DOES MILD HYPOHYDRATION REALLY REDUCE CYCLING ENDURANCE PERFORMANCE IN THE HEAT?

Dear Editor-in-Chief:

Bardis et al. (1) demonstrated that mild hypohydration of 1% body weight reduces exercise performance during three consecutive cycling loops in the heat consisting of a low-intensity, fixed-power output, 5-km ride, an all-out 5-km cycling time trial, and a 5-min rest period. Albeit Bardis et al.'s article shows some merits, we believe that 1) the conclusion requires fine-tuning to better reflect the study's findings/research context and 2) the research protocol has significant shortcomings that call into question the validity of the results. Given the tumultuous debate that actually takes place surrounding the effect of hypohydration on endurance performance (8), readers deserve to be made aware of those weaknesses to perform a more enlightened analysis and evaluation of the article.

Bardis et al. concluded that "… mild hypohydration decreased cycling performance, possibly by inducing greater thermal and cardiovascular strain." It is our contention that this closing statement requires two adjustments. 1) Bardis et al. should have specified that their observation of mild hypohydration impairing cycling performance potentially only applies to the context of their exercise protocol and not to out-of-doors competitive exercise conditions. In fact, we demonstrated through meta-analyses that hypohydration of up to 4.3% body weight does not impair real-world-like cycling time trial performances under thermoneutral and warm temperatures (4,5). 2) Bardis et al. argued that hypohydration may have compromised stroke volume and cardiac output and, consequently, concluded that increased cardiovascular strain may have been one of the mechanisms through which hypohydration acted to impair cycling performance. Yet, Bardis et al. observed no difference in HR between interventions. In a classic article, Montain and Coyle (7) convincingly demonstrated that the hypohydration-associated impairment in stroke volume or cardiac output is accompanied by a compensatory increase in HR. Because Bardis et al.'s findings are unsupported by those of Montain and Coyle, we feel that it is reasonable to exclude the possibility that cardiovascular strain played a role in the hypohydration-mediated decrease in performance.

Bardis et al. did not familiarize their participants with the exercise protocol. To this effect, Maughan (6) recently argued that familiarization trials are a prerequisite in hydration- and performance-related studies if valid and reproducible results are to be obtained. Research conditions were administered in a counterbalanced fashion; however, subjects were not randomly assigned to their experimental block. Therefore, one cannot be reasonably confident that the composition of the two blocks at the start of the study was equivalent with respect to variables that could have confounded findings (magnitude of learning effect, training-related fatigue, anxiety, etc.), thereby weakening causal conclusions. Of critical importance is that subjects were not fan cooled during the exercise protocols, which substantially lowered the body's capacity for heat loss through convection and evaporation. It has been demonstrated that mild and moderate (3% body weight) hypohydration does not impair cycling (2) or running (3) endurance performance when subjects are properly ventilated during exercise, that is, at airflow matching their rate of forward progression.

We look forward to reading the future contributions of Dr. Kavouras's research laboratory on this topic.

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