

Exercise and Nutrition in Athletes

It has long been accepted that nutrition is vitally important in endurance sports such as cycling, swimming and distance running. Many times, athletes do not follow as strict a diet as do marathoners, tri-athletes and long distance swimmers, which is far from ideal. Nutrition plays as vital a role in soccer as it does in a marathon. To further examine how important nutrition can be, let's take a look at some facts: We have known . . .

for the better part of the 20th century that the storage form of carbohydrate (muscle glycogen) can influence exercise time.

since the mid 1960's that exercise can deplete glycogen and that the right make-up of the diet (2/3 of calories as carbs) can put lots more glycogen in the muscles.

since the early 1970's that running volume and intensity in soccer is reduced when muscle glycogen is low

also from the early 70's, that teams that drank a 'glucose syrup' (what we now think of as a 'sports drink') on game day scored more goals, conceded fewer goals, had more ball touches, and more scoring efforts in the 2nd half of competition.

since the early 80's that the general dietary choices of soccer players were little different from the spectators in the stands. And the player's muscle glycogen was about the same as a non-athlete. Not good.

since the late 80's that drinking a 'sports drink' before and during a game would increase running volume and intensity during competition during the second half.

since the late 80's that the window for fastest glycogen replenishment is in the first hour after exercise.

since the mid 90's that when players consumed a carbohydrate-rich diet for 24 hours, they ran significantly farther on an intermittent running test than they did when they ate a 'normal' diet.

The data is pretty overwhelming. A high carbohydrate diet puts more fuel in the tank (more muscle glycogen), and this increased fuel is effective in improving intermittent exercise performance. More glycogen means a player can run longer and faster late in the game. If your team has done this and your opponent hasn't, the end result could be goals. So make the right choices - eat high glycemic foods in the first hour after training or competition. Foods like this include Cheerios with skim milk and raisins, peanut butter and jelly/jam on bagels or sourdough bread, graham crackers and cottage cheese, Chex mix, Nutri-Grain bars and lo-fat vanilla wafers. Later meals should include moderate glycemic index foods like bananas, orange juices, corn, pita bread, oatmeal cookies, pasta. The goal is 8-10 grams of carbs per kilogram of body weight in 24 hours. An acute supplement of a high carbohydrate drink can be effective in adding some alternate fuel to help save glycogen for late in the game.

Don't complain that you feel listless if your idea of eating after a game is a bag of chips and a soda. It is important that soccer players pay attention to their diet. The players and teams that eat right are putting a better machine on the field and are better prepared to be a force late in the game when so many scoring opportunities and goals occur. In a game such as soccer, when the deciding factor in a game can be an inch here, or a cleat there, something as vital as nutrition should not be overlooked, nor should it be ignored. On the field, players are looking for any advantage they can find. By eating a proper diet, players can gain advantages off the field that will translate to better on-field performance.

Have you ever wondered why visitors to tournaments are offered Donuts, Hot Dogs, Hamburger's, Pop, and even a bag of potato chips to follow? It may not always be hospitality!

What the players eat and drink before and during a competition can be critical towards winning or losing. We all too often rely on mis-information or "when I was a kid/player" syndromes, but there is medical proof that the food intake before and during a competition can - and does - make a difference.

Please feel free to copy the following "guide" and distribute freely. Remember, it's only a guide, and we don't guarantee success in your next competition.

Evening Meal; Before a Competition:

Pre-event nutrition can have a major effect on performance. Players diet should be HIGH IN CARBOHYDRATES, LOW IN FAT. The target is 60-70% carbohydrate, 10-15% protein. This is a very important meal as the main energy reserves are made up from the previous days meals, not from the pre-game meal or big breakfast of the competition day.

Items recommended the night before a competition are:

DRINKS	MEAL ITEMS	DESSERTS/SNACKS
Apple Juice	Spaghetti	Cheese and Crackers
Orange Juice	Tomato Sauce with Meat	Popcorn (no butter)
Vegetable Juice	Rice (steam or boiled)	Fruit - fresh or dried
Fruit Juice	Lean Meat	Sherbet, 1 scoop
Water	Fish	Pretzels
	Poultry	Plain Biscuits
	Potatoes	
	Cooked dried peas, beans or lentils	
	Salad (very low dressing)	
	Vegetables (fresh, frozen or canned)	
	Pizza, (Cheese & Veggie)	
	Bread, all varieties	

AVOID:

Nutrient-poor carbohydrates:

Jam, jelly, white sugar, marshmallows, jelly beans etc.

Fats:

Chocolate, potato chips, tacos, nachos, cheezies
Gravy, sauces, salad dressing, butter, margarine
Fried Foods

High fat cold cuts (bologna, salami, sausage)**Breakfast :****Before / During a Competition**

On most competition days the breakfast is the pre-game meal. The pre-game meal offers very little for the energy production system; however, it can do much damage if the wrong foods are consumed.

It has been suggested that the player enter the game with the stomach as empty as possible. When there is food in the stomach, the heart pumps large volumes of blood to the stomach to aid in digestion. If playing or practicing, however, the blood is shunted to the working muscles, therefore stopping the digestive process. This often causes stomach cramps and gas, making the player very uncomfortable.

Items recommended for breakfast the day of a competition are:

DRINKS	MEAL ITEMS	SNACKS
Apple Juice	Bagels	Fruit bars
Orange Juice	Raisin Bran	Fig Newtons
Vegetable Juice	Toast, 2-3 slices	Fruit - fresh or dried
Fruit Juice	Yogurt	Raisins
Water	Muffin, Bran - Oatmeal	Banana
Hot Chocolate	Pancakes (low butter / syrup)	
Milk	Bread, all varieties	

AVOID:**Fats:**

- Bacon, sausage, excess butter / margarine etc.

Fried Foods:

- Home fries, hash browns, fried/scrambled eggs etc.

Lunch :**During a Competition**

If lunch is a pre-game meal please refer to the pre-game section. The pre-game meal offers very little for the energy production system however, it can do much damage if the wrong foods are consumed. It

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DRINKS	MEAL ITEMS	SNACKS
Apple Juice	Sandwich (2oz meat, fish or poultry)	Fruit bars
Orange Juice	Cup of stock soup	Fig Newtons
Vegetable Juice	Bagels	Fruit - fresh or dried
Fruit Juice	Vegetables	Raisins
Water	Bread, all varieties	Apple
Milk Shake		Banana
Milk		Cheese and crackers
		Pretzels- Saltines

AVOID:

Fat:

- Excess butter / margarine etc., Salami, bologna, sausage, hamburgers, hot-dogs

Fried Foods:

- French fries, home fries, hash browns etc.

Pre-Game Meals / Snacks:

Before a Competition:

During a Competition

The GOAL:

An empty stomach and gastrointestinal tract, but enough fuel for the muscles and enough food to prevent hunger.

A settled stomach and a confident athlete.

A well hydrated, comfortable athlete.

WHY?:

So that the blood will go to the working muscles, not the digestive organs.

Because muscles rely primarily on fuel stored from meals eaten in the days before the competition.

Food eaten on the day of the game fuels the brain and keeps the muscles topped up when the competition is long or intermittent.

So that pre-competition nerves don't upset the stomach.

Items recommended for pre-game meals / snacks:

DRINKS	SNACKS
Water	Fruit bars
Apple Juice	Fig Newtons
Orange Juice	Fruit - fresh or dried
Fruit Juice	Raisins
	Apple
	Banana
	Saltines
	Popcorn (no butter)

1 Hour before the game:

(High carbohydrate, Low fat, little protein, Low fiber, primarily liquid)

- Milk and a medium banana
- Plain muffin and fruit juice
- Toast with jam and milk

2 Hours before the game:

(High carbohydrate, Low fat, moderate protein)

- Cereal, banana and milk
- Plain muffin and fruit juice
- Toast with jam and milk

3 Hours before the game:

(High carbohydrate, Moderate fat, more protein)

- Sandwich - Lean meat, fish poultry or egg, milk, fruit ...or
- 2-3 ounces of lean meat (not fried), 1 medium potato or rice or pasta, fruit and milk ...or
- Large bowl of cereal, fruit yogurt, toast, fruit

Protein Intake

Jeffrey J. Zachwieja, PhD - Senior Scientist, Gatorade Sports Science Institute

Daily Protein Needs

Digestion of dietary protein yields amino acids, which, after being absorbed, are available for metabolism and the growth and repair of all tissues in the body. Because many athletes are purposefully trying to add more muscle, most believe the protein content of the diet should be considerably higher than that of non-athletes. It is true that on average, athletes require slightly more protein (1.2-1.5 g/kg body weight; 0.5-0.7 grams/lb) than do less-active people (0.8-1.0 g/kg body weight; 0.4-0.5 grams/lb). However, it is far from true that in order to meet this additional need, athletes must rely upon protein and amino acid supplements. Further, there is simply no scientific evidence to support the idea that the protein or amino acids in supplements are more effective for athletes than protein in ordinary foods.

New Notions

Protein is typically consumed away from activity, often during meals or snacks before or after an athletic event or practice. Lately, research focused on how protein intake during exercise may improve performance has caught the attention of sports scientists, coaches, and athletes alike. Similarly, studies on whether or not protein intake immediately before or after exercise can enhance the recovery process have generated a high level of interest. The purpose of this brief review is to clarify what has been reported and identify practical applications of the findings. Two topics will be covered: 1) the ingestion of protein and amino acids immediately before and after exercise and 2) the ingestion of protein and amino acids during exercise.

Protein Before and After Exercise

Effect on muscle glycogen resynthesis

The ability of the body to recover from games, practices or an intense workout requires adequate rest and proper nutrition. Consuming carbohydrate shortly after exercise will facilitate the restoration of muscle glycogen (stored carbohydrate energy), which is an important component of the recovery process. Some believe that a mixture of carbohydrate and protein will speed up this process, but that contention is not supported by the prevailing science. At least five carefully controlled studies have shown that adding protein, amino acids or protein hydrolysates to a carbohydrate supplement is no more effective for muscle glycogen resynthesis than ingesting equal calories of carbohydrate alone. 1-5

Effect on muscle protein synthesis

Consuming foods or beverages containing small amounts of protein shortly before or after exercise, especially weight-training exercise may still be of value. Research has demonstrated that ingestion of amino acids alone 6 or in combination with carbohydrate 7 after weight-training exercise stimulates protein synthesis and improves net protein balance in muscle. In the presence of carbohydrate, it appears that only small amounts of essential amino acids (e.g., as little as 6 grams) are required for the positive effect. Data are not yet available for the effect of whole proteins, amino acid dose-response or the impact of different forms of training on muscle protein synthesis. The newest research is most intriguing, it suggests that muscle protein synthesis is stimulated more when a carbohydrate amino acid drink is consumed before vs. immediately after weight training exercise 8. Still, athletes and coaches should cautiously incorporate these nutritional practices into their routines. The research represents only

a “snapshot” view of the dynamic process of muscle protein metabolism and in no way can it be taken to mean these practices will lead to bigger, stronger muscles.

Protein During Exercise

Effect on performance

Only a few amino acids can be used by muscles for energy and their oxidation accounts for only 2-5% of the total energy expenditure, even during intense exercise. Most of the energy for exercise comes from carbohydrate and fat. The best scientific studies have been unable to show that branched-chain amino acid ingestion during exercise benefits performance 9,10. In fact, a potential side effect of amino acid ingestion during exercise is excess ammonia accumulation (a by-product of amino acid breakdown), which could contribute to fatigue 11.

It has been suggested that consuming a protein-carbohydrate mixture during exercise will raise blood insulin to higher levels than carbohydrate alone, increasing the use of carbohydrate in muscle to better delay fatigue. Although there are a few published abstracts that point to such a conclusion, these studies have yet to be published in a peer-reviewed scientific journal, so it is impossible to determine the validity of the results. At this point, we can only conclude on the basis of published research that ingesting amino acids (and likely protein) during exercise has no effect on exercise performance. Although future publications may provide a different perspective, it is hard to imagine how ingesting small quantities of protein or amino acids during exercise could benefit performance. For example, if higher blood insulin levels did result from ingesting a protein-carbohydrate drink during exercise, this could possibly reduce fat oxidation and fatty-acid availability. Well-trained athletes have an incredible ability to use fat as a fuel. In fact, this helps them save carbohydrate for when it's needed the most; for example, during a finishing sprint. Along these lines, there are no good scientific data to show that ingesting protein along with carbohydrate during exercise spares the use of muscle glycogen or increases the uptake and use of blood glucose by muscle.

Bottom Line

Athletes are always searching for a competitive edge and often look to a supplement or special combination of nutrients to find it. Research has shown, however, that there are no magic-bullet supplements for improving sports performance and, while a cornerstone nutrient for the athletic diet, protein is also not a magic bullet. Protein plays an important role in helping the body recover from training and competition and a balanced nutrition shake or bar may be an effective way to jump-start this process. The common-sense approach to improve performance, backed by lots of research, is to rely on a sound, fundamental program that stresses hydration and nutrition as a complement to an effective training program.

WATER: The Most Important Nutrient

Forget about every other question that you have about nutrition until you've figured out how to stay hydrated. Being smart about water intake can separate good performance from great performance.

You are mostly water. In fact, if you took the water out of a 180-pound lean body, there would be about 55 pounds left. Because your muscles, your brain, your blood and sweat are mostly water, your body doesn't work like it should when it doesn't have enough water. You don't think as clearly, your endurance is compromised and your heart works harder.

When you're severely dehydrated, sweating stops and your body overheats. The result - fatigue, weakness, dizziness, and collapse, or worse. In fact, every year, deaths in young healthy athletes are linked to severe dehydration.

Sweat It Out

Sometimes you don't even see sweat, like when you swim. But you sweat whenever your body heats up from working out. Sweat is your body's cooling system. Evaporation of sweat from your skin cools you down.

When you sweat, you lose water from your body and that water must be replaced. Replacing the water takes a plan.

Dehydration: A shortage of water in the body.

Don't Rely on Thirst

You might be thinking, "What's the big deal? Won't drinking when I'm thirsty guarantee that I'm hydrated?" Surprisingly, no. During exercise, for reasons not totally understood, humans don't drink enough to prevent dehydration. You need to drink before you're thirsty and keep drinking after you no longer feel thirsty.

Drink It In

Forget about the old rule of drinking 8 glasses per day. You probably need more than that on most days. Counting how many glasses you drink is only one way of keeping track of what you need. A better way of making sure you're hydrated is to check your body weight before and after practice. For accuracy, weigh in minimal clothing if there's privacy, and afterwards, change out of the sweaty clothing before you weigh. The weight lost during practice or competition is not fat, it's water loss.

One pint of water weighs one pound. To replace the water, drink one pint of fluid for every pound you lost. (One pint = 16 ounces = 500 ml = $\frac{1}{2}$ liter). It is critical to replace the water loss as quickly as possible. Before your next workout, your weight should be back up to normal.

If you can't check your weight, pay attention to your body for signs of dehydration. Your mouth should not be dry. Your urine should be lemon-colored most of the time.

More than one episode of dark yellow urine is a warning sign that you don't have much reserve. (Exception: Vitamin supplements can turn your urine yellow-orange, even if you are hydrated.) Loss of appetite, stomachaches, and muscle cramps can be other warning signals of dehydration.

When?

Drink before, during and after working out. Drink a pint or so of fluid a few hours before exercise. This will help make sure you are hydrated and give you enough time to urinate if you need to beforehand.

Keep drinking during exercise. And don't worry about getting too much fluid. If you're sweating, your body needs a constant supply. Your stomach might gurgle, but your body will absorb and use the fluid. Feeling sick and cramping have been blamed on too much water when in fact, stomachaches and muscle cramps are usually signs of not drinking enough fluid.

Drinking fluids after workouts is extremely important. Even when drinking fluids during a workout, many athletes become dehydrated. Athletes working out in the heat for several hours can lose 10 pounds. That's more than a gallon of water.

Hydration Tip: Fill your water bottle and keep it in plain sight so you remember to drink it.

What Should I Drink?

Your body needs water. But remember water comes in all sizes, shapes and colors. Milk is 90% water. Juice and most soft drinks are 89% water, sport drinks are 94% water, and even pizza is 50% water. And it all counts. Nearly everything that passes your lips provides water for your body, and in fact, research shows that most hydration happens at meals from the combination of food and beverages.

Research also shows that we tend to drink more if the fluid is flavored and if a variety of fluids are available.

Keys to Hydration

When you have figured out how to stay hydrated, especially when you sweat heavily, you have accomplished the single most important performance-enhancing aspect of nutrition.

Water is your most important nutrient.