

# Caffeinated Chewing Gum Activate the Sympathetic Nervous System and Improves

## Shot Put Performance

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### 【目的】

Caffeine stimulates the central and peripheral nervous systems, enhancing athletic performance, including muscle strength and endurance. Chewing gum allows for faster caffeine absorption while offering similar benefits as traditional methods. Previous studies have shown that caffeinated gum can improve shot put performance, but they used lower doses and didn't explore the underlying mechanisms. This study aims to investigate the effects of caffeinated chewing gum on the physiological responses and performance of college shot put athletes.

### 【方法】

This study involved 14 male college shot put athletes (age:  $20.00 \pm 1.41$  years, height:  $176.67 \pm 5.46$  cm, weight:  $96.27 \pm 19.62$  kg). Participants were randomly assigned to a caffeine chewing gum trial (CAF) containing 3 mg of caffeine per kg of body weight or a placebo trial (PLA) with caffeine-free gum, chewed for 10 minutes before exercise. Participants completed a dynamic warm-up, hand grip strength testing, countermovement jump (CMJ), and shot put performance testing. Saliva samples and heart rate variability (HRV) were measured at rest, pre-exercise, and post-exercise, with  $\alpha$ -amylase levels assessed for sympathetic nervous system activity. Data are presented as mean  $\pm$  standard deviation. Paired t-tests were used to analyze differences in hand grip strength, CMJ height, and throw distances. HRV and  $\alpha$ -amylase were analyzed using two-way ANOVA with repeated measures. The significance level was set at  $\alpha = 0.05$ .

### 【結果】

The CAF trial significantly improved CMJ height ( $p = 0.033$ , Cohen's  $d = 0.594$ ), both dominant ( $p = 0.025$ , Cohen's  $d = 0.63$ ) and non-dominant ( $p = 0.031$ , Cohen's  $d = 0.603$ ) hands grip strength, average throwing distance ( $p = 0.002$ , Cohen's  $d = 0.946$ ), and maximum throwing distance ( $p = 0.004$ , Cohen's  $d = 0.864$ ) compared to the PLA trial. For salivary  $\alpha$ -amylase, the CAF trial was higher than PLA at pre-exercise ( $p = 0.014$ ) and post-exercise ( $p = 0.041$ ), with no difference at rest ( $p = 0.086$ ). In HRV parameters, significant interactions were observed for LF ( $p < 0.001$ ), HF ( $p < 0.001$ ), and LF/HF ratio ( $p < 0.001$ ). Post-hoc analyses showed: LF was higher in the CAF trial pre ( $p < 0.001$ ) and post-exercise ( $p < 0.001$ ), with no difference at rest ( $p = 0.195$ ). HF was lower in the CAF trial pre ( $p < 0.001$ ) and post-exercise ( $p < 0.001$ ), with no difference at rest ( $p = 0.195$ ). The LF/HF ratio was higher in the CAF trial pre ( $p < 0.001$ ) and post-exercise ( $p < 0.001$ ), with no difference at rest ( $p = 0.367$ ).

### 【考察】

The study indicates that caffeinated chewing gum significantly enhances sympathetic nervous system activity and improves CMJ height, grip strength, and shot-put performance. These results suggest that consuming the gum before exercise enhances sympathetic activation, with caffeine improving both upper-body strength and lower-body explosive power, resulting in better shot-put outcomes.

### 【現場への応用】

The study found that consuming caffeinated chewing gum (3 mg/kg) for 10 minutes before exercise enhances athletic performance and activates the sympathetic nervous system. These results may be useful for coaches and athletes in competitions. Future research could explore gender differences and types of caffeine intake on these physiological responses.