

# LUCOZADE SPORT SCIENCE:

## THE SCIENCE BEHIND SPORTS DRINKS

### KEY POINTS

- ‡ The two main factors that contribute to fatigue during endurance performance are dehydration (loss of fluid as a result of sweating) and the depletion of the body's carbohydrate stores.
- ‡ Sports drinks are categorized according to osmolality - an index of the number of particles in solution. The 3 key categories are hypotonic, isotonic and hypertonic solutions.
- ‡ Hypotonic drinks are designed to maintain hydration, isotonic drinks to provide carbohydrate and maintain hydration, whilst hypertonic drinks are used to supply carbohydrate.
- ‡ Depending on the type, intensity and duration of exercise sports drinks can improve endurance performance by providing fuel to the exercising muscles and/or maintaining hydration.

### INTRODUCTION

For those serious about their sport or exercise it is a well accepted concept that diet can significantly affect performance. The two main factors that contribute to fatigue during endurance performance are dehydration (loss of fluid as a result of sweating) and the depletion of the body's carbohydrate stores. As a result, sports nutrition guidelines have focused on specific strategies to ensure the supply of carbohydrate and the provision of fluid in the periods immediately before, during and after exercise. Specifically formulated sports drinks are a preferred strategy amongst many athletes as they can fuel the exercising muscles, maintain hydration, and consequently enhance endurance performance by delaying the onset of fatigue.

### BACKGROUND

#### Hydration

Exercise results in the production of heat within the body, which unless removed, can lead to significant increases in body (core and skin) temperature. Sweating is the body's primary mechanism of heat loss. However, if the fluid lost as sweat is not replaced, then dehydration occurs and body temperature will increase anyway. As a result, the consumption of fluid is critical to the safe and effective functioning of the body during exercise.

#### Electrolytes

Sodium is the primary electrolyte lost in sweat. Approximately 60% of the body's sodium surrounds the cells within the body and helps to keep the right amount of water inside your cells, outside your cells and in the blood. If a large amount of sodium is lost in sweat and not replaced then the concentration of sodium within the blood is reduced increasing the movement of fluid into the cells. Consequently, replacing the sodium lost in sweat is important in ensuring a correct water balance.

#### Carbohydrate

Carbohydrate is an important source of energy during moderate to high intensity activity. Unfortunately there is only a limited amount of carbohydrate (~ 2000 kcal) stored within the body which if depleted beyond a critical point decreases endurance performance by causing an individual to slow down. This is because they do not have sufficient energy, in the form of carbohydrate, to sustain their chosen exercise intensity for the remainder of their event.

## UNDERSTANDING SPORTS DRINKS

### Function

Sports drinks are designed to tackle the two key causes of fatigue in endurance events (dehydration and a depletion of the body's carbohydrate stores). However, the functionality of sports drinks can only benefit performance if they promote voluntary fluid intake, gastric emptying (the emptying the drink from the stomach) and the quick absorption of the drink into the intestine. A sports drinks ability to do this is therefore dependant on its composition or formulation.

### Formulation

Sports drinks are categorized according to their osmolality – an index of the number of particles in solution. In sports drinks osmolality is dependant on the carbohydrate type and concentration as well as the sodium in solution. Blood plasma has an osmolality of 280-300 mOsm/kg and any drink with the same osmolality of blood is said to in balance with the body's own fluids and defined as isotonic. Hypotonic solutions have an osmolality lower than blood whilst hypertonic solutions have a higher osmolality than blood. By varying the osmolality of the sports drinks, the core functional benefit also changes.

## HYPOTONIC SPORTS DRINKS

Hypotonic sports drinks typically contain 2-4 g/100 ml carbohydrate and < 50 mg sodium. They are effective at transporting fluid and carbohydrate into the blood stream, albeit the actual carbohydrate supply is relatively low. Consequently, hypotonic sports drinks provide effective hydration, principally by increasing an individual's voluntary fluid intake. Hypotonic drinks are excellent for;

- ▶ Those people exercising with the goal of maintaining fitness, improving body tone or weight management.
- ▶ Those exercising (running) or playing sport (football) that is less than 60 minutes in duration and is low to moderate in intensity.

## ISOTONIC SPORTS DRINKS

Isotonic sports drinks typically contain 6-8 g/100 ml carbohydrate and 46-69 mg/100 ml sodium. They are effective at transporting fluid and carbohydrate into the blood stream, thereby tackling the two major causes of fatigue; dehydration and a reduction in the body's carbohydrate stores. Isotonic sports drinks are known to enhance performance of  $\geq 60$  min in duration and high intensity in nature or more prolonged ( $\geq 90$  min) exercise that is moderate intensity in nature. This is achieved by delaying the onset of fatigue.

Isotonic sports drinks are also excellent in aiding recovery from demanding exercise by providing an effective medium in which to replenish carbohydrate stores and restore fluid balance. Principally the sodium in the drink helps the retention of the ingested fluids, stimulate thirst and increase voluntary fluid intake. Isotonic drinks are excellent for;

- ▶ Those competing in team sports, racket sports and endurance events where both dehydration and the depletion of carbohydrate stores may limit performance.
- ▶ Those exercising for  $\geq 30$  min at a high intensity, or those exercising for  $\geq 60$  min at a low to moderate intensity.

## HYPERTONIC SPORTS

Hypertonic sports drinks typically contain  $\geq 10$  g/100 ml carbohydrate. They very rarely contain electrolytes. They are therefore known in some situations as 'energy' drinks as their primary focus is to provide a large amount of carbohydrate during periods immediately following exercise where a high intake of carbohydrate is vital but in some situations hydration is not. Hypertonic sports drinks should therefore not be used to maintain hydration as the large amount of carbohydrate is known to slow the time it takes for the drink to empty from the stomach (gastric emptying) and slow the time it takes for the drink to be absorbed in the intestine. They are therefore functional sports drinks aimed at providing a high amount of carbohydrate in a liquid format when bulky foods are either not available or not preferred. .