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Age-related Differences In The Efficacy Of Pre-habilitative Conditioning

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2795 Board #146 June 4 3:30 PM - 5:00 PM

Muscle Quality Is Strongly Associated With Physical Function In Middle-aged And Older Adults

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(No disclosure reported)

There is an association between age related declines in muscle strength and muscle mass. This combination may result in loss of function and consequently increases in impairment and disability. Loss of function, increased impairment and disability results in higher rates of falls, chronic diseases, dependency, institutionalization, and mortality. Thus, the need to quantify and identify the underlying mechanisms that contribute to impairment and disability may provide insight to appropriate interventions and public health knowledge.

PURPOSE: Explore the association in lower-limb muscle quality and physical function in a cross-sectional study of 93 adults (66.5±14.32 yrs.)

METHODS: One repetition maximum (1RM) strength and peak power were determined using the pneumatic bilateral leg press. Physical function was assessed by a ten chair stand (10CH), 400M walk (400M), stair climb (STCL), and Short Physical Performance Battery (SPPB). Computed tomography was used to assess mid-thigh body composition. Muscle Quality was calculated from absolute strength and power results and adjusted for total muscle CSA to yield estimates of specific strength (SS) (N/cm²) and specific peak power (SP) (W/cm²) at 40% and 70% of the 1RM.

RESULTS: There were high correlations for muscle quality and 1RM, 40%, and 70% of 1RM in all measures of function. The strongest correlations were 10CH and 40% and 70% SP (-0.494 and -0.517); 400M and 40% SP (-0.310); STCL and 40% and 70% SP (-0.503 and -0.542); SPPB and 40% and 70% SP (-0.587 and -0.594). Controlling for gender did not affect these relationships.

CONCLUSION: Muscle quality is strongly associated with physical function. Normalizing force or power to cross-sectional thigh muscle area may be a better index of physical function than absolute maximal force production or thigh muscle area alone.

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2796 Board #147 June 4 3:30 PM - 5:00 PM

Age-related Differences In The Efficacy Of Pre-habilitative Conditioning

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(No disclosure reported)

The ability of pre-habilitative conditioning (i.e. a priori exercise training) to modulate the deleterious effects of unloading on muscle fibers has largely been overlooked. Moreover, the impact that aging has on the efficacy of pre-habilitative conditioning is unknown.

PURPOSE: The aim of this investigation was to reveal the potential of pre-habilitation to mitigate the atrophic adaptation of muscle fibers to unloading in young adult, and aged muscles.

METHODS: Forty young adult (9 mo old) male Fischer 344 rats were assigned to 4 treatment groups (N=10/group): controls (CTL), unloaded (UL), pre-habilitation prior to unloading (PH-UL), and pre-habilitation alone (PH). Forty aged (25 mo old) male Fischer 344 rats were also assigned to the treatment groups of CTL, UL, PH-UL, and PH (N=10/group). Muscle unloading occurred during 2 wks of hindlimb suspension. Pre-habilitative conditioning consisted of 2 wks of treadmill running for up to 30 min per session (5 days/wk). At the end of the intervention period, animals were euthanized, soleus muscles were surgically removed, quickly frozen at resting length, and later subjected to standard histochemical staining for myosin ATPase activity. Within each age group, 1 way ANOVA was performed to compare muscle fiber cross-sectional area.

RESULTS: For young adult rats, data showed that although UL evoked significant (P<0.05) fiber atrophy (~22%), the PH-UL group showed a significantly greater degree of atrophy (~40%) compared to CTL fibers. PH alone did not significantly alter muscle fiber size in young adult rats. Among aged rats, it was determined that UL resulted in significant atrophy relative to CTL (~45%). However, among aged rats pre-habilitation significantly tempered unloaded induced atrophy as the fibers of the PH-UL group displayed a reduction in size of 32% (45% vs. 32%, P<0.05). Moreover, among the aged rats it was found that PH alone significantly increased fiber size compared to CTL (~14%).

CONCLUSION: The findings presented here indicate that the capacity of pre-habilitative conditioning to attenuate unloading induced muscle fiber atrophy is age specific.

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2797 Board #148 June 4 3:30 PM - 5:00 PM

Effects Of Endurance Exercise On Jnk, Hsp72, And Nf-kB Activation In Oletf Skeletal Muscle

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(No disclosure reported)

Redox-sensitive kinases and HSP72 (heat shock protein) have been reported to be associated with the development and protection of type 2 diabetes, respectively. Exercise training has been proved to serve as a therapeutic method for the treatment of type 2 diabetes. However, little is known about how exercise exerts protective effect on type 2 diabetes through regulation of redox-sensitive kinase and HSP72.

PURPOSE: To investigate the effect of 12 weeks of treadmill exercise training on the expression of stress kinases including JNK (c-Jun NH2-terminal kinase) and IKK (I κ B kinase), HSP72, and NF- κ B activation in type 2 diabetic OLETF (Otsuka Long-Evans Tokushima Fatty) rat skeletal muscle.

METHODS: The OLETF rats were randomly divided into exercise training group (Ex-OLETF, n=8) and sedentary group (Sed-OLETF, n=8), and the LETO rats were used as control group (n=5). OLETF rats were aerobically trained 5 days/wk for 12 weeks at a speed of 15-21 m/min. After 48 hours the last training session, gastrocnemius muscle was removed and stored at -80 °C for further analysis.

RESULTS: As markers of oxidative stress, the levels of hydroperoxide and 4-HNE in OLETF groups were significantly higher compared with LETO group. There was no difference between Ex-OLETF and Sed-OLETF. Phosphorylation of IKK beta, I κ B alpha, and cytosolic fraction of JNK was elevated in OLETF compared with LETO, however, there was no significant difference between Ex-OLETF and Sed-OLETF. The expression of HSP72 was downregulated in OLETF compared with LETO, but was significantly increased in Ex-OLETF compared with Sed-OLETF. NF- κ B DNA binding activity in Sed-OLETF group was significantly higher compared with LETO group. Although it was not statistically significant, exercise training in Ex-OLETF group showed the trend of reducing the activation of NF- κ B DNA binding activity compared with Sed-OLETF group.

CONCLUSION: Our findings indicate that although oxidative stress, stress kinase activation, and lower HSP72 expression are found in OLETF skeletal muscle compared to LETO control, it appears that protective effect of exercise on type 2 diabetes would be regulated by independent of JNK and NF- κ B pathway.