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SLIDE SESSIONS

Fatigue tended to be less in the old at the end of reperfusion (66±20% vs. 53±12%, p=0.08). Activation did not change in either group during FF (p≥0.44). At the end of ischemia, central (CAR=0.98±0.04 vs. 0.83±0.21, p=0.02) and peripheral (90±9% vs. 76±13%, p=0.01) activation was lower in young. At the end of reperfusion, CAR recovered in both groups, but peripheral activation remained lower in young (99±10% vs. 83±11%, p < 0.01).

CONCLUSION: The enhanced fatigue resistance observed in FF and ischemia suggests that, during intermittent MVCs, age-related differences in fatigue are not explained by differences in oxidative metabolism.

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960 **June 2 9:15 AM - 9:30 AM**

Age Affects Skeletal Muscle Response to an Acute Exposure of Stretch-Shortening Contractions

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Previous studies have shown that aging increased susceptibility to contraction-induced injury in skeletal muscle and impaired recovery after injury.

PURPOSE: To investigate the effect of an acute stretch-shortening contraction (SSC) exposure on the temporal skeletal muscle response of young and old rats.

METHODS: The left dorsiflexor muscles of young (12 wks age, N = 30) and old (30 mo age, N = 30) male Fischer 344 x Brown Norway rats were exposed to an acute protocol of 80 maximal SSCs (60 deg/s, 50 deg range of motion) in vivo using a custom-fabricated dynamometer. Performance was characterized by isometric performance, negative and positive work, and stretch-shortening parameters (peak eccentric force and minimum pre-stretch force) pre-exposure and at 6 hrs, 24 hrs, 48 hrs, 72 hrs, and 120 hrs after exposure (N= 6 young and 6 old animals at each time point).

RESULTS: The isometric force, peak force, minimum force, negative work and positive work were not statistically different between groups before the exposure. However, after the SSC exposure, older age negatively affected the isometric performance ($p = 0.0001$), minimum force ($p < 0.0001$), peak eccentric force ($p = 0.0002$), negative work ($p = 0.0005$), and positive work ($p < 0.0001$). The isometric performance and dynamic performance (minimum force, peak force, negative work and positive work) differed most between the age groups 72 hours and 120 hours after the SSC exposure. At the 72 hour and 120 hour time points, the older group exhibited lower isometric force ($p = 0.0125$ and 0.0051, respectively), minimum force ($p = 0.0149$ and 0.0005, respectively), peak force ($p = 0.0018$ and 0.0239, respectively), negative work ($p = 0.0050$ and 0.0298, respectively), and positive work ($p = 0.0190$ and 0.0054, respectively) than their younger counterparts.

CONCLUSIONS: Age negatively affected both the isometric and dynamic performance measures temporally after an acute exposure to SSCs, particularly at the later time points. These findings suggest that aging impairs the ability of skeletal muscle to adapt to an acute exposure of SSCs.

Disclaimer: "The findings and conclusions in this report (abstract/presentation) have not been formally disseminated by the National Institute for Occupational Safety and Health and should not be construed to represent any agency determination or policy."

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961 **June 2 9:30 AM - 9:45 AM**

Aging Augments Oxidative Stress In Skeletal Muscle During Suspension-induced Unloading

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Oxidative stress increases during hindlimb suspension in muscle from young adult animals. However, it is not known if oxidative stress is also increased in a similar fashion during unloading in aged skeletal muscle. Therefore, the **PURPOSE** of this study was to test the hypothesis that aging augments oxidative stress during muscle unloading-induced atrophy.

METHODS: By using the techniques of RT-PCR, western immunobloting and other biochemical assays, the present study examined the markers of oxidative stress and antioxidant enzymes gene and protein expressions in gastrocnemius muscles of young adult and aged Fischer344xBrown Norway rats after 14 days of hindlimb suspension.

RESULTS: Sarcopenia was observed when comparing both muscle wet weights and muscle weight normalized to body weight between young adult and aged animals. As expected, muscle mass decreased after suspension in both young adult and aged animals. The contents of MDA/4-HAE and nitrotyrosine and the catalase activity were greater in unloaded relative to control muscles in young adult and aged animals. H2O2 content was elevated while MnSOD protein content was reduced in suspended muscles when compared to control muscles exclusively in the aged animals. Changes in oxidative stress markers MDA/4-HAE, H2O2 and MnSOD protein contents to hindlimb unloading occurred in an age-dependent manner. The age-related decrease in muscle mass was accompanied by greater catalase activity and contents of 8-OHdG and nitrotyrosine but lower abundances of MnSOD mRNA and protein catalase mRNA, relative to muscles from young adult animals.

CONCLUSIONS: These findings are consistent with the hypotheses that oxidative stress has a role in mediating disuse-induced and sarcopenia associated muscle. Our data suggest that aging may predispose skeletal muscle to increased levels of oxidative stress both at rest and during unloading.

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962 **June 2 9:45 AM - 10:00 AM**

Effects of Whole Body Vibration on Force Production in Young, Middle-aged, and Older Men

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PURPOSE: The purpose of this study was to examine the influence of age on the ability to exert muscular force following whole body vibration in healthy males between the ages of 18-25, 35-45, and 55-64 years.

METHODS: 50 total subjects were assigned to one of three groups depending solely on age. The three groups were young (n=20; 22.75±1.74 years), middle-aged (n=15; 40.53±3.07 years), and old (n=15; 58.07±2.40 years). All subjects participated in a 1 hour testing session which consisted of pre- and post-trials for both countermovement vertical jumps and a maximal isometric leg extension, with a whole-body vibration intervention in between. The vibration protocol was 3 sets, 30-seconds in duration, at a frequency of 30 Hz on a low-amplitude. From these tests, several variables were obtained including; peak power, peak rate of force development, rate of force development index, peak force, time to peak force, average time to peak force, and EMG amplitude values for both the vastus lateralis and rectus femoris.

RESULTS: Examination of the pre- and post-vibration values for each measure indicated a non-significant decrease in average peak power, average peak RFD, average peak force, average time to peak force (young only) and average EMG amplitude for both the VL and the RF. There were non-significant increases in RFD index, and time to peak force (middle-aged and old only). There were significantly higher values for pre-vibration values compared to post-vibration values across age groups for average peak power, average peak RFD, average peak force, and EMG amplitude for both the VL and RF. The young showed significantly higher values for average peak power, average peak force, and RF EMG amplitude when compared to the old across pre- and post-vibration. One significant age group by trial interaction occurred in the EMG amplitude for the VL. The young group decreased significantly more than both the middle and older groups.

CONCLUSIONS: These results suggest that there is no significant influence of age on the ability to exert muscular force following whole body vibration in healthy males, with each age group generally demonstrating a post-vibration depression in performance parameters.

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963 **June 2 10:00 AM - 10:15 AM**

Role of Cellular Oxygen in Age-related Differences in Muscle Fatigue During Incremental Contractions

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The skeletal muscle of healthy older adults has been shown to fatigue less, and rely relatively more on oxidative energy production, than that of young adults. It is not known whether these differences in muscle function are related to differences in cellular oxygenation.

PURPOSE: to determine whether 1) intramyocellular oxygenation, reflected by myoglobin desaturation (dMb, by 1H magnetic resonance spectroscopy), differs in young and older adults during incremental contractions to fatigue (fall in maximal voluntary contraction, MVC), 2) changes in dMb (%max) are related to fatigue, and 3) muscle strength interacts with these variables.

METHODS: Twenty young (26+4 yrs) and 18 older (70+4 yrs) healthy men and women performed 16 min of isometric dorsiflexor contractions (4s contract/6s relax), beginning at 10% MVC and incrementing by 10% every 2 min. The force-time integral (FTI) and dMb (30 s averages) were measured continuously, and MVC was assessed before each stage. Regression analyses were used to examine the influence of strength on fatigue and changes in dMb.

RESULTS: Young fatigued more than old (MVCpost/MVCpre = 68±4% and 84±3%, respectively; $p<0.001$) and had higher dMb at contraction intensities above 50%MVC ($p<0.05$). Overall, fatigue was not related to end-exercise dMb (n=36, r=0.27, p=0.11), which tended to plateau in the young as MVC continued to fall in the final stages of contractions. Pre-exercise strength was associated with both fatigue ($r=0.53$, $p<0.001$) and end-exercise dMb ($r=0.51$, $p=0.002$).

CONCLUSIONS: The observation that less fatigue in the old is accompanied by lower dMb is consistent with earlier studies showing a metabolic basis for the fatigue resistance of older muscle. Differences in end-exercise dMb did not explain differences in fatigue. However, differences in fatigue and dMb appeared to be mediated in part by muscle strength, possibly due to greater vascular occlusion during contractions in the stronger subjects.

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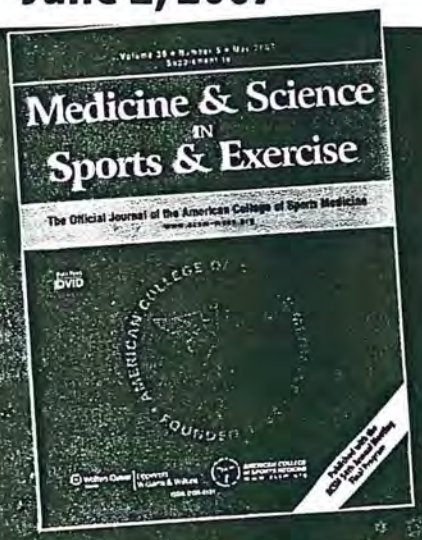

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