



IMPLICATION OF DIETARY PRACTICES FOR SPORTS PERFORMANCE

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INTRODUCTION

Sports nutrition is a specialization within the field of nutrition that partners closely with the study of the human body and exercise science. Sports nutrition can be defined as the application of nutrition knowledge to a practical daily eating plan focused on providing the fuel for physical activity, facilitating the repair and rebuilding process following hard physical work, and optimizing athletic performance in competitive events, while also promoting overall health and wellness.

To fully understand and subsequently apply sports nutrition concepts, professionals instructing athletes on proper eating strategies first need to have a command of general nutrition as well as exercise science.

The six nutrients are carbohydrates, proteins, fats, vitamins, minerals, and water and are classified as essential nutrients. The body requires these nutrients to function properly; however, the body is unable to endogenously manufacture them in the quantities needed daily, and therefore these nutrients must be obtained from the diet. Carbohydrates, proteins, and fats are classified as macronutrients because they have a caloric value and the body needs a large quantity of them on a daily basis. The micronutrients include vitamins and minerals; the prefix micro is used because the body's daily requirements for these nutrients are small.

Eating before exercise can be challenging for athletes. While they need fuel to perform, they should not exercise on a full stomach. Food that remains in the stomach during training or competition may cause indigestion, nausea, and possibly vomiting. A good recommendation is to eat a meal 2-4 hours before exercise. If an athlete is nervous about his or her performance, the digestive process may take even longer.

Eating for peak performance also includes making wise food choices post exercise. The right post-game meal replenishes athletes' muscles for the event or competition around the corner. In fact, muscles are most receptive to recovery during the first 30 minutes after competition

Basic Diet

Carbohydrates are compounds constructed of carbon, hydrogen, and oxygen molecules. Carbohydrates are converted into glucose in the body, providing the main source of fuel (4 calories per gram of carbohydrate) for all physical activity. Carbohydrates are found in a wide variety of foods, including grains, fruits, and vegetables, as well as in the milk/alternative (soy, rice, nut, and other nondairy products) group.

Amino acids are the building blocks of proteins, which are constructed of carbon, hydrogen, oxygen, and nitrogen molecules. Amino acids can be made within the body (nonessential) or obtained from dietary sources. Proteins are involved in the development, growth, and repair of muscle and other bodily tissues and are therefore critical for recovery from intense physical training. Proteins ensure that the body stays healthy and continues working efficiently by aiding in many bodily processes. Protein can also be used for energy, providing 4 calories per gram; however, it is not used efficiently and therefore is not a source of energy preferred by the body. Proteins are found in a variety of foods, including grains and vegetables, but are mainly concentrated in the milk/alternative as well as meat and beans/alternative (soy products, nuts, seeds, beans, and other nonanimal products) groups.

Fats, like the other macronutrients, are compounds made up of carbon, hydrogen, and oxygen molecules. Fats are also known as lipids, and they come from both plant and animal sources in our diet. Triglycerides are the most common type of fat. Other fats include cholesterol and phospholipids. With 9 calories per gram, fats are a concentrated source of energy. Fat is primarily used as a fuel at rest and during low- to moderate-intensity exercise. Fats are also involved in providing structure to cell membranes, aiding in the production of hormones, forming the insulation that wraps nerve cells, and facilitating the absorption of fat-soluble vitamins. Fats are concentrated in butter, margarines, salad dressings, and oils, but they are also found in meats, dairy products, nuts, seeds, olives, avocados, and some grain products.

Vitamins are a large class of nutrients that contain carbon and hydrogen, as well as possibly oxygen, nitrogen, and other elements. There are two main requirements for a substance to be classified as a vitamin. First, the substance must be consumed exogenously because the body cannot produce it or cannot produce it in sufficient quantities to meet its needs. Second, the substance must be essential to at least one vital chemical reaction or process in the human body. Vitamins do not directly provide energy to the body; however, some vitamins aid in the

extraction of energy from macronutrients. Vitamins are involved in a wide variety of bodily functions and processes that help to keep the body healthy and disease free. Vitamins are classified as either water soluble (B vitamins and vitamin C) or fat soluble (vitamins A, D, E, and K), depending on their method of absorption, transport, and storage in the body. Vitamins are found in nearly all foods, including fruits, vegetables, grains, meat and beans/alternative, milk/alternative, and some fats.

Minerals are also a large group of nutrients. They are composed of a variety of elements; however, they lack carbon. Minerals have a role in the structural development of tissues as well as the regulation of bodily processes. Physical activity places demands on muscles and bones, increases the need for oxygen-carrying compounds in the blood, and increases the loss of sweat and electrolytes from the body, all of which hinge on the adequate intake and replacement of dietary minerals. Minerals are categorized into major minerals (calcium, sodium, potassium, chloride, phosphorus, magnesium, and sulfur) and trace minerals (iron, zinc, copper, selenium, iodine, fluoride, molybdenum, and manganese) based on the total quantity required by the body on a daily basis. Similar to vitamins, minerals are found in a wide variety of foods, but mainly are concentrated in the meat and beans/alternative and milk/alternative groups.

Forming a category of its own, water deserves to be highlighted because of its vital roles within the body. The human body can survive for a much greater length of time without any of the macro- or micronutrients than without water. The body is 55–60% water, representing a nearly ubiquitous presence in bodily tissues and fluids. In athletics, water is important for temperature regulation, lubrication of joints, and the transport of nutrients to active tissues. In addition to plain water, water can be obtained from juices, milk, coffee, tea, and other beverages, as well as watery foods such as fruits, vegetables, and soups.

HOW DOES THE BODY PRODUCE ENERGY

The body derives its energy from foods ingested daily. Carbohydrates, fats, and proteins are known as the energy nutrients because they serve as the body's source for energy. These energy nutrients are quite literally chemicals that have energy trapped.

within the bonds between the atoms of which they are made. The energy trapped within these nutrients is released when metabolic pathways within the cells break down the foods into their constituent parts, carbon dioxide and water. Some of the energy released is conserved or captured and used to make another high-energy chemical called adenosine triphosphate (ATP). The rest of the energy is lost as heat. ATP is the body's direct source of energy for

cellular work. Without a constant source of ATP, muscles would not be able to generate force, and thus athletes would not be able to move or perform any physical activity.

WHAT TO EAT

Because glucose is the preferred energy source for most exercise, a pre-exercise meal should include foods that are high in carbohydrates and easy to digest. This include foods such as pasta, fruits, breads, energy bars and drinks.

PLANNING

Planning is essential if you are competing in an all-day event, such as track meets or other tournaments. Consider the time of your event, the amount of your meal and the energy required. Also, be aware of the amount of fluid you consume. You should plan ahead and prepare meals and snacks that you have tried before and know will sit well with you. Do not experiment with something new on the event day.

SUGGESTED PRE-EXERCISE FOODS

Eating before exercise is something only the athlete can determine based upon experience, but some general guidelines include eating a solid meal 4 hours before exercise, a snack or a high carbohydrate energy drink 2 to 3 hours before exercise, and fluid replacement (sports drink) 1 hour before exercise.

1 HOUR OR LESS BEFORE COMPETITION

- fruit or vegetable juice such as orange, tomato, or V-8, and/or
- fresh fruit such as apples, watermelon, peaches, grapes, or oranges and/or
- Energy gels
- up to 1 1/2 cups of a sports drink.

2 TO 3 HOURS BEFORE COMPETITION

- fresh fruit
- fruit or vegetable juices
- bread, bagels
- low-fat yogurt
- sports drink

3 TO 4 HOURS BEFORE COMPETITION

- fresh fruit
- fruit or vegetable juices
- bread, bagels
- pasta with tomato sauce
- baked potatoes
- energy bar
- cereal with low-fat milk
- low-fat yogurt
- toast/bread with limited peanut butter, lean meat, or low-fat cheese
- 30 oz of a sports drink

Sports drink/bar/gel

Fruit smoothie (mango/banana/ berries, low-fat/non-fat milk or yogurt, honey)

Fruit or vegetable juice

Flour tortilla, banana, and honey

SUGAR AND PERFORMANCE

If you are an endurance athlete, evidence suggests that eating some sugar (like energy bars, some types of candy bars, or sports drinks) 35 to 40 minutes before an event may provide

energy (glucose) to your exercising muscles when your other energy stores have dropped to low levels. However, you should experiment with such strategies before competition because some people do not perform well after a blood glucose spike.

CAFFEINE AND PERFORMANCE

Caffeine acts as a stimulant on the central nervous system. It had been thought to boost endurance by stimulating a greater use of fat for energy, and thereby reserving glycogen in the muscles. Research, however, doesn't support that theory. When caffeine improves endurance, it does so by acting as a stimulant.

Caffeine can have serious side effects for some people. Those who are very sensitive to its effects may experience nausea, muscle tremors, and headaches. Too much caffeine is a diuretic, and can result in dehydration, which decreases performance.

FOODS TO AVOID BEFORE EXERCISE

Any foods with a lot of fat can be very difficult and slow to digest and remain in the stomach a long time. They also will pull blood into the stomach to aid in digestion, which can cause cramping and discomfort. Meats, doughnuts, fries, potato chips, and candy bars should be avoided in a pre-exercise meal.

Keep in mind that everyone is a bit different and what works for you may not work for you teammate or training partner. Factor in individual preferences and favorite foods, and an eating plan is a highly individualize thing.

BEFORE – Focus on Fluid and Carbohydrate

Meal ideas – from home or on the go:

The amount and type of food will vary according to the amount of time available between the meal/snack and the start of training or competition. All low time for digestion.

- Toast/bagel with jam, peanut butter, juice, yogurt
- Oatmeal/cereal, milk, raisins, juice
- Pancakes with a little syrup/spread, ham, juice
- Grilled chicken sandwich, juice
- Lean meat sandwich, carrots, milk, oatmeal raisin cookie, fruit
- Minestrone soup, cheese, crackers, vegetable juice
- Chili, bagel, milk
- Pasta with tomato/lean meat sauce, applesauce, chocolate milk
- Lentil soup, crusty roll, salad with a little dressing, soybeverage.

Avoid bacterial contamination of meals and snacks. Keep cold foods cold and hot foods hot. Bacteria reproduce quickly at room temperature.

Before exercise, choose foods which are higher in carbohydrate and lower in protein and fat. This will allow quick absorption of carbohydrate energy from the food into the body. Include protein and fat sources during meals and snacks at other times during the day.

Drink 14-20 oz of water in the 24 hrs before competition. Check your hydration status prior to competition. Urination 2-4 hrs prior to competition should be a lightyellow “lemonade” color. If there is no urine or urine is dark drink an extra 8 oz 2 hrs prior to competition. Drink 18-34 oz (light to heavy sweater/dehydrated) of sports drink during the first hour of competition.

Research shows that eating a meal in the 4 hrs prior to an athletic competition improves performance. The pre competition meal is especially important for cognitive function, skills, and movement patterns associated with different sports. Eating before competition results in higher energy levels, slower fatigue, better hydration, as well as faster recovery and decreased injury risk.

Items recommended the night before a competition are:

DRINKS MEAL ITEMS DESSERTS/SNACKS •

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

Never try new foods or drinks before or during competition

• **DURING EXERCISE:**

Consuming some carbohydrates during exercise can enhance performance but this generally only applies to individuals participating in endurance or high intensity sports that last over 60 minutes, as this is when carbohydrate stores may substantially decrease (e.g. marathon/long distance running, football games or competitive swimming events).

It is important to consume plenty of fluids during exercise, especially if you are sweating heavily (also to replace electrolytes lost from sweating) and/or the environmental temperature is high.

Try to sip small amounts of fluids whenever possible during exercise to stay hydrated.

Don't wait until you feel thirsty, as this is a sign that you are already partly dehydrated. Keep sipping water before and during the activity, if possible, to keep hydration levels topped up.

WHAT TO EAT DURING A RACE

Energy bars, energy gels and bananas are excellent for replenishing carbohydrate during a race. Take small bites while continuing the run.

Keep yourself hydrated. Dehydration occurs when water lost through heavy breathing and perspiration is not replaced adequately by fluid intake. You may lose up to 3 to 5 kg of water weight in a three-hour marathon.

To prevent dehydration during a race:

Take another 300 to 600 ml of fluid 15 minutes before the race begins.

Drink 150 to 250 ml of fluid at regular intervals to replace fluid loss. Take small sips while continuing to run.

Fluids include plain water (for runs lasting less than 90 minutes) and sports or isotonic drinks (for longer distances such as marathon).

Avoid soda, fruit juices and cordials. Their high sugar concentrations may delay gastric emptying and cause stomach discomfort during the run.

Items recommended for breakfast the day of a competition are:

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

POST-COMPETITION MEALS

Choose carbohydrate rich foods as soon as possible after competing, such as fruits, juices and high carbohydrate drinks. The carbohydrate rich foods will replenish glycogen stores quickly. Be sure to replace fluids that have been lost while competing. Follow the rule of thumb of 2 cups of fluid for every 1 pound that is lost. Athletes need to be sure to replace potassium or sodium lost by using foods. Potassium can be found in fruits and vegetables while sodium can be found in salty foods and sports drinks (Powerade). The postcompetition meal should be eaten within 15-60 minutes after competing. The carbohydrate intake should be increased right away but should return at the next meal. The food eaten after competing can affect one's recovery, such as combining carbohydrates and protein. Protein helps muscles recover more quickly when combined with carbohydrates. Rehydration also helps replenish the glycogen stores.

Examples of Post-Competition Meal: -1 cup cottage cheese + 2 cups fruit -1 cup of juice, 1 slice whole wheat bread, 2 tablespoons of peanut butter -1 cup of non fat yogurt, ½ cup of grape nuts, and 2 tablespoons of raisins -1 banana, 1 bagel, 2 tablespoons peanut butter

Hydration

The amount of liquid one consumes is also very important as dehydration has a negative effect on performance. The athlete needs to make sure they consume enough liquid before,

during and after competing to prevent dehydration. Before exercise aim to consume 16 ounces of fluid 2 hours prior to a competition. During exercise consume eight to ten ounces every 15-20 minutes. After exercise drink 16-20 ounces for every pound of body weight that is lost with exercise. During the day, the athlete should habitually consume water and other fluids. All fluids, such as water, milk, juices, tea, etc., count towards fluids needs, but try to stay away from drinks high in sugar. Sports Drinks, such as Powerade, are strongly recommended for all athletes during activities lasting more than 1 hour. Sports Drinks are recommended as they contain carbohydrates and sodium. Carbohydrates are needed as they aid water absorption in the small intestine. They will help supply fuel for exercise which lasts longer than one hour and will also help improve performance. Sodium also helps water to be absorbed more quickly. It enhances the palatability which helps encourage the athlete to drink. With dehydration comes the reduced blood flow to active muscles as well as increased glycogen use which depletes carbohydrate stores resulting in early fatigue.

WHAT TO EAT AFTER A RACE

Hydrate with sport drinks after a marathon. Isotonic drinks are preferred as they contain similar concentration of salts and sugar as the human body. Avoid alcohol in the 24 hours following a race, as it promotes dehydration.

Do not drink just based on your thirst, as it won't reflect all of your fluid needs. For a visual guide, your urine should be almost colourless a couple of hours after the run.

Within one hour after a race or marathon, grab a carbohydrate-rich snack such as banana sandwich, red bean bun, energy bar, peanut butter on a banana and a sports drink.

Within two to three hours after a race or marathon, have a balanced meal comprising a lean protein (fish, chicken), carbohydrates (rice, pasta, potatoes) and good fats (avocados, nut butter).

After Exercise: 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. F Athletes who may benefit from recovery nutrition include those who are competing in tournament play or have multiple competitions over the course of one or several days, have skipped meals throughout the day, did not consume enough calories, and want to improve strength and power. F The recommendation is 1-1.2 grams of carbohydrates per kilogram of body weight per hour for the first four hours after exercise. Refueling may be enhanced by consuming small amounts of carbohydrate more frequently (every 15-30 minutes) for up to four hours. F Add a small

amount (~20 grams) of protein to the first feeding to stimulate muscle repair and rebuilding.

F Table 5 and 6 list recovery tips and examples of recovery snack

RECOVERY ELECTROLYTES

When you are exercising, you sweat. When you sweat, you lose important electrolytes, such as potassium and sodium. These help your body function normally. Most likely you will replenish these electrolytes with your recovery foods. A pound of sweat contains about 80-100 milligrams potassium. In the course of 2-3 hours of very hard exercise you might lose 300-800 milligrams of potassium and 1800-5600 milligrams of sodium.

To refill energy in the muscle with trainings less than eight hours apart, eat as soon as possible after exercise and then every 15-30 minutes for up to four hours. Choose higher-carbohydrate foods such as bagels, pasta, fruits, yogurts, cereal with lowfat 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 four hours post-exercise. Consume 1-1.2 g of carbohydrates per kilogram body weight per hour for the first four hours after glycogen-depleting exercise. Be sure to rehydrate as well .

Here are some examples of common foods:

Food	Mg potassium/serving	Mg potassium/ 100 calories
Potato	840/1 large	380/.5 large
Yogurt	530/8 oz low fat	370/ 2/3 C
Orange juice	475/8oz	420/7oz
Banana	450/medium	450/1 medium
Raisins	300/ .25 C	230/3 Tbsp
AllSport	55/8 oz	70/10oz
Powerade	30/8oz	45/11.5oz
Gatorade	30/ 8oz	60/ 16oz
Cranapple	40/8oz	30/6oz

Examples of Sodium in Popular Foods:

Recovery Food	Sodium (mg)
Pizza, ◆ of 12◆ cheese	1300
Mac and Cheese, 1 Cup	1060
Spaghettios, 1 C	990
Chicken Noodle Soup, 1 C	830
Bagel, 1 small	320
Pretzels, 1 large	220
Bread, 1 slice	180
Frozen yogurt, 1 C	100
Orange Juice, 8 ounces	5

SUMMARY

Athletic and exercise performance is not only influenced by the training schedule of the athlete but is also dramatically influenced by the nutritional status of the individual. Total dietary intake not only influences training and performance, but also the strength and endurance of the individual. Additionally, the composition of dietary intake can significantly impact the metabolic responses to exercise, which in turn, can impact performance. It is therefore important to pay close attention to the dietary and nutrient intakes of these active individuals to enhance performance and exercise capacity.

Athletes need and want reliable, accurate information to improve their health and performance. This includes the range of athletes, children, adolescents, college students, recreational athletes, and professional athletes. Much of the information they receive may not be accurate; athletes may fall victim to quackery and fads specifically targeted to this group. With the growth of interest in sports nutrition, different methods of communicating sound nutrition knowledge must be considered. A registered dietitian or licensed nutritionist, with a background in nutrition and physical activity, who can tailor diets to the individual athletes in a specific sport, may one day become an essential part of serious sports efforts.

In the end, it's important to start by improving overall diet quality and incorporating basic Precision Nutrition style habits. Then, once a solid foundation is built, the workout nutrition strategies above can really make a difference.

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