Review of: "Modelling Skeletal Muscle Motor Unit Recruitment Contributions to Contractile Function: Part 3 - Substrate Oxidation of Phosphagen, Lipid, and Carbohydrate Metabolism"

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Potential competing interests: No potential competing interests to declare.

This study is the third in a series aimed at developing a theoretical model to describe how (*a*) graded motor unit recruitment of (*b*) different muscle fiber types (slow oxidative through fast glycolytic) contribute to whole muscle contractile function. The two previous modeling efforts derived equations that predict the effects of (a) & (b) above on contractile velocity, force & power, and ATP turnover.

The present study extended this effort by combining values obtained from the previous studies with known values for ATP yields from different energy substrates (i.e., derived substrate ATP coefficients) to predict how graded motor unit recruitment across fiber types influences the source of ATP used for contraction, i.e., phosphagens versus glycolysis (glucose) versus mitochondria-dependent oxidation (glucose & fatty acids).

The rationale for the current study was that experimental studies examining motor unit recruitment and muscle bioenergetics have been limited to whole organs, and there is limited understanding of the specific contribution of both fiber type and energy system used by each type to overall muscle performance during graded increases in demand.

Given what we already think we know about muscle metabolism during exercise, the results show what one might expect regarding the use of energy substrates across fiber types as demand increases. Beyond the fact that this is an interesting and novel stratification of metabolism according to fiber type, the authors need to better convey how this work advances the field.

A couple of other clarification questions and suggestions for improvement follow.

1. The Introduction starts by explaining a muscle biopsy technique. Please consider restructuring the Introduction to more succinctly develop the purpose and aim of the study.

2. Details of the functions used in this model are not well described. Equation coefficients are presented with no detailed description of how they were derived. Please expand in this area, perhaps adding the general form and more description of the variables in the equations in which the coefficients were incorporated.

3. Units for ATP turnover seem unconventional; mmol*L^{-1} is a measure of concentration. How is this conceptually equivalent to turnover, which by usual convention is a rate? This underscores the need here to improve the description of methods/experimental design.

4. The premise of the model is the “all or none” principle of skeletal muscle contraction. However, there is evidence that motor units and mammalian skeletal muscle can be activated submaximally, including twitch and fused contractions (*Journal of Neurophysiology* 1977(40, 1432-43); 1991(65, 1509-16); 2005(93, 2449-24459); *Plos Computational Biology* 2011(7:e1001107). How would unfused contractions affect the models, and might this add novelty and significance to the study?

5. How does muscle fatigue factor into the model, e.g., changes in motor unit firing frequency, redistribution of fiber-type dependent contribution to contractile force, overall muscle force?

6. Reference to the previous publications having necessary details demands additional reading. Please consider improving the autonomy of this manuscript.