



## **Caffeine: Why, When, for What?**

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Caffeine is a socially acceptable drug that is consumed worldwide and occupies a unique position in the athletic world. It is a legal drug whose ability to enhance performance in trained athletes in well-controlled laboratory and simulated field studies has stood the test of time. From the original work in the late 1970s to the present, caffeine ingestion (3-13 mg/kg body mass) has been consistently shown to improve endurance exercise performance by ~20-50% when compared to a placebo trial (~35-80 min). Recent studies have demonstrated the ability of low and moderate doses of caffeine (<6 mg/kg body mass) to be just as effective as the higher doses, with reduced side effects. Caffeine is normally ingested ~1 h prior to exercise, but ingesting it throughout exercise and especially late in exercise has been shown to improve endurance cycling performance.

There is growing evidence to suggest that caffeine is ergogenic or "work enhancing" during short-term exercise. Performance was improved with caffeine ingestion during simulated running, cycling, rowing, and swimming races lasting from ~4 to 30 min. However, performance during graded exercise tests lasting 8-20 min and during sprint exercise (less than 90 s) was generally unaffected by caffeine. Exercise events lasting between 90 s to 4 min have not been tested.

The classic caffeine-induced cascade of events leading to the sparing of muscle carbohydrate use during exercise that was initially proposed to explain the improvement in performance during endurance exercise now seems less tenable for most exercise situations. Alternately, there has been growing support for the suggestion that caffeine enhances performance by reducing the perception of effort during exercise by altering the handling of sensory signals from working muscles or by directly affecting the central nervous system.



## **Caffeine: Why, When, for What? (continued)**

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In terms of caffeine use in the real world, it has been difficult to perform well-controlled field studies. However, laboratory and field-based simulations of races suggest that caffeine should be ergogenic in some sports. Caffeine can be ingested in tablets or coffee, although there is one study reporting no performance enhancement with coffee compared to tablets. Caffeine can also be taken in combination with carbohydrate-electrolyte sports drinks, but should not be taken as part of "energy drinks," given the many other constituents in these drinks. Considerable evidence also suggests that low-to-moderate doses of caffeine do not cause dehydration if consumed shortly before or during exercise. Low-to-moderate doses of caffeine (< 6 mg/kg body mass) are also associated with mild or no side effects and do not produce urinary caffeine levels that are banned (12 µg/ml) by the International Olympic Committee.

However, as is typical with drugs, there is large individual variation in the physiological responses to caffeine. Athletes considering using caffeine in competition should first experiment with the recommended low-to-moderate doses as part of their regular training program.