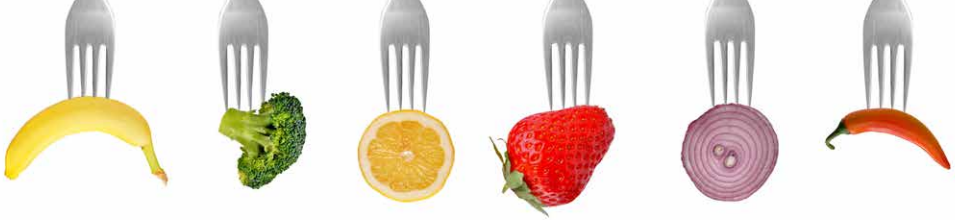


Table 3: *COOLER FUELERS*

Food	Serving Size	Fat	Carbohydrates	Protein
Baby carrots	7 carrots	0 g	3 g	0 g
Peanut butter pretzels	8 pieces	7 g	15 g	5 g
Celery	1 large stalk	0 g	2 g	0 g
Cherry tomatoes	1/2 cup	0 g	7 g	1 g
Chocolate milk (lowfat)	1 cup	2 g	26 g	8 g
String cheese	2 sticks	12 g	2 g	16 g
Dried mango	1 package	0 g	56 g	4 g
Sports drink*	8 oz	0 g	14 g	0 g
Snack bar (oatmeal raisin walnut)	1 bar	5 g	43 g	10 g
Fresh fruit	1 piece or 1 cup	<1 g	19 g	.3 g
Hummus	1/4 cup	5 g	13 g	3 g
High protein milk shake	1 bottle (12 fl oz)	4.5 g	40 g	20 g
Nuts (mixed)	1/4 cup	15 g	7 g	5 g
Peanut butter	2 tbsp	16 g	7 g	8 g
Pita bread (whole wheat large pita)	1 pita	2 g	35 g	6 g
Pretzels	1 cup	X g	X g	X g
Turkey sandwich (3 slices deli meat, mustard, wheat bread), baby carrots	turkey: 1 slice mustard: 1 tbsp 2 slices whole 7 carrots	1 g per slice 0 g bread: 1 slice 0 g	0 g per slice 0 g 5 g 3 g	5 g per slice 0 g 24 g 2 g <1 g
Vanilla wafers	4 wafers	10 g	19 g	<1 g
Whole grain bagel	1 bagel (4 oz)	1.5 g	47 g	11 g
Whole grain cereal	1 cup	1 g	47 g	7 g
Whole grain crackers	5 crackers	15 g	11 g	1 g
Pretzels	1 cup	1.2 g	32 g	4g

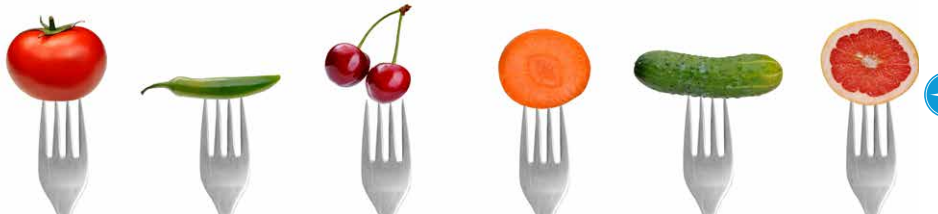


Table 4: *CALCULATING CARBOHYDRATE CONCENTRATIONS IN BEVERAGES*

To assess the concentration of a fluid replacement drink or any beverage, use the following calculations:

$$\frac{\text{Amount of carbohydrate in grams (from the label)}}{\text{The volume in one serving (use 240 ml per cup)}} \times 100 = \text{percentage}$$

Example: $\frac{15 \text{ grams}}{240 \text{ ml}} = .625 \times 100 = 6\%$

**Remember that sports drinks are beverages that contain electrolytes and carbohydrates, not caffeine and other stimulants. For more information on sports drinks and hydration, read the Fluids and Hydration section.*

After Exercise:

Recovery nutrition is beneficial for all athletes to help them recover more quickly in preparation for the next event or training session and to maximize the adaptive benefits of exercise. Carbohydrates and protein are the two main macronutrients to focus on for optimal recovery. Consuming a carbohydrate snack as soon as possible after training will allow the body to start replenishing glycogen stores in the body. Additionally, consuming a couple of mixed meals high in carbohydrates within six hours after training or a competition ensures that the muscles continue with glycogen restoration.

- *Maximize muscle glycogen recovery after an intense or long training session or event with 1-1.2 g carbs 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 (15-30 g) 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.*
- *Table 5 and 6 list recovery tips and examples of recovery snacks.*

Table 5: *POST-EXERCISE RECOVERY TIPS*

To refill energy in the muscle with trainings less than 8 hours apart, eat as soon as possible after exercise and then every 15-30 minutes for up to 4 hours.
Choose higher-carbohydrate foods, such as bagels, pasta, fruits, yogurts, cereal with low-fat milk, peanut butter, sports drinks, granola bars, french toast, sub sandwiches, baked potatoes with chili, smoothie made with fruit, fruit juice, yogurt, and frozen yogurt.
Include protein to aid in muscle recovery and promote muscle growth.
If you can't consume solid foods as soon as possible after exercise, try 2-4 cups of a sports drink, then consume solid food within 4 hours post-exercise.
Consume 1-1.2 g of carbohydrates per kilogram of body weight per hour for the first 4 hours after glycogen-depleting exercise. Be sure to rehydrate as well (see Table 12).

Table 6: *RECOVERY SNACK IDEAS*

Fruit and yogurt smoothie
Cheese sticks and fruit
Hard boiled eggs and whole grain crackers
Cereal with milk
Fruit and Greek yogurt
Pita and hummus
Chocolate milk (lowfat)

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 what the body can use is not going to give athletes larger and stronger muscles. While research shows that protein requirements are higher for athletes to aid in muscle repair and growth, most athletes are already consuming more protein than the body can use. Use the following formulas as guidelines to ensure proper amounts of protein are included in your dietary intake.

Table 7: *DAILY PROTEIN RECOMMENDATIONS*

Type of Training	Grams (g) of Protein Recommended
Endurance	1.4-1.8 g of protein per kilogram of body weight
Strength (to gain muscle mass)	1.6-2.0 g of protein per kilogram of body weight
Strength (maintenance)	1.6-1.7 g of protein per kilogram of body weight
Weight Restricted	1.8-2.2 g of protein per kilogram of body weight

To calculate protein requirements per pound of body weight, use Table 8.

Table 8: *PROTEIN REQUIREMENTS IN GRAMS PER POUND OF BODY WEIGHT*

To calculate the amount of protein your body needs on a daily basis, simply take your body weight in pounds and multiply it by the appropriate recommendation. For example, the range of protein for a 84.1 kilogram (185 pound) soccer player is 118-143 grams daily.

Weight In Kilograms		Protein In Grams		Daily Protein Intake
84.1	x	1.4	=	118 g
84.1	x	1.7	=	143 g

Calculate your own protein needs. Refer to Table 7 to get the recommended grams of protein for your type of training, and calculate both the low and the high values to get a range of appropriate protein for your daily intake.

Weight In Kilograms		Protein In Grams		Daily Protein Intake
	x		=	
	x		=	

Table 9 provides additional information to translate this information into servings of protein-rich food.

Table 9: *PROTEIN CONTENT OF COMMONLY CONSUMED FOODS*

Food	Serving size	Grams of protein
Chicken breast	3 oz	22 g
Ground beef	3 oz	22 g
Broiled fish	3 oz	20 g
Cottage cheese	1/2 cup	12 g
Greek yogurt	8 oz	25 g
Cooked lentils	1/2 cup	9 g
Cooked black beans	1/2 cup	8 g
Milk	1 cup	8 g
Peanut butter	2 tbsp	7 g
String cheese	1 oz	7 g
Extra firm tofu	3 oz	8 g
Egg	1 large or 2 egg whites	6 g
Mixed nuts	1/4 cup	5 g
Cooked quinoa	1 cup	8 g
Whole wheat bread	1 slice	3 g

Protein After Exercise

The body's ability to recover from games, practices, or intense workouts requires adequate rest and proper nutrition. An important component of the recovery process is consuming both carbohydrates and protein shortly after exercise to restore muscle glycogen and stimulate muscle protein synthesis.

EAT

Keep in mind that food is fuel and athletes should not come to practice or games without having had enough food to support the energy requirements for their sport. To keep athletes properly fueled and have their protein needs met, use the **EAT** guidelines:

Eat breakfast. It is the best way to start the day well fueled. Include foods that contain carbohydrates and protein, such as nonfat milk, yogurt, or eggs.

Add carbohydrates and protein to post-exercise meals. Some energy bars provide carbohydrates to replenish muscle glycogen stores and protein to help build and repair muscles.

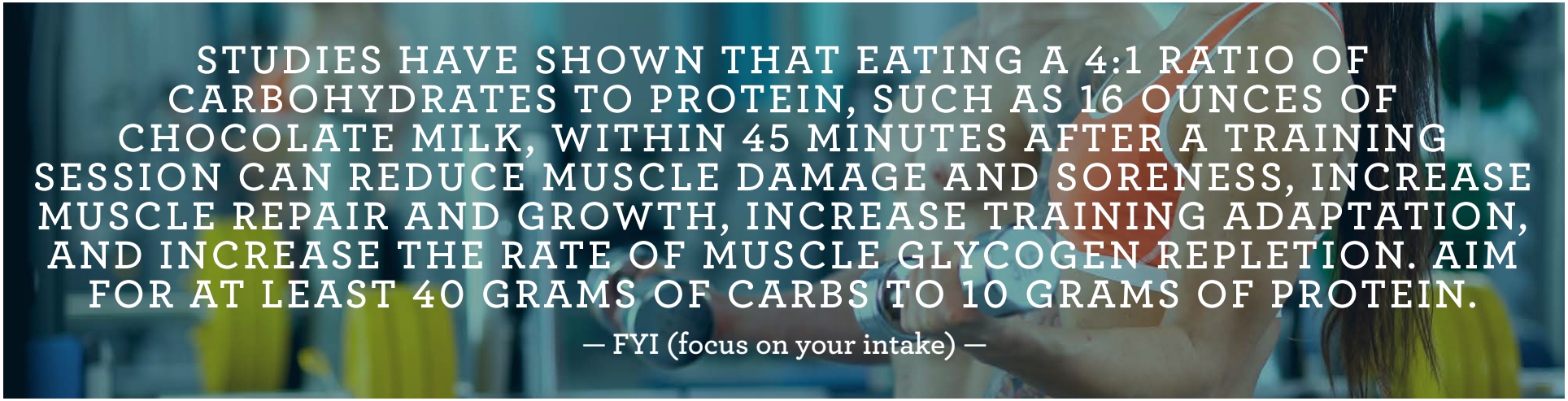
Toss the supplements. Athletes should rely on protein from food sources first, instead of supplements. This helps ensure that diets are balanced for health and performance. In addition to meat sources of protein, dairy products, nuts, and seeds are all rich sources of protein and can easily be added to any meal or snack.

Building Body Mass

Many athletes want to add more bulk to their bodies in the form of lean muscle. Many supplement products claim to build muscles. 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 risk of products being contaminated with sport-prohibited or unknown substances with or without the manufacturer knowing. There is no guarantee that the product contents match with those listed on the label. Taking a lot of extra protein either from supplements or food does not guarantee bigger muscles. If it did, athletes could spend time lounging instead of lifting to build muscle.

The following are healthy ways to build muscle:

- *Follow a strength training program that challenges muscles.*
- *Add 500 to 1,000 more calories each day to current dietary intake, to allow the body to use protein already present in the diet for muscle growth and not be broken down to fuel activity.*
- *Eat foods that are both high in carbohydrates and proteins like grilled chicken sandwiches, peanut butter sandwiches, and Greek yogurt with granola.*
- *Choose low-fat sources of both carbohydrates and protein. For example, choose a baked potato over French fries, or grilled chicken over fried chicken.*
- *Eat protein throughout the day to best support muscle growth. Aim for 0.3 grams/kilogram of body weight, or about 15-20 grams of protein, every 3-4 hours.*



Fat as Fuel

Fat Intake in Athletes

Fat is the primary fuel for light to moderate intensity exercise. Fat is a valuable metabolic fuel for muscles during endurance exercise and performs many important functions in the body, although it does not provide quick bursts of energy needed for speed.

The more efficient an athlete becomes in their respective sport, the easier it is for them to operate at a lower intensity while maintaining the same level of work or maintaining the same speed (metabolic efficiency).

Stored fat provides an abundant source of energy. A 150-pound athlete with a relatively low 6% body fat carries 1,500-2,000 calories in the form of glycogen and 45,000 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 foods are being consumed.

Research has shown that metabolic adaptations do occur as a result of high fat fueling, although claims that high fat, carbohydrate-restricted diets improve performance in competitive athletes have not been proven.

For athletes that require bursts of power in their sport, such as in gymnastics, soccer, basketball, baseball, boxing, figure skating, swimming, and rowing, a high fat diet is not recommended to support optimal performance.

Foods that contain fat can generally be categorized by containing mostly saturated or unsaturated fat. Foods high in saturated fat include fatty meats, high-fat dairy like whole milk or ice cream, coconut oil, palm oil, butter, and ghee. To support heart health and minimize inflammation, saturated fat intake should be limited.

Foods rich in unsaturated fat include nuts, seeds, avocado and avocado oil, olives and olive oil, vegetable oils, and fatty fish like salmon. Support optimal health and performance by getting most dietary fats from unsaturated fat sources.

Athletes should consume 20-35% of total calories from fat, focusing on most fat calories coming from unsaturated sources. 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 can lead to unwanted weight gain and an undesirable body composition. A standard American dietary pattern is usually high in fat, so athletes need to pay attention to where fat is coming from in their diet to keep their intake in a healthy, performance-supporting range.

Table 10: *SUBSTITUTIONS FOR REDUCING FAT INTAKE*

Instead of:	Try:
Whole milk	Skim, 1%, or 2% milk
Ice cream	Higher protein ice cream, avocado ice cream, 100% real fruit popsicles
Sour cream	Plain Greek yogurt
Bacon	Canadian or turkey bacon
80% or 85% lean ground beef or turkey	90 or 93% lean beef or turkey
Fried chicken	Baked, roasted, seared, or grilled chicken
Doughnuts and pastries	100% whole grain breads, homemade whole grain breads
Apple pie	Baked or raw apple
Cookies, cakes, or brownies	Peanut butter pretzels, dried fruit, trail mix
French fries	Baked or roasted potatoes

Gut Health

Probiotics are live microorganisms that populate the gut with healthy bacteria. In turn, healthy bacteria in the gut helps to support the body's immune system, leading to fewer respiratory illnesses and the prevention of a multitude of medical conditions. Probiotics are naturally found in fermented foods like yogurt, kefir, kombucha, sauerkraut, kimchi, tempeh and miso. While there are supplemental forms of probiotics available, it is best and safest to consume them from food sources.

Prebiotics can be thought of as the food for beneficial gut bacteria. Food is the best way to get prebiotics in your diet, which usually come in the form of fiber from plants. Great food sources of prebiotics include onion, garlic, pears, apple, banana, whole wheat, asparagus, beans, mango, Brussels sprouts, and dairy.

Vitamins and Minerals

Vitamins and minerals (when not consumed in food form) are classified by the Federal Drug Administration (FDA) as dietary supplements. Amino acids, botanicals, herbs, and substances, such as enzymes, organ tissues and glandulars, and metabolites, are also classified 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 are crucial for peak performance and contribute to endurance and repair of injured tissues. A good working knowledge and understanding of foods that provide essential nutrients will aid in an athlete reaching their greatest potential.

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 natural foods. Most sports nutrition professionals agree that supplementation will not necessarily improve performance.

However, the athlete who takes a simple one-a-day type of vitamin or mineral that does not exceed the nutrient levels of the Recommended Dietary Allowance (DRA)/Dietary Reference Intake (DRI), is probably not doing any harm, especially if it is third-party tested. An athlete should consult with his or her sports dietitian, or other health care professional, to determine whether vitamin and mineral supplementation is needed to maintain optimal health.

Nutrients that may be low in an athlete's diet are listed in Table 11. Choose a variety of foods in each food category to ensure that all nutrients are included in your diet.

Athletes should always choose food over dietary supplementation. The body needs more than 40 nutrients every day and supplements do not contain all the nutrients that are found in food. Supplements cannot make up for a poor diet or poor beverage choices.

Table 11: *MICRONUTRIENT SOURCES*

Selected Micronutrients	B Vitamins	Calcium	Vitamin C	Vitamin D	Magnesium	Selenium	Iron
Vegetables	Leafy green vegetables Asparagus Cauliflower Sweet potatoes Mushrooms	Broccoli Kale Turnip greens	Tomatoes Brussel sprouts Broccoli Red peppers Turnip greens Collard greens		Spinach Potatoes	Green beans Broccoli	Spinach
Fruits	Dried prunes Bananas	Fortified orange juice	Oranges Grapefruit Berries Kiwi Mango		Raisins Banana	Banana	Raisins Dried apricots
Grains	Whole grain breads Cereals Pasta, Rice Tortillas	Corn tortilla Flour tortilla	Fortified breakfast cereals	Fortified cereal	Whole grain cereals Oatmeal	Spaghetti Rice	Oatmeal Spaghetti Fortified cereals
Dairy	Milk Yogurt	Milk Dairy products		Fortified dairy products	Yogurt	Cottage cheese Cheddar cheese	
Meats Eggs Nuts Beans	Turkey Pork Chicken Salmon Tuna	Soybeans	Salmon	Tuna Salmon Sardines Eggs	Almonds Cashews Peanuts Chickpeas	Lean beef Ham Chicken Nuts	Red meat Dark meat Chickpeas Shrimp Tofu

Natural 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.

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. Fat soluble vitamins (A, D, E, and K) can be toxic when misused. 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.

Remember that more is not always better. The established 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. Even though it has been shown that a severely inadequate intake of certain vitamins and/or minerals can impair performance, it is unusual for an athlete to have 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.

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 may cause 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.

Some trade associations and other businesses have programs that include analytical testing and quality assessment of dietary supplements, culminating in a "stamp of approval" or a "guarantee" that the supplement is safe for use in sport. These programs may 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 if 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.

Supplements and Your Health

Background. 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.

The increased visibility of many vitamins, minerals, herbals, as well as other dietary supplements, some argue, 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. Best estimates suggest that there are hundreds of supplement products currently available that contain one or more of approximately 20-25 designer steroids alone. 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 continued to surface from independent research.

Contamination can also occur. In the United States, high-profile 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 dangerous or sport-prohibited substance 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.

The health consequences are numerous. The consumption of these dangerous hidden drugs, such as designer steroids, has been 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! This is a REAL concern. 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. Anabolic steroids and stimulants are prohibited classes of substances in sport. 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, in fact, 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.

SUPPLEMENT CONNECT
USADA.org/Supplement-Connect

Fluids and Hydration

Hydration is one of the most important nutritional concerns for an athlete. Approximately 60% of body weight is water. As an athlete trains or competes, fluid is lost through the skin through sweat and through the lungs while breathing. If this 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 heart beat 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 regularly as they should be*

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 due to dehydration is reduced. 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. Often, athletes do not realize that they are losing body fluids or that they are impacting their performance through dehydration. Athletes who are not sure how much fluid to drink can monitor hydration using two helpful techniques:

- *Weighing themselves before and after practice or competition. Difference in weight can indicate how much fluid was lost during the activity and help determine how much fluid should be replaced.*
- *Checking urine color. Urine that is dark gold in color indicates dehydration. Urine similar in color to pale lemonade is a sign of a hydrated athlete.*

Many times athletes wait to drink until they are thirsty. Thirst is not an accurate indicator of how much fluid an athlete has lost. Athletes who wait to replenish body fluids until feeling thirsty are already dehydrated. As a matter of fact, most individuals do not become thirsty until more than 2% of body weight is lost. Waiting until you are thirsty can affect your performance. When athletes only drink enough to quench their thirst, they may still be dehydrated.

For best results, keep a bottle of fluid available when working out and drink as often as desired, ideally every 15-20 minutes. Table 12 lists guidelines for fluid replacement from the National Athletic Trainers Association, the Academy of Nutrition and Dietetics, and the American College of Sports Medicine.

Table 12: *GUIDELINES FOR PROPER HYDRATION*

- **MONITOR FLUID LOSSES:** Weigh-in before and after training, especially during hot weather and conditioning phases of the season
- **FOR EACH KILOGRAM (POUND)** lost during exercise, drink 1.5 liters for each kg lost and 3 cups for each pound lost
- **DO NOT RESTRICT** fluids before, during, or after the event
- **DO NOT RELY ON** thirst as an indicator

URINE COLOR CHART

What about fluid replacement drinks?

Sports drinks containing between 6-8% carbohydrates can provide energy to the working muscle that water cannot, which increases exercise capacity and improves performance. It appears that athletes who consume a sports drink can maintain blood glucose levels at a time when muscle glycogen stores are diminished. This allows carbohydrate utilization and energy production to continue at high rates. Research has also shown that mouth rinses with carbohydrates can improve performance at rates similar to ingestion. 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.

How important are the electrolytes provided by fluid replacement drinks?

The ingestion of sodium during exercise may help with maintenance or restoration of plasma volume during exercise and recovery. The consumption of sports drinks containing sodium helps retain water in the body and aids in hydration by increasing the absorption of fluid from the intestines into the muscles. Recent research has suggested 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. Endurance activities lasting longer than 3 hours may require as much as 175 mg of sodium per 8-ounce serving.

There has been concern by parents, coaches, and athletes that sports drinks may contain too much sodium. However, many fluid replacement drinks are low in sodium. An 8-ounce serving of a fluid replacement drink can have a sodium content similar to that of a cup of reduced fat milk. Most Americans consume too much sodium through processed and convenience foods, not through fluid replacement drinks.

What is an ideal fluid replacement drink?

The ideal fluid replacement 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.

Guidelines for Fluid Replacement

The following guidelines for maintaining body fluid balance, improving performance in the heat, and preventing heat-related illness appear to be prudent based on current scientific knowledge.

- *For intense training and long workouts, a fluid replacement drink containing carbohydrates may provide an important source of energy. A 6-8% carbohydrate beverage is typically most effective in maintaining fluid balance while supplying the muscles with fuel.*
- *The fluid consumed during activity should contain a small amount of sodium and electrolytes. The sodium may be beneficial for quicker absorption and replacement of sweat loss.*
- *The beverage should be palatable and taste good.*
- *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.*
- *The athlete should drink 7-12 ounces of cold fluid about 15-30 minutes before workouts. If the workout is prolonged, choose a beverage that has a 6-8% carbohydrate concentration.*
- *Drink 4-8 ounces of cold fluid during exercise at 15-20 minute intervals.*
- *Start drinking early in the workout because thirst does not develop until 2% of body weight has been lost, by which time performance may have begun to decline.*
- ***Avoid carbonated drinks**, which can cause GI distress and may decrease the volume of fluid consumed.*
- ***Avoid beverages containing caffeine, alcohol, and those promoted as energy drinks.***
- *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. Use a trial and error approach until you discover the fluids that work well for you and encourage hydration.*

Bottom Line

Nutrition plays a critical role in athletic performance, and athletes, coaches, and parents need to realize that making wise food choices can increase the chances of optimal athletic performance. It is easy for athletes to fall prey to nutrition misinformation and fad diets in the search for a quick fix to improve performance.

It is imperative that athletes stay current on accurate nutrition issues as they are ever-changing. By making informed food choices, athletes will have an advantage over those who choose to ignore the role that food plays in human 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.

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