

## **Enhancing Exercise Performance With Pre-Game Carbohydrate Intake**

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Carbohydrates are an important source of energy for sports that involve repeated bouts of explosive power and for long distance events. As this defines most sports, carbohydrate intake is a critical determinant in optimizing athletic performance. A short list of sports that rely on carbohydrate as a predominant energy source include (basketball, soccer, hockey, la crosse, football, tennis, squash, badminton , racquetball, handball, middle and long distance running, swimming, rowing, and cross-country skiing).

For sports of this nature adequate carbohydrate intake before, during and after exercise is associated with enhanced exercise performance. Thus, knowing the right amount, type and timing of carbohydrate helps to provide an athlete with a competitive edge.

The early studies on carbohydrate and exercise performance date back to the late 1960s (Bergstrom et al., 1967), which confirmed the work of Christensen and Hansen, who 30 years earlier had demonstrated the importance of increased dietary carbohydrate for endurance exercise performance. So, at a time when professional athletes were still eating a pre-game steak, research was already in place to suggest that any combination of pasta, rice, bread, vegetables, fruits, peas and beans would have been a better choice to enhance performance.

Recent studies have proven that an athlete's diet should consist of 60-70% carbohydrate calories during heavy training where carbohydrates are a predominant energy source.

The pre-exercise or pre-game meal should consist primarily of carbohydrates and be ingested 3 to 4 hours prior to competition. This should not include a lot of refined sugar products, but rather carbohydrates that don't abruptly cause a rise in blood sugar or insulin concentrations. Good examples include oatmeal, whole wheat bread, whole wheat pasta with tomato sauce , brown rice, most vegetables, most fruits, peas, beans, high fiber breakfast cereals (low in sugar) with low fat milk or yogurt (non fat or 1% milk fat).

The pre-exercise or pre-game carbohydrate meal is intended to expand the liver's carbohydrate reserves, which become the exclusive source of blood sugar during the sport or training session. During exercise the muscles at work extract sugar (carbohydrate) from the bloodstream at rate that is 30-40 times greater than under resting conditions. Thus, to prevent liver carbohydrate depletion and a fall in blood sugar adequate carbohydrate intake 3-4 hours prior to the event is an essential part of optimal sports nutrition. In addition, it is possible that a portion of these carbohydrates can contribute to reloading of the muscles' carbohydrate fuel tank, which is a critical factor in for sports performance as we will discuss.

In one study Sherman et al. demonstrated that ingestion of 312 grams (1,248 calories) of carbohydrate 4 hours prior to strenuous exercise resulted in a 15% improvement in

exercise performance. As a side note, no improvement was observed when either 45 grams (180 calories) or 156 grams (624 calories) of carbohydrate was ingested. Therefore the meal must contain a sufficient total number of carbohydrate calories to yield a sports-enhancing effect when strenuous or prolonged exercise is involved.

In contrast to this, carbohydrate ingestion 30 to 60 minutes prior to strenuous exercise has been shown to impair exercise performance. This is believed to be due to the effects of insulin which produce a rapid drop in blood sugar when combined with exercise. Thus, it is undesirable to raise blood insulin levels just prior to strenuous exercise.

For this reason drinking or eating carbohydrates just prior to exercise can be detrimental to performance. The one exception to this rule is fructose sugar. Fructose sugar does not disrupt blood sugar or insulin levels to a significant degree and its ingestion 30 minutes prior to exercise has been shown to enhance exercise performance. For this reason I often suggest to athletes that they ingest up to 20 grams of fructose sugar added to cold water (20-25 ounces) 30 minutes prior to their event. This recommendation is less important for more moderate exercise activities such as recreational walking or for submaximal exercise lasting less than one hour. The general importance of carbohydrates for strenuous or long distance events is that it provides a high octane type of fuel that enables muscles to work at a higher rate of power output. During exercise if muscle carbohydrate stores become depleted, muscle power will suffer. Hence, the athlete slows their pace during long distance events or is unable to achieve or maintain their optimal speed in sports that require repeated bouts of rapid acceleration and sprints.

Prior to exercises of this nature refueling of the liver carbohydrate and muscle carbohydrate fuel tank (glycogen reserves) is crucial to performance capabilities.

Knowing how to replenish carbohydrates during exercise, post exercise and during day to day meal planning is also essential and is discussed in other articles in this program.

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