Less peripheral fatigue after prior exercise is not evidence against the regulation of the critical peripheral fatigue threshold

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TO THE EDITOR: Johnson and colleagues (2) report that cycling endurance time is substantially diminished and end-exercise peripheral locomotor muscle fatigue significantly lower when preceded by fatiguing arm cranking exercise. This is certainly an interesting study, and the findings are consistent with prior work that used dynamic single-leg knee extension exercise to exhaustion in one leg followed by the same exercise task in the other leg (1). Indeed, in combination, these studies provide further indirect evidence for the documented group III/IV muscle afferent feedback-mediated spillover of central fatigue to remote muscles (3).

It has been suggested that humans voluntarily terminate high-intensity, constant-load endurance exercise once their individual sensory tolerance limit, a hypothetical construct that might coincide with a certain level of peripheral fatigue and associated intramuscular metabolic milieu, is reached. The interindividual consistency of the degree of end-exercise fatigue initiated the idea of the “critical threshold” of peripheral fatigue. Briefly, this concept is based on evidence that voluntarily exercising humans never exceed an individually different, and, most importantly, highly task-specific magnitude of peripheral fatigue. Group III/IV muscle afferents, which relate intramuscular metabolic changes to the central nervous system, have been suggested to play a critical role in determining the sensory tolerance limit and the critical threshold of fatigue.

Johnson and colleagues (2) claim to have evidence disproving the existence of a critical threshold of peripheral fatigue; however, this is perhaps not completely justified. Indeed, it is therefore important to advise the reader of the fact that their study was not appropriately designed to challenge the threshold concept and that this issue was not recognized in their interpretation of their findings. Specifically, to disprove the threshold concept, an experimental intervention designed to cause the subjects to voluntarily surpass the threshold (i.e., fatigue more) would have been required, because a consistent exceedance of the threshold is requisite to challenge this concept. Clearly, not reaching the degree of peripheral locomotor fatigue associated with the threshold, as was the case with the cycling trial to exhaustion after arm exercise, is a limitation in this context and does not actually challenge the validity of the threshold concept.

Although, upon careful inspection, the Johnson study (2) does not address the validity of the threshold concept, it does demonstrate that voluntary exhaustion can occur before attaining the critical threshold of peripheral fatigue. The cause of this premature (i.e., before reaching the critical threshold) voluntary termination of exercise was previously explained by the fact that central fatigue can crossover from exercising (and fatigued) muscles to impair voluntary endurance performance of a remote, previously rested muscle group (1, 3).

Therefore, with all of this information taken together, the concept that peripheral fatigue and the associated intramuscular metabolic milieu never exceeds, under normal conditions (e.g., without pharmacological intervention), a critical threshold during intense whole body endurance exercise remains to be disproven.

DISCLOSURES

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REFERENCES

