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Insights on Muscle Force Control Loss Caused by Neuromuscular Fatigue

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Perspective

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INTRODUCTION

Perceptive observers have known since antiquity that intensively exercised muscles show a progressive decline in performance, a phenomenon known traditionally as neuromuscular fatigue and more recently as performance fatigability. Neuromuscular fatigue is broadly defined as a decrease in maximal force (or torque)-generating capacity caused by exercise. This definition is expanded to include a decline in any objective measure of performance over a specific time period, recognising that the ability to generate maximal muscle force is not the only determinant of exercise performance. Indeed, the ability to control submaximal muscular forces, that is, to generate task-relevant and precise levels of force, is an important, though frequently overlooked, factor in determining performance.

Variability has long been recognised as an unavoidable feature of voluntary muscle contraction. As a result, muscle force output is neither smooth nor consistent; rather, it exhibits constant inherent fluctuations around the required target force, indicating that force control is not perfect. Leon Binet first commented on the effect of neuromuscular fatigue on the ability to control force in 1920, stating that "tremor increases as a result of muscular contraction and becomes exaggerated under the influence of work [1-3]."A century of subsequent research has revealed increases in the magnitude and, more recently, decreases in the temporal structure (i.e., complexity) of muscle force fluctuations during fatiguing contractions, with both changes indicating a poorer ability to control muscle force.

DESCRIPTION

Recent research has focused on the mechanistic basis of the neuromuscular fatigue-induced reduction in submaximal muscle force control, implying that, as with the mechanisms underlying the reduction in maximal force-generating capacity, both central and peripheral processes may be involved. However, of equal, if not greater, importance is the effect of muscle force control loss on exercise performance, where it serves to impede the ability to exert a desired force and produce an intended movement trajectory; this explains a significant amount of variation in the performance of functional tasks (e.g., static and dynamic balance), and has been proposed to be relevant for exercise tolerance [4,5].

The goal of this review is to provide a comprehensive overview of the changes in muscle force control caused by neuromuscular fatigue. This examination begins with a brief description of muscle force control measurement and quantification during neuromuscular fatigue. We then present evidence for how muscle force control changes with neuromuscular fatigue and discuss the potential mechanistic basis. Finally, we discuss the performance implications of neuromuscular fatigue-induced muscle force control loss. Throughout the review, we also highlight previous research limitations and gaps in our knowledge (and, as a result, areas for future research to focus on) regarding neuromuscular fatigue-induced loss of muscle force control. In summary, traditional magnitude-based measures provide an index of a time series' degree of deviation from a fixed point.

The standard deviation (SD) quantifies the absolute magnitude of fluctuations in muscle force output, whereas the coefficient of variation (CV) quantifies the magnitude of fluctuations normalised to the mean force output, allowing for comparisons between individuals/populations with varying maximal strength. These metrics reflect the consistency of the force. It should be noted, however, that force control and the magnitude of force fluctuations have only been calculated in this manner since the millennium's turn. Previously, force control was frequently measured using the frequency or root mean square of physiological and/or force tremor.

CONCLUSION

The inability of magnitude-based measures to distinguish outputs with distinctly different dynamics is one of their limitations. Complexity-based measures characterize the moment-to-moment relationship between successive points (or series of points) in an output, allowing the quantification of temporal irregularity, time irreversibility, and long-range fractal correlations. Approximate entropy (ApEn) and sample entropy (SampEn) measure the degree of regularity/randomness in an output, whereas detrended fluctuation analysis (DFA) measures long-range fractal correlations within an output. These metrics reflect force adaptability, or the ability to quickly and accurately adjust force output in response to perturbations.

REFERENCES

1. Moe A, Ingstad K, Brataas HV. Patient influence in home-based reablement for older persons: Qualitative research. BMC Health Serv Res. 2017; 17:736.
2. Carbonell-Baeza A, et al.Pain and functional capacity in female fibromyalgia patients. Pain Med. 2011;12:1667-1675.
3. Samuelsson K, et al.patient-reported outcome of a multidisciplinary pain management program, focusing on occupational performance and satisfaction with performance. Open Rehabil J. 2011;4:42-50.
4. Vijayananthan A, Nawawi O. The importance of Good Clinical Practice guidelines and its role in clinical trials. Biomed Imaging Interv J.2008; 4.
5. Roshanravan B, et al. Association between physical performance and all-cause mortality in CKD. J Am Soc Nephrol.2013; 24:822-830.