Since the time the ancient Greeks and Romans started the Olympic games, athletes have had their own special regimen to come up with great performances, which included diet and nutrition too. For instance, Milo of Croton, the wrestler with legendary strength who won five successive Olympic Games from 532 to 516 B.C., ate 9 kg of meat, 9 kg of bread and 8.5 litres of wine a day!

Alcohol was commonly drunk as an ergogenic aid to increase performance in the Olympics through the early 1900s. However, the view of sports nutrition today has much evolved from the ancient Olympic gladiators’ meal plan.

In fact, sports nutrition has emerged as an independent field in itself comprising the study and practice of nutrition and diet as it relates to athletic performance. It is concerned with the type and quantity of fluid and food taken by an athlete, and deals with nutrients such as vitamins, minerals, supplements and organic substances such as carbohydrates and proteins. Although sports nutrition is an important part of many sports training regimens, it is most commonly considered in strength sports (weight lifting and bodybuilding) and endurance sports (cycling, running, triathlon).

Enhancing performance is the primary goal of sports nutrition and this it does by various ways. First, it improves performance by improving body composition, which increases speed, quickness, mobility, and strength. Second, it helps the speed of recovery, which will in turn create more capacity for practicing and competition as the body becomes more fit and adjusted to the good nutrition incorporated into the workout regimen. Third, it helps to increase energy for both practice and competition. Strategic diet also increases immunity, allowing one to stay healthy and be able to continue and intensify practice and training.

Carbohydrates – Main Fuel Source
Carbohydrates are arguably the most important components that provide energy to fuel muscle contractions. Once eaten, carbohydrates break down into smaller sugars (glucose, fructose and galactose) that get absorbed and used as energy. Any glucose not needed right away gets stored in the muscles and the liver in the form of glycogen. Once these glycogen stores are filled up, any extra carbohydrate gets stored as fat.

Glycogen is the source of energy most often used for exercise. It is needed for short, intense bouts of exercise from sprinting to weight lifting because it is immediately accessible. Glycogen also supplies energy during the first few minutes of any sport. During long, slow duration exercise, fat can help fuel activity, but glycogen is still needed to help break down the fat into something the muscles can use.

Adequate carbohydrate intake also helps prevent protein from being used as energy. If the body doesn’t have enough carbohydrate, protein is broken down to make glucose for energy. Carbohydrate has other specific functions in the body including fueling the central nervous system (CNS) and brain.

One gram of carbohydrate provides four calories of energy. Athletes often talk about carbohydrate loading and carbohydrate depletion which refers to the amount of carbohydrate energy we can store in our muscles. This is generally around 2,000 carbohydrate calories, but this number can be changed through depletion and loading. During depletion (from diet, exercise or a combination) the stored carbohydrate is used.

If we don’t replenish these stores, we can run out of fuel for immediate exercise. Athletes often refer to this as bonking or hitting the wall. In the same way, eating large amounts of...
carbohydrates can increase these stores, referred as carbohydrate loading or carbo-loading. Our maximal carbohydrate storage is approximately 15 grams per kilogram of body weight (15 grams per 2.2 pounds). So, a 175-pound athlete could store up to 1200 grams of carbohydrate (4,800 calories)—enough energy to fuel high intensity exercise for quite some time.

Carbohydrate stored as glycogen is an easily accessible source of energy for exercise. How long this energy supply lasts depends on the length and intensity of exercise and can range anywhere from 30 to 90 minutes or more. To avoid running out of energy during exercise, the athlete starts with full glycogen stores, replenishes them during exercise and refills them after exercise to be ready for the next workout.

Carbohydrates are also divided into simple and complex forms. Simple sugars (carbs) are absorbed and converted to energy very quickly and provide a rapid source of energy. Fruit and energy drinks are a good source of simple carbohydrates.

Complex carbohydrates take a bit longer to be digested and absorbed into the body. They also take longer to break down and therefore provide energy at a slower rate than simple sugars. Examples of complex carbohydrates are breads, rice and pasta. Starch and fiber are also considered complex carbohydrates but fiber can not be digested or used for energy. Starch is probably the most important energy source in an athlete’s diet because it is broken down and stored as glycogen. Foods high in starch include whole grain breads, cereals, pasta, and grains.

Proteins for Repair
Athletes need proteins primarily to repair and rebuild muscle that is broken down during exercise and to help optimize carbohydrate storage in the form of glycogen. Protein is not an ideal source of fuel for exercise, but can be used when the diet lacks adequate carbohydrates. This is detrimental, though, because if used for fuel, there isn’t enough available to repair and rebuild body tissues, including muscles.

Complete proteins (those containing eight essential amino acids) come mostly from animal products such as meat, fish, and eggs and incomplete proteins (lacking one or more essential amino acids) come from sources like vegetables, fruits and nuts. Vegetarian athletes may have trouble getting adequate protein if they aren’t aware of how to combine food.

The average adult needs 0.8 grams of proteins per kilogram (2.2lbs) of body weight per day. Strength training athletes need about 1.4 to 1.8 grams per kilogram (2.2lbs) of body weight per day. Endurance athletes need about 1.2 to 1.4 grams per kilogram (2.2lbs) of body weight per day.

Energy from Fats
Fats provide the highest concentration of energy of all the nutrients. One gram of fat equals nine calories. This calorie density, along with our seemingly unlimited storage capacity for fat, makes fat our largest reserve of energy. While these calories are less accessible to athletes performing quick, intense efforts like sprinting or weight lifting, fat is essential for longer, slower, lower intensity and endurance exercise. Even during high intensity exercise, where carbohydrate is the main fuel source, fat is needed to help access glycogen.

Converting stored body fat into energy takes a great deal of oxygen, so exercise intensity must decrease for this process to occur. For these reasons, athletes need to carefully time when they eat fat, how much they eat and the type of fat they eat.

What an athlete consumes before, during and after exercise is important for enhancing performance.

Eating for Exercise
While eating soon before exercise doesn’t provide the bulk of the fuel needed for the activity, it can prevent the distracting symptoms of hunger during exercise. The major source of fuel for active muscles is carbohydrate.
which gets stored in the muscles as glycogen in the days before exercise.

Pre-exercise meal: Exercising on a full stomach is not ideal. Food that remains in your stomach during an event may cause stomach upset, nausea, and cramping. To make sure you have enough energy, yet reduce stomach discomfort, you should allow a meal to fully digest before the start of the event. This generally takes 1 to 4 hours, depending upon what and how much you’ve eaten. Each one of us is a bit different, and you should experiment prior to workouts to determine what works best for you.

If you have an early morning race or workout, it’s best to get up early enough to eat your pre-exercise meal. If not, you should try to eat or drink something easily digestible about 20 to 30 minutes before the event. The closer you are to the time of your event, the less you should eat. You can have a liquid meal closer to your event rather than a solid meal because the stomach digests liquids faster.

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

Post-exercise meal: The first nutritional priority after exercise is to replace fluid lost during exercise. It is also important to consume carbohydrates such as fruit or juice within 15 minutes post-exercise to help restore glycogen. Research has shown that eating 100-200 grams of carbohydrate within two hours of endurance exercise is essential for building adequate glycogen stores for continued training.

Waiting longer than two hours to eat results in 50% less glycogen stored in the muscle. The reason is, carbohydrate consumption stimulates insulin production, which aids the production of muscle glycogen. Combining protein with carbohydrate in the two hours after exercise nearly doubles the insulin response, which results in more stored glycogen. The optimal carbohydrate to protein ratio for this effect is 4:1 (four grams of carbohydrate for every one gram of protein). Eating more protein than that, however, has a negative impact because it slows rehydration and glycogen replenishment.

Consuming protein after exercise provides the amino acids necessary to rebuild muscle tissue that is damaged during intense, prolonged exercise. It can also increase the absorption of water from the intestines and improve muscle hydration.

Planning for the Competition
Planning is essential if athletes are competing in an all-day event, such as track meets or other tournaments. Consider the time of event, the amount of meal and the energy required. Also, be aware of the amount of fluid one consumes. One should plan ahead and prepare meals and snacks that have been tried before. Do not experiment with something new on the day of the event.

Tips for Vegetarian Athletes
Vegetarians must take extra care to avoid deficiencies of iron, zinc, and vitamin B12, which can hurt exercise and strength training performance. One can get enough protein by eating plenty of low-fat dairy products (milk, yogurt, cheese etc.) and protein-rich plant sources, like soy and peanut butter.

Heme iron is a type of easily absorbed iron that is found in animal protein. If you eat fish or chicken, you will get this type of iron, but if you do not eat meat, you will need to find other sources of iron. Our bodies don’t absorb non-heme iron (found in vegetables) as easily as the iron that comes from animal foods.

Non-meat eaters, especially female athletes, must pay attention to their dietary iron needs. Good sources of non-heme include wholegrain cereals, leafy green vegetables, figs, lentils and kidney beans, and some dried fruits. Some foods like coffee, whole grains, bran, legumes, and spinach contain substances that block the absorption of iron in the intestine hence they should be combined with vitamin C to increase iron absorption.

Exercise for Endurance
Athletes who compete in endurance events often do not want to eat during competitions, although replacing depleted carbohydrate stores (muscle glycogen) is essential to continue high intensity exercise. To solve this problem, many athletes have begun using energy gels as a source of easy to consume carbohydrates.

Most gels show a similar glycemic response when compared to liquid or solid foods with the same amount of carbohydrates, although the liquid and gel carbohydrates induce a slightly faster rise in glucose in the first 15 minutes of exercise with a corresponding increase in insulin that is higher with the liquid carbohydrate.

An energy gel composed of 25 g of carbohydrate taken with 200 ml of fluid is able to maintain blood glucose levels during a two hour run at 70% of VO2 (maximal oxygen uptake) when compared to a placebo. While it appears that gels may be effective in providing energy for exercise, the biggest challenge may be taking in enough fluid along with them. If athletes don’t drink enough water when consuming a gel they risk slowing down the absorption of both the carbohydrate and water.

Eating for Strength
In order to build lean muscle mass you need to combine an adequate calorie intake with a solid muscle strengthening programme. Experts recommend at least 500 to 600 g of carbohydrate per day to keep muscle...
One gram of carbohydrate provides four calories of energy. Athletes often talk about carbohydrate loading and carbohydrate depletion which refers to the amount of carbohydrate energy we can store in our muscles.

glycogen stores high. One can work out the requirement using the formula:

\[
3.6 \text{ g carb x body wt (lbs)} = \text{grams carb/day}
\]

(2,000 carbohydrate calories for 200-pound person)

However, most strength athletes still overestimate their protein needs. Daily protein recommendations for strength athletes are about 0.6 to 0.8 grams per pound of body weight. That’s about 128 to 164 grams for those weighing 200 pounds.

Most supplements that are supposed to help build muscle don’t work. But some, such as creatine, fluid and electrolyte replacers, carbohydrate supplements, and liquid meal replacers may offer some benefits to strength training athletes.

Water and Sports Performance

Adequate fluid intake for athletes is essential for comfort, performance and safety. Studies have found that a loss of two or more percent of one’s body weight due to sweating is linked to a drop in blood volume. When this occurs, the heart works harder to move blood through the bloodstream. This can also cause muscle cramps, dizziness, fatigue and even heat illness.

Although rare, exercisers are also at risk of drinking too much water and suffering from hyponatremia or water intoxication. Clearly, drinking the right amount of the right fluids is critical for performance and safety while exercising. Because there is wide variability in sweat rates, losses and hydration levels of individuals, it is nearly impossible to provide specific recommendations or guidelines about the type or amount of fluids athletes should consume.

Finding the right amount of fluid to drink depends upon a variety of individual factors including the length and intensity of exercise and other individual differences. There are, however, two simple methods of estimating adequate hydration. Monitoring urine volume output and color. A large amount of light coloured, diluted urine probably means you are hydrated; dark coloured, concentrated urine probably means you are dehydrated.

The second method is weighing yourself before and after exercise. Any weight lost is likely from fluid, so try to drink enough to replenish those losses. Any weight gain could mean you are drinking more than you need. Consumption of beverages containing electrolytes and carbohydrates can help sustain fluid-electrolyte balance and exercise performance. It is better to increase salt intake per day several days prior to competition (except for those with hypertension), and try not to drink more than you sweat.

Generally, sodium containing sports drinks are used during long distance, high intensity events (more than 60-90 minutes long). During marathon a good rule of thumb is to drink about 1 cup of fluid every 20 minutes. In the days before the race, add salt to your foods (provided that you don’t have high blood pressure and your doctor has not restricted your salt intake) and avoid use of nonsteroidal anti-inflammatory (NSAIDS) medicines that contain sodium as these drugs may predispose runners to hyponatremia.

Sports Drinks

Sports drinks are beverages designed to help athletes rehydrate, as well as restore electrolytes, carbohydrates, and other nutrients, which get depleted after training or competition. Electrolyte replacement promotes proper rehydration, which is important in delaying the onset of fatigue during exercise.

Sports drinks can be split into three major types: Isotonic sports drinks, Hypertonic sports drinks and Hypotonic sports drinks. Isotonic sports drinks contain similar concentrations of salt and sugar as in the human body. Hypertonic sports drinks contain a higher concentration of salt and sugar than the human body. Hypotonic sports drinks contain a lower concentration of salt and sugar than the human body.

Many sports drinks also reduce the risk of water intoxication by replenishing fluids and electrolytes in a ratio similar to that normally found in the human body. However, some sports drinks have low concentrations of electrolytes, so zealous overconsumption of these could also lead to water intoxication.

Sports Supplements

Athletes often look for alternative nutrition to perform their best. Supplements are a multi-million dollar business that offer some good and some unnecessary products. A supplement is something added to the diet, typically to make up for a nutritional deficiency. Ideally, it should be used as a substitute for eating well. Supplements include vitamins, amino acids, minerals, herbs and other botanicals.

Products classified as dietary supplements are not required to meet any Food and Drug Administration (FDA) standards. There are no regulations that guarantee the safety or purity of something sold as a supplement. So, supplements are not:

- required to meet the same safety requirements as over-the-counter or prescription drugs or food ingredients
- held to specific manufacturing standards
- guaranteed to meet product potency or purity ratings
- required to prove the effectiveness of any health claim they make
- required to meet safety or efficacy testing prior going to the market.

The FDA is prohibited from removing a product from the market unless it can prove that the product will cause a medical problem. Most health risks of supplements are discovered after the product is in the market. Supplements that are pulled from the market are usually linked to a reported serious health risk that is tied to the use of the product. So, ideally one should avoid sports supplements.

Those aspiring to be sportspersons should keep in mind that their performance on the field would, for the most part, also depend on the diet they take and when they take.

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