



Caffeine as an Ergogenic aid

Text: PVM Nutritional Sciences

Use of caffeine as an ergogenic aid is widespread and very common amongst both elite and recreational athletes. Caffeine occurs naturally in many foods including coffee, tea, cocoa, cola beverages, energy drinks and chocolate. The table below indicates the caffeine content of commonly consumed beverages:

Beverages	Caffeine content (mg) per 250ml serving
Coffee, brewed	80-145
Instant coffee	65-75
Tea	40-60
Cola beverages	35-45
Cocoa	< 10
Decaffeinated coffee	< 5
Energy drinks	42-88

Caffeine and sporting performance

Caffeine consumption is generally viewed as safe and effective if used within recommended intake ranges. The IOC (International Olympic Committee) indicated that the evidence for use of caffeine to improve endurance and reaction time is strongly supported.

Proposed effects include:

- Stimulation of the nervous system which reduces perception of effort and/or enhances recruitment of motor units.
- Improved reaction time, increased alertness, and heightened sense of wellbeing.
- Stimulation of Na-K pump activity in inactive tissues attenuates the rise in plasma potassium with exercise. Lower plasma potassium helps maintain the membrane potential in contracting muscle and contributes to the ergogenic effect during endurance exercise.
- May increase release of calcium from the sarcoplasmic reticulum in the muscle which can delay the onset of muscle fatigue.



Caffeine can enhance performance of events lasting longer than 1 hour and can be useful to enhance focus and mental alertness of shorter duration events. Intakes of 65-130mg, 1 hour prior to events, have been shown to have beneficial effects on motor and mental performance.

Side-effects

Individuals respond differently to caffeine intake. Some people are non-responders while others experience negative side effects. Negative reactions depend on an individual's specific sensitivity to caffeine, the amount that is consumed, body weight and anxiety level.

Side-effects of caffeine can include:

- Nervousness
- Anxiety
- Palpitations
- Headaches
- Gastro-Intestinal distress (especially in non-habitual consumers)
- Disturbed sleep

Caffeine may counteract the effects of creatine and should therefore not be consumed simultaneously. It also slightly inhibits the absorption of Vitamin B1 (Thiamine), which has an important function in energy metabolism, as well as the minerals calcium and iron. For this reason, frequent consumption of large dosages is not recommended. Caffeine should further not be used in combination with other stimulants, alcohol or unregulated herbal remedies. Contrary to popular belief, caffeine does not cause dehydration and electrolyte imbalances.



Recommendations

- Various studies confirm that a caffeine dosage of 3-6mg/kg body weight produces significant endurance performance improvements in both recreational and elite athletes. Higher dosages (6-9mg/kg) does not seem to provide any additive effects and can even lead to adverse effects such as poor performance and insomnia, and should thus be avoided. From the different trials done on caffeine and sport, it seems that consumption of 3-6 mg caffeine/kg body weight is the safest intake range.
- Smaller dosages of caffeine (1-3mg/kg) has also been shown to result in ergogenic effects.
- Caffeine is readily absorbed, peaks after 60min and the effects may be sustained for up to 6 hours. A single dose of caffeine 60 minutes before the start of an event is associated with positive results.
- The splitting of dosages throughout training/ competing has not been shown to result in more beneficial effects compared to a single dose. Thus, either single dosages or smaller more frequent dosages, can be ingested.
- The form in which caffeine is ingested also plays a role. The ingestion of caffeine as coffee appears to be less effective compared to consumption of pure caffeine, possibly due to the presence of other substances in coffee such as nicotinic acid, opiate receptor inhibitors and cholinomimetics, which may act to oppose the ergogenic benefits of caffeine. Furthermore, there is large variability in the caffeine content of different coffees. It is however recommended that further research be conducted in this regard.
- Caffeine intake strategies should be individualized and tested during training before usage in competition.

In conclusion, \pm 3mg/kg **pure** caffeine may have ergogenic benefits for athletes who do not experience side-effects of high caffeine intakes. Caffeine intake in excess of 6-9mg/kg body weight should be avoided and it is recommended to first test usage during training.

PVM Octane Chocolate Gels contain **100mg pure caffeine** per gel. A 70kg athlete for example, would need to consume 210mg caffeine to experience an ergogenic effect, which is the equivalent of

2-3 chocolate gels. **A practical strategy** includes consumption of 1-2mg/kg caffeine (i.e. 1-2 chocolate gels) 30-60min prior to an event followed by 1mg/kg (i.e. 1 chocolate gel) every 2 hours. Frequent intake is however dependent on duration of the event and caffeine sensitivity. Total daily caffeine intake should not exceed 400-600mg.

Endurance performance improvements (even if only small) are worthwhile and can mean the difference between winning and losing. Caffeine may further be a useful training aid, facilitating better and more consistent training regimes.



PVM Octane Chocolate Gels are the only flavour to contain caffeine. Citrus, Cherry and Vanilla flavoured Gels are caffeine free.