

# Warming Up Before a 20-Minute Endurance Effort: Is It Really Worth It?

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## Abstract

**Purpose:** To analyze the effects of different warm-up protocols on endurance-cycling performance from an integrative perspective (by assessing perceptual, neuromuscular, physiological, and metabolic variables). **Methods:** Following a randomized crossover design, 15 male cyclists (35 [9] y; peak oxygen uptake [ $\text{VO}_2\text{peak}$ ] 66.4 [6.8]  $\text{mL}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ ) performed a 20-minute cycling time trial (TT) preceded by no warm-up, a standard warm-up (10 min at 60% of  $\text{VO}_2\text{peak}$ ), or a warm-up that was intended to induce potentiation postactivation (PAP warm-up; 5 min at 60% of  $\text{VO}_2\text{peak}$  followed by three 10-s all-out sprints). Study outcomes were jumping ability and heart-rate variability (both assessed at baseline and before the TT), TT performance (mean power output), and perceptual (rating of perceived exertion) and physiological (oxygen uptake, muscle oxygenation, heart-rate variability, blood lactate, and thigh skin temperature) responses during and after the TT. **Results:** Both standard and PAP warm-up (9.7% [4.7%] and 12.9% [6.5%], respectively,  $P < .001$ ), but not no warm-up (-0.9% [4.8%],  $P = .074$ ), increased jumping ability and decreased heart-rate variability (-7.9% [14.2%],  $P = .027$ ; -20.3% [24.7%],  $P = .006$ ; and -1.7% [10.5%],  $P = .366$ ). Participants started the TT (minutes 0-3) at a higher power output and oxygen uptake after PAP warm-up compared with the other 2 protocols ( $P < .05$ ), but no between-conditions differences were found overall for the remainder of outcomes ( $P > .05$ ). **Conclusions:** Compared with no warm-up, warming up enhanced jumping performance and sympathetic modulation before the TT, and the inclusion of brief sprints resulted in a higher initial power output during the TT. However, no warm-up benefits were found for overall TT performance or for perceptual or physiological responses during the TT.

**Keywords:** cycling, exercise, preconditioning, time trial