

LUCOZADE SPORT SCIENCE:

CARBOHYDRATE NEEDS IN SPORT

KEY POINTS

- ▶ Carbohydrate is the fuel of choice for the brain, exercising muscle and central nervous system during exercise.
- ▶ Sports nutrition guidelines are focused on strategies to enhance carbohydrate availability in the periods before, during and after exercise.
- ▶ It is recommended that you should consume a high carbohydrate meal in the 3-4 hours before exercise to maximise the amount of stored carbohydrate available to the exercising muscles.
- ▶ During moderate to high intensity endurance exercise ≥ 60 min in duration, consume 30-60 g of carbohydrate per hour to maintain exercise intensity and delay fatigue.
- ▶ General recommendations are provided for carbohydrate intake during training and recovery, however, these recommendations should be fine-tuned according to individual requirements.

INTRODUCTION

One of the most important aspects of the 'athletic' diet is to provide the muscle with substrates to fuel the training programme. Carbohydrate is the fuel of choice for the brain, exercising muscle and central nervous system and is known to improve endurance performance during:

- ▶ Prolonged (≥ 90 min) exercise at a sub-maximal intensity.
- ▶ Prolonged (≥ 90 min) high intensity intermittent exercise, similar to team sports.
- ▶ Shorter duration (~ 60 min) high intensity exercise, similar to a time trial.

Consequently sports nutrition guidelines are focused on strategies to enhance carbohydrate availability in the periods before, during and after exercise.

CARBOHYDRATE INTAKE PRE-EXERCISE

Carbohydrate Loading

Performance in continuous or intermittent exercise (duration; ≥ 90 min) is generally improved by a high carbohydrate diet in the 1-7 days prior. This is a result of delaying the onset of fatigue by increasing the availability of muscle glycogen (stored carbohydrate in the muscles) towards the latter stages of the event. However, if your event/sport is < 90 min in duration, and/or you ensure that you consume a high carbohydrate diet in the hours before and during exercise (as per guidelines below); carbohydrate loading will not necessarily provide any additional benefit.

For those involved in sport where carbohydrate loading may be beneficial, combine 1-4 days of training taper alongside a high carbohydrate diet of 7-12 grams per kilogram of body mass per day (g/kgBM/day). This is equivalent to 490-840 g for a 70 kg athlete.

Carbohydrate ingestion 3-4 h before exercise

It is recommended that you should consume a high carbohydrate meal in the 3-4 hours before exercise as it has been shown to improve performance by increasing the amount of stored carbohydrate available to the exercising muscles.

Consume 1-4 g/kgBM of carbohydrate (approximately 70-280 g for a 70 kg individual) 3-4 h before exercise. Suitable foods include cereals, bread, rice, pasta and potatoes.

CARBOHYDRATE INTAKE DURING EXERCISE

The provision of carbohydrate (glucose, sucrose, maltodextrins or alternative high glycaemic index carbohydrates) during exercise is normal practice during events/sports that are ≥ 60 min in duration and continuous (running/cycling) or high intensity intermittent (team/racket sports) in nature. This is because ingested carbohydrate becomes the main source of fuel towards the latter stages of exercise.

Consume 30-60 g of carbohydrate per hour (g/h) in small feedings every 10-30 min, or as allowed by the event/sport. Isotonic sports drinks (600-1200 ml) and/or carbohydrate gels, bars or confectionary provide suitable options.

CARBOHYDRATE INTAKE FOR TRAINING AND RECOVERY

During training, the main aim of individuals is to consume sufficient carbohydrate to support the training programme. During recovery, sufficient carbohydrate should be consumed to immediately replace what has just been used, whilst also taking into account muscle damage – muscle damage typically impairs the rate of post-exercise glycogen storage. The most important factor affecting the storage of muscle glycogen is the total amount of carbohydrate consumed.

Timing and type of carbohydrate intake

When the recovery time between exercise is short (0-4 h), carbohydrate consumption should begin immediately as this results in higher rates of muscle glycogen storage compared with delayed feeding. However, when the recovery period is longer (8-24 h), assuming total carbohydrate intake is sufficient; there is no further advantage of immediate carbohydrate consumption. In these latter situations athletes can choose their preferred meal schedule according to what is practical and comfortable.

Carbohydrate can be consumed in either a series of snacks or large meals, although it is advised that a regular intake of smaller snacks may be helpful in overcoming the gastric discomfort often associated with eating large amounts of bulky high carbohydrate foods. For immediate recovery, consume moderate to high glycaemic index (GI) foods.

Consuming carbohydrate in combination with ~15-20 g protein may be advantageous in increasing the efficiency of muscle glycogen storage in the immediate period following exercise. This is of particular importance when carbohydrate intake might be below the threshold for maximal storage or feeding intervals are more than 1 h apart. Furthermore, protein in recovery meals is also recommended to enhance net protein balance, tissue repair and training adaptations.

CURRENT CARBOHYDRATE GUIDELINES

- ▶ Immediate recovery after exercise (0-4 h): 1.0-1.2 g/kgBM/h at frequent intervals
- ▶ Daily recovery: moderate duration/low intensity: 5-7 g/kgBM/day
- ▶ Daily recovery: moderate to heavy endurance training: 7-12 g/kgBM/day
- ▶ Daily recovery: extreme exercise programme (4-6+h per day) 10-12 g/kgBM/day

These general recommendations should be fine-tuned with individual consideration of total energy needs, specific training needs and feedback from training performance.

RECOMMENDED READING

- Burke, L.M., Kiens, B. and Ivy, J.L. (2004). Carbohydrates and fat for training and recovery. *Journal of Sports Sciences*, 22, 15-30.
- Coyle, E.F. (2004). Fluid and fuel intake during exercise. *Journal of Sports Sciences*, 22, 39-55.
- Hargreaves, M., Hawley, J.A. and Jeukendrup, A. (2004). Pre-exercise carbohydrate and fat ingestion: effects on metabolism and performance. *Journal of Sports Sciences*, 22, 31-38.