# ENERGEL+ CAFFEINE
# THE SCIENCE BEHIND


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## KEY POINTS

- Carbohydrates are an important energy source for exercise of all types.
- Caffeine is unquestionably a potent ergogenic aid for high intensity and prolonged exercise bouts.
- Caffeine stimulates mental performance too – in particular alertness, promoting improved reaction time and attenuating perceived effort.
- Fatigue during bouts of exercise can be either at the muscle level (peripheral factors) or with the brain (central factors).
- Carbohydrates aid both muscle and brain as an energy source during exercise, whereas caffeine promotes brain activity and so offsets feelings of fatigue.
- At times during prolonged bouts of exercise, the use of a carbohydrate and caffeine gel is useful in maintaining adequate levels of blood glucose and offsetting reductions in brain activity.
- The use of gels provides a rapid availability of glucose and caffeine for muscles and the brain.
- Carbohydrate and caffeine gels are probably best employed at half-time during matches or in the later stages of competitive cycling, running, swimming and triathlons.

## INTRODUCTION

Three major nutritional factors associated with fatigue in most sporting events are (a) muscle glycogen depletion, (b) hypoglycaemia (low blood sugar level) and (c) dehydration. As a consequence, athletes have been encouraged to start sporting events with their muscle and liver glycogen stores as full as possible and also to be as hydrated as possible; indeed, the ACSM guidelines have encouraged this for many years (ACSM, 2009). Furthermore, ensuring blood glucose levels are maintained during the latter stages of performance/training and attempting to keep euhydrated are challenges facing athletes. The consequences of these established scientific facts are the development and use of a multiplicity of sports drinks, which in many cases have been shown to be efficacious (Cermak & van Loon, 2013).

In recent years, the ingestion of carbohydrate (CHO) in the form of a gel has become more prevalent, and as a result it is possible to manipulate CHO and fluid intake independently; the CHO arising from the gel and the fluid from additional water ingestion. There is evidence that taking a CHO gel results in greater amounts of CHO consumption compared with a CHO solution (Pfeiffer et al., 2010), and that a CHO gel can improve performance (Campbell et al., 2008; Earnest et al., 2004; Patterson & Gray, 2007; Phillips et al., 2012). Such improvements in performance may be due to maintenance of blood glucose levels and/or hydration (MacLaren & Morton, 2013). What is also interesting is that despite a greater amount of CHO being available via a gel, there is no increase in gut discomfort for most individuals, although there may be personal variations (Pfeiffer et al., 2009; Phillips et al., 2012). The addition of electrolytes (sodium in particular) helps to drive both fluids and CHO uptake across the small intestine during exercise and at rest (Shi & Passe, 2010).

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Caffeine is probably the most common drug ingested, with coffee being the main source. It is a mild stimulant that occurs naturally in a number of plant species. Significant amounts of caffeine can be found in coffee, tea, chocolate and soft drinks such as Red Bull and Coca-Cola, although it also occurs in other products such as prescription medications, diuretics and pain relievers. Because caffeine is a drug and yet is part of a normal diet, the IOC had placed a limit on the amount that could be consumed before exceeding 'doping' limits. However, since January 2004, caffeine has been removed from the banned list, although the IOC continue to monitor its use. Probably the reason for lifting the ban was the fact that the ergogenic effects of caffeine occur when ingested in doses of 2-6mg/kg body mass; an amount which results in urine values of caffeine lower than the previous IOC limit.

There has been a wealth of information on studies reporting the positive effects of caffeine ingestion both for endurance and high intensity exercise. The ability of caffeine to stimulate the central nervous system (CNS) is an important feature of it's ingestion. The effect of caffeine on the cerebral cortex results in a clearer thought process, a reduced rating of perceived exertion (RPE) and an attenuation of fatigue. The net effect is an enhanced ability to concentrate, thereby aiding athletes competing in sports where quick thinking and rapid reactions are necessary.

## CHO AND CAFFEINE CO-INGESTION AND PERFORMANCE

The evidence for the use of carbohydrate as well as for caffeine is overwhelming in relation to sports performance (see Nutrition X-Change articles by MacLaren and by Clarke). However, what about co-ingesting caffeine with carbohydrate? Studies which have used carbohydrate co-ingested with caffeine during prolonged exercise have invariably resulted in positive findings. To highlight a selection of these findings, a few investigations are now reported.

Eight rugby union players underwent a rugby-orientated shuttle running protocol involving four 21-minute blocks of activity having ingested either a placebo, a CHO, or a CHO + caffeine drink (Roberts et al., 2010). The 15-m sprint times within the blocks of activity were faster in the CHO + caffeine trials; the motor skills were performed more quickly with CHO + caffeine; and the rating of perceived exertion (RPE) was lower in the CHO + caffeine. From these findings, it appears that the combination of CHO + caffeine is capable of not just maintaining the ability to perform high intensity bouts of activity throughout the 84-minutes of simulated rugby, but that skill and RPE (both associated with enhanced brain function) were improved.

In another study, the influence of adding a moderate dose of caffeine to a carbohydrate solution during prolonged soccer activity was explored (Gant et al., 2010). Fifteen male soccer players performed two 90-min intermittent shuttle-running trials. They ingested a carbohydrate electrolyte solution providing a total of 1.8 g/kg body mass of carbohydrate or a similar solution with added caffeine (3.7 mg/kg BM). Solutions were ingested 1 hr before exercise and every 15 min during the protocol. Soccer passing skills and countermovement-jump heights were quantified before exercise and regularly during exercise. Sprinting performance, heart rate, blood lactate concentration and the subjective experiences of participants were also measured routinely. Mean 15-m sprint time was faster during the caffeine trial, as were mean sprint times in the final 15 min of exercise. Counter movement jump (indicator of explosive leg power) was improved during caffeine, as were ratings of pleasure. In this study, the authors observed no significant differences in passing skill, RPE or lactate levels. The addition of caffeine to the carbohydrate-electrolyte solution improved sprinting performance, counter movement jumping and the subjective experiences of players.

More recently, an investigation was undertaken to identify the effects of scheduled' CHO and caffeine supplementation on simulated team sport performance (Keane et al., 2020).

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Ten male hurling players completed three hurling match-play simulations, performed 7 days apart. Supplementation included CHO, CHO + caffeine, and placebo. Participants ingested either a 6% CHO solution, a placebo solution of similar taste, or a combined intake of 6% CHO solution + 200 mg caffeine capsule. At specific time points (pre-test; half time; full time), participants completed a repeated sprint protocol (12 × 20 m). Also assessed was RPE. Mean sprint time performance significantly improved in CHO + caffeine trials compared to placebo and RPE was lower. The data demonstrated the effects of CHO and CAF supplementation on team sport performance, with co-ingestion of CHO + CAF reducing the decrement in repeated sprint performance compared to placebo.

Finally, in a systematic literature review coupled with meta-analysis, the efficacy of caffeine co-ingested with CHO was examined in relation to performance (Conger et al., 2011). Twenty-one research studies met the criteria for analysis. The overall conclusions were that a combination of CHO + caffeine provides a significant but small effect to improve endurance performance compared with CHO alone, and that both are better than a placebo.

## RECOMMENDED USE OF ENERGEL+ CAFFEINE

The formulation of Energel+ Caffeine has been made in order to contribute carbohydrate availability and enhance brain activity before, during and after training or matches, as well as to promote hydration through increased electrolyte intake as long as additional fluid is also imbibed. Key electrolytes such as sodium, potassium and magnesium are contained in Energel+ Caffeine to ensure that important components of blood (and muscle) electrolytes are made available – especially since high losses of salt have been observed in athletes with regard to exercise-related muscle cramps. So, Energel+ Caffeine provides carbohydrate for immediate energy as well as electrolytes to enhance glucose and water uptake across the gut, and furthermore aids hydration. The quantities of the electrolytes have been determined to be optimal for athletes in a variety of sporting situations. The addition of caffeine is provided to offset likely mental fatigue during prolonged activities and thereby augment skill, decision making and reaction timing when compared with placebo.

- Ingest 1 gel per half hour for the duration of the exercise/competition after the first 45 minutes.
- Ingest 1 gel with additional fluid every 30-min in recovery after strenuous training for 1- 2 hours.
- Ingest 1 gel at half-time with additional fluid and then again in the last quarter of a match.
- Ingest 1 gel before extra time and again at half-time of extra time.
- Ingest a gel frequently through the day with additional fluids on pre- and post-match days.

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