The Occurrence of Core Muscle Fatigue during High-intensity Running Exercise and Its Limitation to Performance: The Role of Respiratory Work

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ABSTRACT

This study was designed to examine the three hypotheses: (1) global core muscle (CM) fatigue occurs during continuous high-intensity running; (2) CM fatigue limits running capacity; and (3) the respiratory work during intense running exercise contributes to CM fatigue. Nine male recreational long-distance runners (age: 23.2±6.4, \( \dot{V}O_2 \text{max}: 65.0±4.7 \text{ ml·kg}^{-1}·\text{min}^{-1} \)) were recruited to perform three experimental trials: (1) continuous running at an intensity of ≥80% \( \dot{V}O_2 \text{max} \) until volitional exhaustion (CR trial), (2) CR trial with prior core muscle fatigue workout (CR_F trial), and (3) mimic of CR trial-induced respiratory response while subjects were free of whole-body exercise (Mimic trial). Global CM function was evaluated according to the time to exhaustion in performing a sport-specific endurance plank test (SEPT). Intense running capacity was revealed by the time to exhaustion during the continuous high-intensity running.

By comparing with baseline performance of the SEPT (255.7±85.3 s), CM function in the CR trial (177.3±80.6 s) was reduced subsequent to exhaustive continuous high-intensity running \((t_{(8)}=5.82, \ P<0.05\)). In the CR_F trial, the preceded fatigued CM workout impaired muscle function. SEPT performance reduced from baseline value to 174.6±85.0 s \((t_{(8)}=5.93, \ P<0.05\)). The performance of subsequent continuous high-intensity running (6.5±2.0 min) was impaired significantly compared with the performance of intense running exercise in the
CR trial (10.7±4.5 min, \(t_{(8)}=3.11, P<0.05\)). In the Mimic trial, SEPT performance was reduced significantly from baseline value following the voluntary hyperpneic activity (212.3±90.2 s, \(t_{(8)}=5.93, P<0.05\)).

The current findings suggest that continuous high-intensity running to exhaustion induces CM fatigue in endurance runners. The occurrence of CM fatigue during exercise may be partly attributable to the tremendous respiratory work. The reduction in CM function with fatigue in runners may limit their capacity to perform intense running exercise.
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