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LOW-FREQUENCY FATIGUE INCREASES WITH THE NUMBER OF STRETCHES OF ACTIVATED RAT SKELETAL MUSCLES

Willems, M E.¹; Stauber, W T. FACSM.¹

Author Information

¹Department of Physiology and Pharmacology, West Virginia University, Morgantown, WV 26506

e-mail: mwillems@hsc.wvu.edu

PURPOSE

To examine the relationship between stretch number of activated plantar flexor muscles and low-frequency fatigue.

METHODS

In female Sprague Dawley rats (age 3-5 mo), nerve stimulation was used to produce muscle contractions. Stretches [3 stretches (S), 10S, 60S or 240S (n = 6 in each group)] were imposed on isometric contractions [80 Hz, 0.2 ms pulse duration, 5.3±0.3 V (mean±SE)] by ankle rotation from 90° to 40° (velocity: 600 °-s⁻¹, simulation time: 0.9 s, inter-stretch rest time: 40 s). Forty seconds after the last stretch, an isometric contraction (80 Hz at 90°) was performed. Force-frequency relationships with isometric contractions at 90° were measured before and 1 hour after the stretch protocols. An index for low-frequency fatigue was calculated by the change in the 20:100 Hz isometric force ratio.

RESULTS

All stretch protocols resulted in isometric force deficits (3S: 37.0±2.4%, 10S: 44.6±1.5%, 60S: 74.1±1.9%, 240S: 83.4±2.0%). After 1 hour, substantial deficits remained (3S: 33.3±1.7%, 10S: 37.2±2.3%, 60S: 67.6±1.5%, 240S: 77.7±1.2%) and low-frequency fatigue was present in all groups. Force deficits with contractions at 20 Hz were significantly larger than at 100 Hz (3S: 45.9±2.4% vs. 30.8±2.0%, 10S: 57.1±3.0% vs. 34.2±2.1%, 60S: 78.9±0.4% vs. 63.0±1.7%, 240S: 88.5±1.3% vs. 73.9±1.4%). Low-frequency fatigue became significantly larger with an increase in the number of stretches (P = 0.0009).

CONCLUSIONS

The amount of low-frequency fatigue was related to the number of stretches of activated skeletal muscles providing indirect evidence for an increased failure of excitation-contraction coupling with stretch number. Supported by NIOSH R01-OH-02918.

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