of ISO and ECC on the expression of apoptosis in male and female rats. **METHODS:** Male and female wistar rats (13 weeks old) were used in the experiments. The left and right tibialis anterior muscles were subjected to 20 controlled ISO and ECC, respectively, by using an ankle extensor apparatus and surface electric stimulation under anesthetization. Rats of the same age were used as a normal control (CONT, n = 8). Induction of apoptosis was examined at one hour (1H), one day (1D), three days (3D) and seven days (7D) after ISO and ECC (n=4-6, each group). Apoptosis was assessed by TUNEL assay, and labeled nuclei were identified under a fluorescence microscope. **RESULTS:** Normal muscle fiber histology was found in CONT and ISO muscle in male and female rats. Following ECC, histological muscle damage such as focal inflammation and necrosis muscle fiber showed in male rats but not in female rats. In male and female rats, TUNEL-positive nuclei were significantly increased in ECC (male rats: 1H, 0.8 ± 0.2; 1D, 1.2 ± 0.4; 3D, 3.1 ± 1.1; 7D, 2.8 ± 0.9. female rats: 1H, 0.3 ± 0.2; 1D, 0.8 ± 0.5; 3D, 1.4 ± 0.2; 7D, 1.3 ± 0.6, positive nuclei / mm^2) compared with ISO (male rats: 1H, 0.2 ± 0.1; 1D, 0.8 ± 0.2; 3D, 0.3 ± 0.1; 7D, 0.6 ± 0.3. female rats: 1H, 0.4 ± 0.3; 1D, 0.2 ± 0.1; 3D, 0.1 ± 0.1; 7D, 0.2 ± 0.1). There were gender effects on ECC-induced apoptosis response (male > female; $p < 0.05$). **CONCLUSION:** These results suggest that ECC appear to cause greater apoptosis to skeletal muscle than ISO as well as histological muscle damage.

1652 *Board #107* **11:00 AM - 12:30 PM**

Variability Of Creatine Kinase Increase And Strength Loss In Men And Women Following Eccentric Exercise

Amy K. Kearns, Mariko T. Holbrook, Priscilla M. Clarkson, FACSM. *University of Massachusetts, Amherst, MA.* (Sponsor: Priscilla Clarkson, FACSM)
Email: akearns@excsci.umass.edu

Studies have investigated gender differences in the magnitude of responses to muscle damaging exercise, but the results have been equivocal, which may be due to variability in response between men and women. A systematic examination of individual responses may help elucidate possible sex differences in response to eccentric exercise. **PURPOSE:** We examined the variability in the serum CK and maximal isometric strength (MVC) response after eccentric exercise in a large group of men and women. **METHODS:** Men (N=43) and women (N=58) performed 50 eccentric contractions of the elbow flexors. MVC was assessed before and immediately following the exercise. Blood samples were taken pre and 4 d post-exercise and analyzed for CK activity. Changes in percent MVC and serum CK levels were determined and analyzed for variability. **RESULTS:** The change in percent MVC immediately post-exercise (mean (SE)) was -51.1 (± 2.6) for men and -57.1 (± 2.5) for women. The coefficient of variation (CV) for change in percent MVC for men was -0.34 with a skewness value of 0.61 and kurtosis of -0.38. The corresponding values for women were -0.33, 0.84, and 0.23. Men demonstrated losses in percent MVC from 10 to 80 percent. Women demonstrated losses from 10 to 90 percent. However, over 30 percent of women subjects experienced greater than a 70 percent decrease in their strength immediately following eccentric exercise, while less than 10 percent of men subjects did. The change in CK activity at 4 d post-exercise for men and women was 12,522 (±2,494) and 6,617 (±949) U/L. The CV for change in CK activity for men was 1.31, skewness value 2.16 and kurtosis 6.20. The corresponding values for women were 1.09,1.03 and 0.03. The range for changes in CK activity was much greater in men, from a decrease of 125 U/L to an increase of 80,550 U/L, whereas women showed changes from -20 to 24,621 U/L. However, the eccentric exercise produced increases of greater than 30,000 U/L in more than 10 percent of the men while none of the women had a CK value greater than 25,000 U/L. **CONCLUSION:** Though the change in percent MVC was similarly variable between men and women, the frequency of women with high strength loss was greater than that for men. The change in CK activity is more variable in men than in women. Particularly, a greater distribution of men tended towards being high CK activity responders following eccentric exercise compared to women. Results regarding variability in response to eccentric exercise are necessary for understanding factors that may contribute to an individual's susceptibility to serious consequences of muscle damage.

1653 *Board #108* **9:30 AM - 11:00 AM**

Age Affects Skeletal Muscle Adaptation To Repeated Exposures Of Stretch-shortening Contractions

Robert G. Cutlip[1], Brent A. Baker[1], Ken B. Geronilla[1], Mike L. Kashon[1], Zsolt Murlasits[2], Stephen E. Alway, FACSM[2]. [1]*National Institute for Occupational Safety and Health, Morgantown, WV.* [2]*Laboratory of Muscle Biology and Sarcopenia, Division of Exercise Physiology, West Virginia University School of Medicine, Morgantown, WV.* (Sponsor: Stephen E. Alway, FACSM)
Email: rgc8@cdc.gov

Previous studies have shown that skeletal muscle is more susceptible to contraction-induced injury and recovers more slowly after the initial injury in aged animals. Purpose: To investigate if aging affects the ability of skeletal muscle to adapt to repeated exposures of maximal stretch-shortening cycles (SSCs). Methods: Dorsiflexor muscles of old (30 months, N= 5) and young (12 weeks, N = 6) Fischer 344 x Brown Norway rats were exposed 3 times per week for 4.5 weeks to a protocol of 80 maximal stretch-shortening cycles (60 deg/s, 50 deg range of motion) per exposure in vivo. Performance was characterized by isometric performance, negative, positive, and net work, and stretch-shortening parameters (peak force and minimum force at each exposure interval (fourteen exposures). Results: The isometric force ($p = 0.455$), peak force ($p = 0.761$), and minimum force ($p = 0.853$) was not statistically different between groups at the start of the exposure. During the chronic exposure, those forces responded differently with age ($p = 0.0003$, 0.0081, and 0.0011 respectively) and were significantly different with age at the end of the exposure period ($p < 0.0001$ for all parameters). Negative work and positive work were also not different between groups at the start of the exposure ($p = 0.455$ and 0.475, respectively). During the chronic exposure, both negative and positive work responded differently with age ($p = 0.0044$ and 0.0011, respectively) and resulted in significantly different magnitudes at the end of the exposure period ($p < 0.0011$ for both parameters). There was also a significant increase in all performance parameters from the initial to the final exposure in the young animals ($p < 0.05$), but a concomitant decrease in the old animals in all parameters ($p < 0.05$) except negative work. Conclusions: A chronic exposure of SSCs results in a significant performance increase in young animals, and significant performance decrease in old animals. These findings indicate that aging impairs the ability of skeletal muscle to adapt to repetitive mechanical loading.

1654 *Board #109* **11:00 AM - 12:30 PM**

Early Treatment Of Exercise Induced Muscle Damage With Meloxicam Affects Muscle Cell Membrane Permeability

Wayne E. Derman, FACSM, Sasha West, Martin P. Schwellnus, FACSM, Michael I. Lambert, Timothy D. Noakes, FACSM. *University of Cape Town, Cape Town, South Africa.*
Email: wderman@sports.uct.ac.za
*(***W.E. Derman**, *Boehringer Ingelheim Research Grant Recipient.)*

Exercise induced muscle damage occurs after unaccustomed physical activity, resulting in stiff, painful muscles with impaired function. Conventional non-steroidal anti-inflammatory agents are often ingested prior to, or after exercise to treat these symptoms. **PURPOSE**: To determine the effects of the cox-2 selective agent meloxicam (M), on symptoms of exercise induced muscle damage and plasma creatine kinase [CK] activity. **METHODS**: Forty five healthy males were recruited for a double-blind placebo controlled trial and were then randomly assigned to treatment with either M 15mg immediately before (ME) or 48 hrs after induced injury (ML) or a placebo (P) and monitored for a total of 168 hours. Muscle injury was induced in their non-dominant arms using an eccentric exercise protocol. The dominant arm, which did not do any exercise was the control. **RESULTS**: Subjects in all three groups experienced severe pain (2.5 ± 2.2 units; 2.3 ± 2.1 units; 2.4 ± 2.5 units vs. control $P<0.001$) following the eccentric exercise. After 24 hours the difference in elbow joint angle between control and exercised arm, of all three groups had increased significantly (7.0 ± 6.5°; 4.3 ± 3.4°; 2.7 ± 2.7°; ME , ML and P; $P < 0.05$), possibly as a consequence of elbow flexor muscles shortening. Peak [CK] was higher at 72 hr in ME (2540 ± 4230 U.L^{-1}) compared to ML (671 ± 953 U.L^{-1}) and P (675 ± 1002 U.L^{-1}; $P< 0.05$ vs pre exercise control). M was well tolerated by the subjects in both groups without any adverse effects. **CONCLUSIONS**: These data show that symptoms of exercise induced skeletal muscle damage are not positively influenced by ME or ML. Indeed, it appears that ingestion of M immediately preceding injury seems to affect muscle cell membrane permeability resulting in higher peak [CK]. These findings have important implications to athletes who ingest anti-inflammatory agents before exercising in an attempt to decrease skeletal muscle injury.

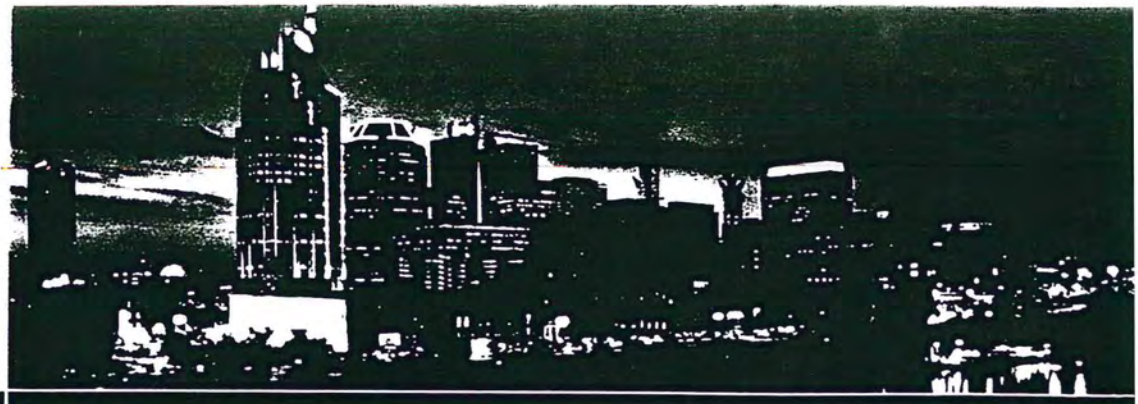
1655 *Board #110* **9:30 AM - 11:00 AM**

Tumor Necrosis Factor-alpha Promotes Skeletal Muscle Inflammation

Kevin D. Feeback, Jennifer M. Peterson, Francis X. Pizza. *University of Toledo, Toledo, OH.*
Email: kfeebackut@yahoo.com

Tumor necrosis factor (TNF)-alpha, a pro-inflammatory cytokine, is thought to contribute to cachexia (muscle wasting) and promote skeletal muscle inflammation. **PURPOSE**: To determine if TNF-alpha administration promotes the accumulation of inflammatory cells in skeletal muscle. **METHODS**: Murine recombinant TNF-alpha, at 100-µg/kg concentration, was delivered for seven days via mini-osmotic pumps to C57BL/6 mice. Sham treated mice received 0.1% murine serum albumin in sterile saline via mini-osmotic pumps for seven days. Following seven days of treatment, extensor digitorum longus (EDL) and soleus muscles were dissected out and analyzed for neutrophil and macrophage concentrations via immunohistochemistry. Overt signs of skeletal muscle injury and regeneration were assessed via histological staining. **RESULTS**: In EDL muscles from TNF-alpha treated mice, neutrophil and macrophage concentrations were elevated six and three fold respectively, compared to the sham treated mice. Neutrophil and macrophage concentration were also elevated five and two fold respectively, in soleus muscles from TNF-alpha treated mice compared to sham treated mice. No overt signs of muscle injury were observed in EDL muscles, but modest signs of muscle injury were present in soleus muscles from TNF-alpha treated mice. Furthermore, signs of muscle regeneration were not present in either EDL or soleus muscle from TNF-alpha treated mice. **CONCLUSIONS**: TNF-alpha promotes inflammation in skeletal muscle as indicated by the accumulation of neutrophils and macrophages. Further investigation is needed to determine the role of inflammatory cells in cachexia.

AMERICAN COLLEGE of SPORTS MEDICINE
www.acsm.org



AMERICAN COLLEGE OF SPORTS MEDICINE

52ND ANNUAL MEETING

FINAL PROGRAM

Award Winners Profiled Inside

Improved Program-At-A-Glance

Including the Supplement to the May 2005 *Medicine & Science in Sports & Exercise*® *(The Abstract Issue)*

The very best in the science of sports medicine!

The entire landscape of sports medicine in one dynamic conference … with up to 25 simultaneous sessions!

Nashville, Tennessee
June 1-4, 2005