

## **Four Days of Caffeine Withdrawal in Caffeine Consumers Lowers Strength in Knee Flexors and Extensors**

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There is strong evidence supporting the ergogenic properties of caffeine with aerobic exercise, but potential ergogenic benefits to anaerobic activities remain in question. These studies of anaerobic exercise have varied designs and equivocal results. It is also unclear how caffeine withdrawal can affect performance. **PURPOSE:** To study the effects of caffeine withdrawal on peak torque (PT), average power, perceived exertion (RPE) and perceived pain index (PPI) during exercise with an isokinetic dynamometer in habitual caffeine consumers. **METHODS:** Physically active subjects ( $n=33$ ; 30 female, 3 male; age:  $21\pm 1$ ; mass:  $60.25\pm 6.79$  kg) performed anaerobic exercise tests before and after 4 days of caffeine withdrawal. Isokinetic PT and average power were tested in the subjects' dominant leg at  $60^\circ\cdot s^{-1}$ ,  $180^\circ\cdot s^{-1}$ , and  $300^\circ\cdot s^{-1}$ . Short duration endurance was assessed in 30 repetitions at  $180^\circ\cdot s^{-1}$ . Isometric PT was measured at  $30^\circ$  and  $90^\circ$  flexion. Data were analyzed with either paired t-tests or repeated measures ANOVA with an alpha of 0.05 and presented as means  $\pm$  SD. **RESULTS:** Following caffeine withdrawal, knee extension PT at  $60^\circ\cdot s^{-1}$  decreased by 7.5 N-m ( $92\pm 21$  vs.  $84\pm 25$  N-m;  $p=0.006$ ); 30 repetitions PT at  $180^\circ\cdot s^{-1}$  decreased from  $69\pm 16$  to  $65\pm 14$  N-m ( $p=0.016$ ); isometric PT at  $30^\circ$  of knee flexion decreased from  $54\pm 16$  to  $48\pm 10$  N-m ( $p=0.005$ ); and isometric PT at  $90^\circ$  of knee flexion declined by 8.2 N-m ( $102\pm 39$  vs.  $94\pm 38$  N-m;  $p<0.001$ ). Knee flexion PT at  $180^\circ\cdot s^{-1}$  decreased by 2.8 N-m ( $40\pm 12$  vs.  $37\pm 10$  N-m;  $p=0.049$ ) and during 30 repetitions at  $180^\circ\cdot s^{-1}$  decreased from  $40\pm 9$  to  $37\pm 10$  N-m ( $p=0.04$ ). Average power for extension at  $60^\circ\cdot s^{-1}$  decreased 6.6 N-m ( $78\pm 23$  N-m vs.  $72\pm 19$  N-m;  $p=0.015$ ) and flexion average power at  $180^\circ\cdot s^{-1}$  decreased from  $86\pm 37$  to  $78\pm 29$  N-m ( $p=0.05$ ) following caffeine withdrawal. For 30 repetitions at  $180^\circ\cdot s^{-1}$ , knee extension average power decreased 6 N-m ( $135\pm 35$  vs.  $129\pm 31$  N-m;  $p=0.039$ ) and flexion average power decreased 7.5 N-m ( $68\pm 24$  vs.  $61\pm 22$  N-m;  $p=0.02$ ). No significant differences in RPE or PPI following withdrawal were observed in response to the exercises. **CONCLUSION:** The current study demonstrated that caffeine withdrawal significantly decreases isokinetic and isometric torque and power in moderate-to-high caffeine consumers.