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Peer Review

Review of: "Sustained Muscle EMG Activity to Contractile Failure During Incremental Exercise and Intense Constant Load Cycling: No Evidence of a Central Governor"

Hany Akeel Al-hussaniy[1]

1. University of Baghdad, Iraq

This study investigates surface electromyographic (sEMG) responses during incremental and constant-load cycling exercise to examine predictions of the Central Governor Model (CGM). The manuscript addresses a long-standing and controversial topic in exercise physiology and attempts to provide experimental evidence challenging central neural limitation theories of fatigue. The study contributes meaningful data by evaluating muscle activation patterns during multiple high-intensity exercise protocols, which represents a valuable addition to the neuromuscular fatigue literature.

The study demonstrates several strengths. The experimental design incorporates both incremental VO_2max testing and multiple constant-load critical power trials, allowing comparison of neuromuscular responses across physiologically distinct exercise domains. The use of repeated-measures statistical analysis enhances internal consistency, and the authors provide detailed descriptions of EMG signal acquisition and processing. The inclusion of trained cyclists ensures ecological validity for high-performance exercise physiology research, and the attempt to isolate contraction-specific EMG signals using custom software reflects methodological innovation.

Despite these strengths, several limitations reduce the interpretative strength of the conclusions. The small sample size, particularly the imbalance in sex representation and the loss of usable data for some muscles, limits statistical power and generalizability. The inability to analyze biceps femoris and gastrocnemius activity reduces the comprehensiveness of neuromuscular evaluation and restricts conclusions to only selected muscle groups. Additionally, although the authors acknowledge limitations

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of sEMG in assessing motor unit recruitment, the manuscript still relies heavily on amplitude-based interpretations of neural drive, which remains controversial in the electrophysiological literature.

Conceptually, the manuscript may overextend its conclusions regarding refutation of the Central Governor Model. Demonstrating sustained or increasing sEMG activity does not necessarily exclude central regulatory mechanisms, as central fatigue and neural modulation may occur independently of gross muscle activation amplitude. Alternative explanations, including compensatory recruitment patterns, altered motor unit synchronization, or peripheral fatigue feedback mechanisms, require more balanced discussion. A more cautious interpretation of the findings would strengthen scientific objectivity.

Methodologically, several aspects would benefit from clarification. The justification for selecting the final 30-second segment as a key analytical window requires a stronger physiological rationale. Additional detail regarding signal normalization procedures, inter-participant variability control, and reliability testing of EMG measurements would enhance reproducibility. Furthermore, although statistical analyses were performed appropriately, assumptions such as sphericity equality were accepted without reporting verification tests, which weakens statistical transparency.

The discussion provides an extensive literature context but could be improved by integrating alternative fatigue models beyond CGM, including integrative psychobiological and peripheral feedback models, which may offer more nuanced interpretations of the results. Expanding the translational implications of these findings for athletic training or clinical exercise testing would also enhance the practical value of the manuscript.

Declarations

Potential competing interests: No potential competing interests to declare.