

Effects Of Heavy Resistance Unilateral Strength Training On Muscle Fiber Characteristics In Young And Older Men And Women

Gregory F Martel, Stephen M. Roth, Frederick M. Ivey, Jeffrey T. Lemmer, Brian L. Tracy, Diane E. Hurlbut, Ben F. Hurley, E. Jeffrey Metter, & Marc A. Rogers. Department of Kinesiology, University of Maryland College Park, College Park, MD 20742, Department of Physical Therapy, University of Maryland Eastern Shore, Princess Anne, MD, Gerontology Research Center, National Institute on Aging, Baltimore, MD 21224; and 21853

OBJECTIVE:

The purpose of this study was to compare the effects of age and gender on muscle fiber adaptation to heavy resistance strength training (HRST) in young and older men and women. Thirteen young men and eleven young women (20 -30 yr), and thirteen older men and eleven older women (65 -75 yr) completed a 9 week heavy resistance strength training program, consisting of five sets of unilateral leg extension exercise three times a week. The dominate leg of each individual was used as the training leg while the non-dominate leg served as the untrained, within-subject control. Muscle fiber and muscle strength were examined in both legs using muscle biopsies and one repetition maximum (1RM) before and after completion of training.

RESULTS:

1 RM strength increased by 34% in young subjects (men & women combined), and by 28% in older subjects (men & women combined). The men (young & older combined) improved 1 RM by 29%, while the women (young & older combined) improved 1 RM by 34%. Therefore, neither age nor gender played a significant role in 1 RM strength increases. All subjects showed an increase (10-11%) in 1RM of the untrained leg. Additionally, all subject groups showed significant increases in type I, IIa and IIb muscle fiber cross sections in the trained leg; young men (23%, 28% and 45% respectively), young women (20%, 19% and 21% respectively), older men (12%, 23% and 28% respectively) and older women (12%, 14% and 42% respectively). Young and older men and women demonstrated similar muscle fiber hypertrophic responses to HRST, and type IIb muscle fibers appear to account for the largest proportion of hypertrophy for all groups.

SUMMARY:

This study indicates that young and older men and women demonstrate similar changes in muscle strength and muscle fiber characteristics in response to heavy resistance strength training. Neither age nor gender significantly effected the changes in 1 RM, strength or muscle fiber cross sections. In addition, since type II muscle fiber appears most vulnerable to atrophy with aging, the significant increases in type II muscle fiber area in all age groups suggests that HRST may be especially helpful in reducing the muscle loss associate with aging.

The increases in 1 RM strength of 34% & 28% may seem small compared to other studies on HRST reporting gains in 1 RM of 60-110%. This can most likely be attributed to this study's different training protocol using multiple practice sessions at a low resistance level before testing to eliminate the effects of initial strength increases due to motor learning.

Keiser Pieces Used: Leg extension machine.

Published: under review, Journal of Applied Physiology