RE: Capsaicin Supplementation May Enhance Exercise Performance by Modulating Peripheral Neuromuscular Fatigue


Capsaicin (CAP) is the pungent bioactive component of peppers (*Capsicum* spp., Solanaceae). CAP has been shown to modulate the pathways related to pain, inflammation, immunity, anxiety, depression, obesity, and chronic fatigue. CAP has also been shown to enhance energy metabolism. Animal models have demonstrated its effectiveness for enhancing physical performance and recovery. Human studies have shown conflicting results on exercise performance. The purpose of this single-blind, placebo-controlled, counterbalanced crossover study was to explore the potential impact of acute oral CAP consumption on exercise performance, fatigue, and the inflammatory-endocrine response. Primary outcomes included understanding the intrinsic physiological effects of CAP supplementation on young, healthy individuals as well as providing additional evidence for the ergogenic and fatigue-resistance of CAP in humans.

Young, physically active males with no history of cardiovascular, neuromuscular, pulmonary, or metabolic diseases were included. Participants were excluded who smoked or had a history of smoking within the preceding six months and known allergies and/or sensitivities to spice foods or fiber. Participants were recruited from Skidmore College (Saratoga Springs, New York) and the surrounding community.

Participants completed testing on three different days with a minimum of 72 h between test dates. Participants were instructed to refrain from taking vitamins or ergogenic supplements a minimum of two days prior to each experimental visit. Participants were further instructed to abstain from alcohol and caffeine 24 h prior to testing, and report to the lab 2 h before testing. Anthropometric and body composition data were collected on the first visit. In addition, participants completed a maximal incremental test on a magnetically braked cycle ergometer at a self-selected pace. The pace was maintained for the duration of the incremental test as well as subsequent experimental trials. Participants were instructed to continue to exhaustion. At the end of the first session,
participants were familiarized with the isometric maximal voluntary contractions and the electrically evoked muscle contraction testing used on the second and third visits.

On the second and third visits, participants ingested either 2 x 390 mg of CAP capsules (Capsicool®; Nature’s Way; Medley, Florida) or 2 x 500 mg placebo pills (Fiber, Psyllium Husk, Kirkland Signature®; Seattle, Washington). Capsules were similar in appearance and taste. Fatigue at rest was assessed at 50 min after ingestion. Following initial fatigue assessment, participants completed a constant load cycling exercise to exhaustion and another fatigue assessment immediately post-exercise. Neuromuscular assessment included six maximal voluntary contractions (MVC) and superimposed twitch pre- and post-time to exhaustion (TTE). Cycling was terminated when participants could not maintain their self-selected pace for more than 10 s. Saliva was collected before beginning the first neuromuscular assessment, after the last neuromuscular assessment, and after 5 min of recovery.

Ten men with a mean age of 22.3 ± 3.6 were recruited and completed the testing. Pre-exercise cardiorespiratory parameters were similar between trials. Both placebo and CAP conditions resulted in similar TTE. MVCs showed no differences before exercise. Baseline resting switches (Qtw,pre) were similar. Immediately following exercise, Qtw,post trended upward in the CAP condition compared to the placebo. The difference in percentage change post-exercise decline in Qtw,post was significant between the groups (P = 0.037). A significant positive correlation between potentiated twitch (Qtw,post %) and TTE was demonstrated for both the placebo and CAP (P = 0.04 for both). Significant reductions in intrinsic muscle contractile functions, maximal relaxation rate (MRR) and maximal rate of force development (MRFD), pre-to-post TTE were observed (P < 0.000 for both). CAP significantly mitigated exercise-induced decline in MRR (P = 0.01).

Microvascular oxygenation during the TTE was not significant between the groups. No significant condition x time interactions were shown for heart rate, stroke volume, and cardiac output during baseline and exercise. A significant main effect of time for all central hemodynamic markers was observed (P < 0.00), but not an effect of CAP or the placebo. A significant time effect for ventilatory responses to the exercises was shown in oxygen consumption (VO2), ventilation (VE), and respiratory exchange ratio (RER; P < 0.05 for all).

No significant effects of CAP on salivary cortisol secretion were observed at baseline, during, and after exercise. However, there was a main effect of time (P = 0.02) showing an increase in salivary cortisol concentration during recovery. CAP did not influence kinetics. Salivary α-amylase tended to be reduced with CAP. In both conditions, a main effect of time was observed (P < 0.001). CAP significantly increased interleukin-6 (IL-6; P = 0.009) at baseline and during the exercise. Post-exercise, CAP IL-6 concentrations decreased to placebo post-exercise concentrations.

Limitations of this study included use of a single population, electrical stimulation to muscles in the abdomen as opposed to the femoral nerve, and inclusion of minimally invasive measures. The authors suggest that future studies examine CAP supplementation with participants of different demographics. Additionally, they propose future testing needs to investigate metabolism including lactate and muscle level VO2.

Notwithstanding these limitations, the authors conclude that acute CAP supplementation "did not improve exercise performance nor the rate of perceived exertion." Results of this
study did show the capacity to attenuate peripheral fatigue development and modulate saliva biomarkers. Therefore, the authors suggest that capsaicin has the potential to alter peripheral components of neuromuscular fatigue and possibly enhance physical performance.

The authors declare no conflict of interest.

—Samaara Robbins

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