REPETITIVE EXPOSURES OF STRETCH-SHORTENING CYCLES AFFECTS MUSCLE PERFORMANCE DIFFERENTIALLY WITH AGE

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Aims

Repetitive motion is a major risk factor associated with work-related musculoskeletal disorders. The age distribution of the workforce in the United States is predicted to shift to older workers (4). Indeed, the 55-64 year old demographic is now the fastest growing sector of the labor force in the United States. It is projected by this year that 20 percent of the labor force will be comprised of workers over the age of 55 (1). Aging is associated with an impaired adaptation to a single exposure of injurious muscle contractions (3). However, there are no studies to-date that have determined if muscles from old animals can positively adapt to repetitive exposures of resistive muscle contractions that promote adaptation and performance increases in muscles of young animals. The purpose of this research was to investigate if aging affects the ability of skeletal muscle to adapt to repetitive exposures of stretch-shortening cycles (SSCs) in young and old rats.

Methods

Dorsiflexor muscles of old (30 months, N= 5) and young rats (12 weeks, N = 6) were exposed 3 times per week for 4.5-weeks to a protocol of 80 maximal SSCs per exposure (8 sets of 10 repetitions*) in vivo.* Skeletal muscle response was characterized by isometric and dynamic performance, as well as muscle wet weight and quantitative morphological analyses following the exposure period.(2)

Results

The isometric and dynamics performance of the young and old groups was not statistically different at the start of the exposure. By the end of the exposure, however, a statistical difference was noted as performance increased significantly in the young animals and decreased significantly in the old animals. Muscle wet weight of the left tibialis anterior (TA) in the treated limb was significantly greater in the young compared to old animals ($p < 0.001$), while there was no difference in the contra-lateral TA. No degenerative myofibers or changes in non-cellular interstitium was noted in either age group, but a significant increase was observed in the volume of the cellular interstitium in the exposed limb of the old animals ($p = 0.01$), which is indicative of an inflammatory response.(2).

Conclusions

A chronic exposure of repetitive SSCs results in significant performance increase and muscle hypertrophy in young animals, and a significant performance decrease and an increased cellular interstitial response in old animals, but no evidence of myofiber necrosis. These findings suggest that age may impair the ability of skeletal muscle to adapt to repetitive mechanical loading, even in the absence of myofiber degeneration.

References

1. (NRC) NRC, (IM) IfM. Musculoskeletal Disorders and the Workplace. Washington, D.C.: National Academy Press; 2001.
2. Cutlip RG, A. BB, B. GK, Mercer RR, Kashon ML, R. MG, et al. Chronic exposure of stretch-shortening contractions results in skeletal muscle adaptation in young rats and maladaptation in old rats. Applied Physiology, Nutrition and Metabolism. 2006;31(5):573-87.
3. McBride TA, Gorin FA, Carlsen RC. Prolonged recovery and reduced adaptation in aged rat muscle following eccentric exercise. Mech Ageing Dev. 1995 Sep 15;83(3):185-200.
4. Statistics BoL. Civilian labor force 16 years and older by sex, age, race, and Hispanic origin, 1988, 1998, and projected 2008. 1999 [cited; Available from: http://stats.bls.gov/news release/empsit.t12.htm.

PREMUS 2007

Sixth International Scientific Conference on Prevention of Work-Related Musculoskeletal Disorders

27–30 August, 2007
The Conference Center at Harvard Medical
Boston, Massachusetts, USA

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