RESULTS: As a result of the ST program, peak power increased significantly in both men and women at the same absolute (APP; $P < 0.001$) and relative loads (RPP; $P < 0.05$). Men had significantly greater increases in APP and RPP than women with ST when covarying for baseline differences (both $P < 0.001$). However, when each subject was tested at the same absolute load and when peak power was normalized for the muscle volume of the trained knee extensors (i.e., absolute MPQ), women increased their MPQ ($P < 0.05$), but men did not. Both men and women increased their absolute PV ($P < 0.001$), but decreased their relative PV significantly with ST ($P < 0.01$).

CONCLUSIONS: These data indicate that a moderate-velocity ST program increases muscle power quality in women, but not in men, suggesting that in contrast to men, women increase peak power with ST through adaptations other than muscular hypertrophy.

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677 **4:00 PM - 4:15 PM**

Association Among Age, Muscle Size And Strength In Young Adults

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Purpose: Muscular strength is a key determinant of an older person's ability to maintain an active and healthy lifestyle. A reduction in muscle mass and strength has been commonly attributed to aging, but less is known about the relationship in younger adults. Therefore the purpose of the study was to assess the association between age, muscle mass and strength. This data is part of a larger study examining functional Single Nucleotide Polymorphisms associated with human muscle size and strength.

Methods: 888 Subjects (24.3±5.7 yrs old, range: 17.7-40.6) completed a 12 wk progressive resistance training program of the elbow flexors and extensors of the non-dominant arm. Subjects' isometric and dynamic elbow flexor strength (1RM) were measured before and after the 12 wk training period. Isometric strength, peak force at 90° joint angle, was measured using a specially constructed, modified preacher bench and strain gauge (model 32628CTL Lafayette Instruments Company). Dynamic 1RM was measured using a preacher curl bench (Yukon International Inc.) and dumbbells (Powerblocks, Intellbell, Inc.). Cross-sectional area of upper arm muscle at the biceps midbelly was measured using magnetic resonance imaging (MRI) before and after training. Habitual dietary intake was maintained over the course of the study. Data were analyzed using SPSS version 11.0. Pearson correlation coefficients were calculated for baseline and post-training measurements.

Results: We found that age was significantly and positively correlated to baseline biceps size ($r=0.1827$, $p<0.0001$) and elbow flexor strength ($r=0.1035$, $p=0.0034$; $r=0.1042$, $p=0.0026$, isometric and 1RM respectively), but not triceps size nor whole arm size. Age was related to change in 1RM ($r=-0.2276$ $p<0.0001$; $r=-0.2386$ $p<0.0001$, absolute and percent respectively), but no other measure of change in muscle size or strength.

Conclusion: These data suggest that even in young adults age has a small, but significant postive effect on muscle size and strength whereas it plays a minor yet negative role in a young, healthy adult's ability to alter strength with resistance training.

Supported by: NIH-IDS RO1 NS 40606-02

678 **4:15 PM - 4:30 PM**

Resistance Training Improves Knee Extension Power, Contractile Velocity, And Fatigue Resistance In Older Men And Women

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Muscle power exhibits greater age-related declines than strength consequent to marked declines in maximum contractile velocity. Further, older adults are less capable of sustaining maximum concentric velocity during repetitive contractions than young adults. **PURPOSE:** To investigate the effects of 16 wk progressive resistance training (PRT) on knee extension (KE) power, contractile velocity, and fatigability in older versus young adults. **METHODS:** Nineteen young (27.3 ± 1 yr, 9 men) and 18 older (64.1 ± 1 yr, 10 men) adults trained knee extensors 3 d/wk via knee extension, leg press, and squat, each for 3 sets x 8-12 repetitions, with training loads of 70-80% one-repetition maximum (1RM). Testing occurred at baseline, 8 and 16 wk post-training. Dynamic peak strength (1RM) was the heaviest load lifted with full range of motion. Peak concentric KE power was determined across a load spectrum of 5 submaximal loads relative to maximum isometric voluntary contraction (MVC) force (20, 30, 40, 50, 60% MVC). Fatigability was measured by a decline in peak contractile velocity across 10 reps of KE using an external load equal to 40% MVC. Peak concentric velocity was encouraged during power and fatigue tests. Thigh lean mass (TLM) was measured by DEXA. **RESULTS:** Men and women increased KE 1RM ($P<0.05$) by 8 wk with men also increasing strength from 8 to 16 wk. Adjusting for TLM, all groups increased KE specific strength from baseline ($P<0.05$). For the KE load-power curve, there was an upward displacement for all subjects ($P<0.05$) by 8 wk but no further increase from 8 to 16 wk. Tukey's HSD post-hoc testing revealed this upward displacement was driven primarily by older men, the only age-gender sub-group to increase by 8 wk ($P<0.05$). Because MVC increased, absolute loads lifted during power testing increased by 8 wk ($P<0.05$). Even at heavier loads, increased peak contractile velocity was found at each load up to 60% MVC ($P<0.05$). Increases in contractile velocity were driven primarily by older men. Fatigability tested at baseline showed no decline in peak contractile velocity across 10 repetitions in the young group while the older group showed fatigue (-17%, $P<0.05$). After training 8 wk, neither group exhibited significant fatigue. At 16 wk, the older group fatigued 12% as peak contractile velocity increased but 10th repetition velocity was unchanged. **CONCLUSIONS**: Conventional PRT increased strength, power, and contractile velocity in older adults, particularly in older men. PRT also enhanced fatigue resistance in older adults during repetitive contractions. Future studies should examine the efficacy of power training in older adults, especially in older women.

Sponsored by NIA R01 AG17896.

679 **4:30 PM - 4:45 PM**

Muscle Size After 24 Weeks Of Electrically-stimulated Resistance Training In Individuals With Spinal Cord Injury

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Complete spinal cord injury (SCI) leads to many profound physiological adaptations, including dramatic loss of skeletal muscle mass below the point of spinal lesion. **PURPOSE**: To examine the effect of 24 weeks of neuromuscular electrical stimulation (NMES)-evoked resistance training on affected skeletal muscle size in individuals with long-term SCI. **METHODS**: Five men with chronic, complete SCI (levels C5-T10) participated in this study. Average subject age and duration of injury was 35.6 and 13.4 yrs, respectively. Magnetic resonance images (MRI) of the thighs were collected before and after 24 weeks of training. The resistance training was performed at each subject's home where investigators provided instruction by telephone for each session. Subjects trained both thighs with NMES-evoked dynamic, loaded knee extensions 2 days/week for 4 sets of 10 repetitions. NMES activated primarily the quadriceps femoris (QF) muscle group and stimulation amplitude was increased during each repetition to evoke full knee extension. **RESULTS**: After training, skeletal muscle cross sectional area (CSA) increased 64% in the right QF (32.6 ± 11.2 to 53.3 ± 10.3 cm^2, $p = 0.004$) and 67% in the left QF (34.6 ± 11.5 to 57.6 ± 14.9 cm^2, $p = 0.002$), roughly equivalent to ~70% of CSA of able-bodied men (~80 cm^2). **CONCLUSIONS**: These results demonstrate that paralyzed skeletal muscle can still achieve substantial hypertrophy years after SCI with NMES-evoked resistance exercise.

Supported by HD 39676 and HD 39676S2 to GAD

680 **4:45 PM - 5:00 PM**

Acute Stretch-shortening Cycle Contractions Effects On Skeletal Muscle Morphology In Young And Old Rats

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Skeletal muscle is injured more easily in old animals than young animals; however, reports describing the effects of acute and potentially injurious exposures on the morphological response in young and old animals have varied substantially and reasons for this are not fully understood. **Purpose:** To investigate the effects of a potentially injurious stretch-shortening cycle (SSC) exposure on the morphological response of skeletal muscle in young (12 wk, n = 6) and old (30 m, n = 5) rats. **Methods:** Training was performed on the dorsi-flexor muscles of hybrid Fischer-344 x Brown Norway rats *in vivo*. The testing protocol consisted of 150 total SSC contractions (15 sets of 10 contractions), which were conducted at 500°/s throughout a 90°-140° range of motion. Ten days after treatment of SSCs, rats were anesthetized, weighed, and exsanguinated. The left (treated) and right (control) tibialis anterior muscle (LTA, RTA) was excised, weighed, sectioned, quick-frozen, and stored at -80° C. Transverse sections (12 µm) were cut, mounted on pre-coated microscope slides, and stained using a routine procedure with Harris Hematoxylin & Eosin.

Tissue sections were evaluated on a Leica DMLB microscope. Stereology was used to quantify the degree of inflammation and myofiber degeneration in muscle from each group and modifications to the interstitial space. **Results:** Stereological analyses revealed that 10 days following exposure to SSCs the volume density of myofibers with normal morphological features (i.e., fibers without evidence of edema or degeneration) was greater in the young when compared with the old animals ($p=0.0332$) and greater in the RTA compared with the LTA ($p=0.0432$). Further analyses revealed that the average thickness of the normal myofibers was decreased in the young LTA compared to the young RTA. The volume density of non-cellular interstium (NCI), or edema, was increased in the old when compared with the young ($p=0.0001$). Also the volume density of cellular interstium (CI) was shown to have a significant main effect and was increased in the LTA when compared with the RTA ($p=0.0088$). No degenerative myofibers were detected in control or injured muscles from either age group. **Conclusions:** We observed an increase in the volume density of normal myofibers in the young compared with the old animals at 10 days. Conversely, the volume density of NCI and CI were significantly increased in the old animals. Thus, following an acute exposure to injurious SSC contractions, muscles in young animals, but not old animals, recover more quickly and do so without residual signs of inflammation.

681 **5:00 PM - 5:15 PM**

Biceps Brachii Regional Growth In Response To 12-weeks Of Resistance Training

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Resistance training causes skeletal muscle to increase in size. The biceps brachii flexes the forearm and supinates the hand, and therefore must not only resist any weight that is held in the hand but also must resist any turning effect caused by the hand held weight. **PURPOSE**: To determine if elbow flexion resistance training causes a differential growth pattern in three distinct regions of the biceps brachii, near the origin (top of upper arm), the belly (middle of upper arm), and near the insertion (bottom of upper arm).

METHODS: 68 subjects (49F,19M) (25.9±0.8 y, 68.9±12.0 kg, 169.2±1.0 cm, mean ± SEM) participated in a 12wk non-dominant biceps strength training program. A progressive periodized training protocol consisting of 4wks of 12 reps (65-75% 1RM), 5wks of 8 reps (75-82% 1RM) and 3wks of 6 reps (83-90% 1RM) was employed. The exercises included a preacher bench curl, concentration curl, and standing curl. Subjects were studied pre- and post-training using MRI. A series of axial slices (15 slices, 16mm slice thickness, 0mm interscan spacing, 256 X 192 matrix, 22 X 22cm FOV) were collected to study a 24cm length of the upper arm. Volumes were calculated by determining the number of pixels in an assigned region of interest (ROI) within each successive slice, calculating the area (cm2) of each ROI, multiplying by the slice thickness (1.6cm), and summing the successive slice volumes. Pre-training volumes subtracted from post-training volumes yielded training-induced change in volume.

RESULTS: Three-slice volumes, compared for the origin, belly, and insertion regions, revealed differential growth. Biceps brachii volumes increased by 5.5±0.7mL (origin), 8.8±1.1mL (belly) and 12.6±1.3mL (insertion) ($P<0.05$).

CONCLUSIONS: These results indicate training-induced differential growth within the three regions of biceps brachii tested, with the largest change in volume near the insertion. This may have resulted from an increased training challenge experienced near the insertion due to a greater torque requirement needed to maintain proper hand supination.

Supported by: NIH-IDS RO1 NS40606-02

B-39 Clinical Case Slide – Cardiovascular

WEDNESDAY, JUNE 1, 2005 3:45 PM - 5:05 PM
ROOM: Jackson E

682 **Chair: Christine E. Lawless.** *Dupage Medical Group, Lisle, IL.*

683 **Discussant: Kenneth M. Leclerc.** *South Texas Cardiovascular Consultants, San Antonio, TX.*

684 **Discussant: Andrew Pipe, FACSM.** *University of Ottawa Heart Institute, Ottawa, ON, Canada.*

685 **3:45 PM - 4:05 PM**

Misdiagnosis Of Hypertrophic Cardiomyopathy In An Elite Athlete

Gregory P. Whyte, FACSM[1], Nigel Stephens[2], Roxy Senior[2], Sanjay Sharma[3], Robert E. Shave[4], William J. McKenna[5]. *[1]Olympic Medical Institute, Harrow, United Kingdom. [2]Northwick Park Hospital, Harrow, United Kingdom. [3]Lewisham UNiversity Hospital, Lewisham, United Kingdom. [4]Brunel University, Uxbridge, United Kingdom. [5]The Heart Hospital, London, United Kingdom.* Email: greg.whyte@eis2win.co.uk

HISTORY: An 35 year old, male International x-country and track endurance runner attended the CRY Centre for Sports Cardiology at the Olympic Medical Institute for second opinion following a diagnosis of hypertrophic cardiomypathy and advice to hault all high intensity training and competition. The initial diagnosis was made following 6 episodes of syncope reportedly during exercise, and echocardiographic evidence of left ventricular hypertrophy with a posterior free wall thickness of 14mm. **PHYSICAL EXAMINATION**: Resting bradycardia with normal heart sounds and resting BP. **DIFFERENTIAL DIAGNOSIS:** Hypertrophic Cardiomyopathy, Exercise Induced arrhythmia or vaso-vagal syndrome. **TEST AND RESULTS**: The athlete had no family history of cardiovascular disease including Hypertrophic Cardiomyopathy and sudden cardiac death. On questioning the syncopal episodes always occured when the athlete ceased exercise to micturate. Resting ECG was unremarkable for an elite endurance athlete. Integrated cardiopulmonary stress test demonstrated a normal HR, BP, VO_2, VCO_2 and V_E response with no inducible arrhythmia. Immediately on cessation of exercise blood pressure fell from 220/80 to 100/400 mmHg with a commensurate fall in HR from 192 to 50 bpm, leading to pre-syncopal symptoms described previously and near syncope abated by hyperventilation. Echocardiography was unremarkable with maximum wall thickness of 12mm and normal diastolic and systolic function. **FINAL WORKING DIAGNOSIS**: Exercise induced vaso-vagal syndrome. **TREATMENT AND OUTCOMES**: Continuation of training and competition with progressive warm-down built into sessions avoiding sudden cessation of exercise.

686 **4:05 PM - 4:25 PM**

Exercise Intolerance in a Soldier Athlete

Katrina E. Walters, Gregory G. Dammann, James H. Lynch. *Tripler Army Medical Center, Honolulu, HI.* (Sponsor: Francis O'Connor, FACSM)

HISTORY: A 22-year-old active duty Marine presented for care due to increasing exercise intolerance over a 4 month period, which was now preventing him from passing a standard 3 mile run physical fitness test. He reported significant shortness of breath and fatigue with minimal activity, which did not improve with 3-4 times per week Albuterol and twice daily Advair meter-dose inhalers. Review of systems was significant for a 15 pound unintentional weight loss, anorexia, intermittent hematochezia, and an episode of positional chest pain consistent with pericarditis.

PHYSICAL EXAMINATION: Examination revealed clear lung fields to auscultation. Cardiac examination revealed a rub heard best at the left lower sternal border without murmur, with or without provocative maneuvers. Rectal examination was heme negative. No lymphadenopathy was noted. The remainder of the examination was normal.

DIFFERENTIAL DIAGNOSIS

1. Inadequately treated asthma
2. Pericarditis
3. Heart Failure
4. Malignancy
5. Anemia
6. Deconditioning

TEST AND RESULTS:

Pulmonary Function Tests:

-Moderate restrictive lung disease (60-69% predicted FVC) and reduced total lung capacity on body box plethysmography consistent with moderate asthma with air trapping

CBC: -Hgb 11.5, Hct 35, MCV 74

ESR: 36

Chest anterior-posterior and lateral radiograph:

-enlarged cardiac silhouette

Transthoracic Echocardiogram:

-large right atrial mass, approximately 4cm x 6 cm size

Magnetic Resonance Imaging and Computed tomography of chest:

-large anterior mediastinal mass encasing superior vena cava with involvement of the right atria, mediastinal and left supraclavicular lymph node enlargement

Fine Needle Aspiration of left supraclavicular node (ultrasound guided):

-Reed-Sternberg cells seen

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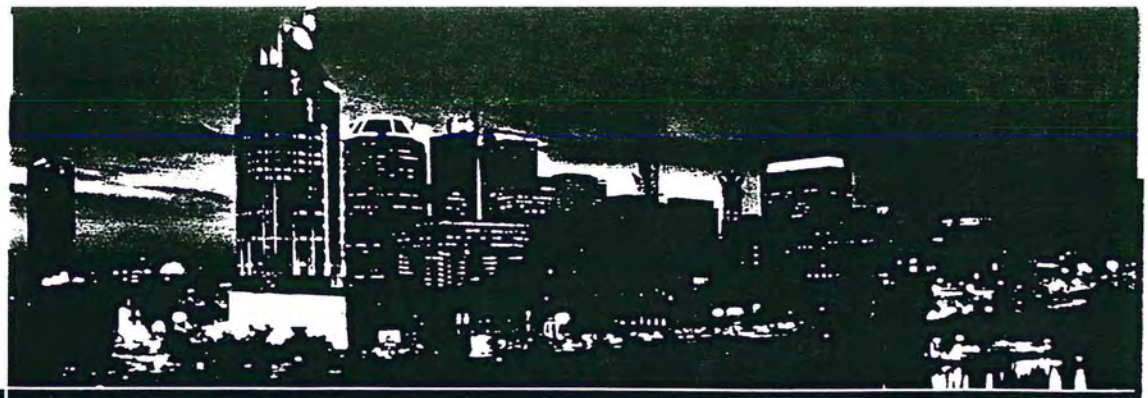

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