Does Caffeine Improve Endurance Performance?

Caffeine improves endurance performance — on this expected response, most researchers, athletes and weekend warriors agree. For a small subset of the population, an ergogenic effect of this magnitude has large practical significance, since a two to four percent increase in performance could equate to a 40 to 80 second improvement in a 35-minute race. Such improvement would easily represent the difference between medaling in a highly competitive race versus not even finishing among the upper tier of runners. Despite 30-plus years of research demonstrating that caffeine improves endurance performance, the mechanism(s) of action remain somewhat a mystery. Several hypotheses have been put forth, including: 1) alterations in fat metabolism leading to glycogen sparing; 2) direct actions on skeletal muscle leading to increased force production, perhaps through alterations in calcium release from the sarcoplasmic reticulum; 3) central and/or peripheral nervous system actions leading to increased skeletal muscle force production; and 4) reductions in perceptions of muscle pain and sense of effort. While there is growing scientific support for certain hypotheses, scientific evidence supporting each of these hypotheses may be found in the recent literature.

The results of a recent study were published in the June 2015 issue of *Medicine & Science in Sports & Exercise*®. They wanted to explore the role of improved strength and reductions in muscle pain, as possible mechanisms by which caffeine might act to improve performance. They used a novel approach by having participants perform leg and arm crank cycling on separate days and, in a different set of experiments, by assessing strength, motor-unit recruitment, ratings of muscle pain and endurance performance. This was done because previous research has indicated that caffeine improves motor-unit recruitment and strength to a greater and more consistent extent in large leg muscle groups, such as the quadriceps, compared to smaller muscle groups in the arms. Using this approach, they successfully manipulated strength and motor-unit recruitment at 60 minutes following caffeine ingestion (5mg·kg-1 body weight) with the quadriceps, but not the biceps, showing an increase. The participants then performed 30 minutes of moderate-intensity (60 percent of V?O2 peak) leg or arm crank cycling, followed by a 10-minute maximal effort time trial. Consistent with other studies, ratings of muscle pain were reduced during moderate intensity cycling, regardless of muscle group used following caffeine ingestion. Interestingly, this effect was lost during the time trial. Work performed during the time trial increased following caffeine ingestion with leg cycling, but not during arm crank cycling. The findings point toward caffeine-induced changes in strength being more important for explaining the increased performance than were reductions in muscle pain.

The mechanism of caffeine's action is likely of little interest to an athlete or a person who simply wants to perform/train at a higher level on a given day. The "how" and "why" it might induce improvements does not concern them. Their concern is simply "does it work?" Based upon a wealth of research, including our own, the answer to that question is clearly "yes," especially for

events such as running and cycling which use the large muscles of the legs. So that cup of coffee isn't helpful just for getting you going in the morning, but perhaps it also should become part of your pre-workout and pre-race routine. Please contact us for further information.

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