Electromyographic Evidence of Selective Fatigue During Eccentric Phase of Stretch-Shortening Cycles in Man

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Selective fatigue, Stretch-shortening cycle, Ankle Extensors

Ten male subjects were tested to determine the effects of muscle fatigue upon activation pattern of the two main ankle extensor muscles, the soleus (SOL) and relatively fast medial gastrocnemius (MG) during a fatiguing 60-s maximal height hopping. The myoelectric signals from SOL and MG together with force signal were simultaneously recorded and analyzed by means of a computer-aided EMG contour analysis, i.e. two-dimensional frequency distributions relating the activation patterns of the two synergists. The EMGs were also full-wave rectified and integrated (iEMG) according to three phases of hopping movement (PRE: pre-activation phase, ECC: eccentric phase and CON: concentric phase). Results indicated that there were significant decreases (P < 0.01) in peak ground reaction force, height of hopping and mechanical power per unit body weight at the end of fatiguing contractions. These mechanical parameter changes were accompanied by the significant (P < 0.01) decreases in all three phases of iEMG for MG while no significant differences could be demonstrated for SOL iEMG during the PRE or ECC phases. Thus, the decreased mechanical parameters could be, in large part, accounted for by the substantial and selective declines of the excitation level of the relatively "fast-twitch" MG muscle. Our data suggest that centrally mediated pre-activation and eccentric phase of the MG activation, presumably a combination of supraspinal influence and stretch reflex modulation, are most affected by fatigue-induced metabolic changes.

Graphs showing EMG activity and force vs time over three phases of hopping.

Supported by grants from the Sveriges Centralförening för Idrottens Främjande and the Karolinska Institute, Sweden.