peak (8.7%) at week 13. The drop in heterogeneity thereafter remains relatively stable thorough 80 weeks of age. However, there is a stepwise decline in the percent heterogeneity from weeks 5-17 (peak 10.3%), weeks 17-44 (peak 4.7 %), and weeks 48-76 (peak 2.8%).
CONCLUSIONS: The data show localized hyperintense regions in muscles of the mdx mouse, which peak near the critical period. Interestingly, there was little change in the T2 signal heterogeneity from mdx muscles at later ages, at a time when muscle histology deteriorates and muscle necrosis continues despite a slight reduction in regeneration. Our findings suggest that researchers need to consider the age of mdx mice when designing imaging studies or evaluating MRI findings.
Supported by grants to RML from the NIH K01AR053235 and 1R01AR059179.

A-29 Thematic Poster - The Aging Cardiovascular System

May 29, 2013, 9:30 AM - 11:30 AM
Room: 209

111 **Chair:** Benjamin D. Levine, FACSM. *Presbyterian Hospital, The University of TX SW Medical Center, Dallas, TX.*
(No relationships reported)

112 Board #1 May 29, 9:30 AM - 11:30 AM

Chronic Exercise Does Not Mitigate The Effects Of Age And Cardiovascular Risk On Coronary Atherosclerosis

Beth A. Parker[1], Amanda L. Zaleski[1], Jeffrey A. Capizzi[1], Lindsay Lorson[1], Kevin D. Ballard[1], Christopher S. Troyanos[2], Aaron L. Baggish[3], Pierre A. D’Hemecourt, FACSM[2], Paul D. Thompson, FACSM[1]. [1]*Hartford Hospital, Hartford, CT.* [2]*Children’s Hospital, Boston, MA.* [3]*Massachusetts General Hospital, Boston, MA.*
(No relationships reported)

PURPOSE: The impact of chronic, high-intensity exercise training on the progression of atherosclerosis is unclear. The purpose of the current study was to assess the carotid intima medial thickness (cIMT) and cardiovascular risk of trained runners vs. their sedentary spouses or partners to evaluate the impact of exercise on the development of atherosclerosis. We hypothesized that chronic, long-distance running athletes would exhibit a more favorable carotid atherosclerotic profile relative to their sedentary partners.
METHODS: Forty two chronic runners (mean age ± standard deviation: 46±13 yr, n=21 women) who qualified for the 2012 Boston Marathon (running 40 ±16 miles/wk for the last 12 ±10 yrs) and their sedentary domestic controls (46±12 yrs, n=21 women) were assessed for demographics, medical and running history, vital signs, height, weight, blood lipids, c-reactive protein (CRP), calculated 10 year Framingham risk, central arterial stiffness (radial applanation tonometry) and cIMT (ultrasound). A paired-t was used to compare each variable between runners and controls and correlations and multiple linear regression were used to assess relations and interactions between continuous variables.
RESULTS: Runners exhibited lower CRP (p<0.01), non-HDL cholesterol (p=0.02), triglycerides (p=0.01), heart rate (p<0.01), body weight (p=0.03), BMI (p<0.01), and carotid augmentation index (p<0.05) as well as higher HDL cholesterol (p=0.03) than their sedentary controls. Left and right cIMT was not different between the two groups (p=0.31 and 0.53, respectively) and was strongly associated with age (r=0.57 and 0.57; both p<0.01) and Framingham risk score (r=0.47 and 0.44; both p<0.01) independent of group (all p>0.08 for interactions).
CONCLUSIONS: While chronic endurance running improves many aspects of the cardiovascular risk profile, it does not ameliorate the effect of age and estimated cardiovascular risk on cIMT. These results suggest that chronic endurance exercise may not be sufficient to reduce the progression of coronary atherosclerosis associated with age and cardiovascular disease.

113 Board #2 May 29, 9:30 AM - 11:30 AM

Heart Rate Recovery After Maximal Exercise is Blunted in Hypertensive Seniors

Tiffany B. Bivens[1], Qi Fu[2], Rhonda L. Meier[1], M. Dean Palmer[1], Kara N. Boyd[1], Sheryl A. Livingston[1], M. Melyn Galbreath[2], Graeme Carrick-Ranson[2], Naoki Fujimoto[2], Shigeki Shibata[2], Jeffrey L. Hastings[2], Matthew D. Spencer[2], Benjamin D. Levine, FACSM[2]. [1]*Institute for Exercise and Environmental Medicine, Dallas, TX.* [2]*The University of Texas Southwestern Medical Center, Dallas, TX.*
(No relationships reported)

Abnormal heart rate recovery (HRR) after maximal exercise may indicate autonomic dysfunction and is regarded as a predictor for cardiovascular mortality. Previous studies have shown that HRR is delayed in heart failure patients. It is unknown if HRR is normal in healthy seniors with hypertension.
PURPOSE: To determine HRR response in stage I hypertensive seniors.
METHODS: We tested 10 unmedicated hypertensive seniors (HTN) [5M/5F, 68 ± 5 (mean ± SD) y.o., awake ambulatory blood pressure (BP) 148 ± 10 / 85 ± 8 mmHg] and 10 healthy, age-matched controls (CON) [5M/5F, 67 ± 5 y.o., 123 ± 4 / 73 ± 4 mmHg]. Maximal upright treadmill testing was performed. Heart rate (HR), BP, oxygen uptake (VO2), cardiac output (Qc), stroke volume (SV), and lactates were obtained during two steady states and graded exercise to peak. During 5 minutes of seated recovery HR was obtained every 1 minute and BP every 2 minutes.
RESULTS: The VO2, HR, Qc, SV, TPR, and lactate response at rest and during exercise was not different between groups. During exercise systolic BP was higher in HTN (SBP, group effect p=0.015), and SBP was higher as well in recovery (group effect, p=0.002). Absolute HRR was blunted in HTN (Table 1, interaction effect p=0.028), and ΔHR from peak was significantly reduced in HTN at 1 minute (Table 1, p=0.002). When analyzing HRR as ΔRR Interval (RRI), there was a trend for HTN to have a blunted response at 1 minute (Table 1, p=0.059).
CONCLUSION: Otherwise healthy seniors with stage I hypertension have a blunted early HRR, indicating an impairment of autonomic function. Whether exercise and/or antihypertensive drug therapy could improve HRR in these patients needs to be determined.

Table 1. Heart Rate Recovery

Time Point	HTN	CON
Peak HR (bpm)	159 ± 10	164 ± 14
1 min. recovery HR (bpm)	136 ± 10 *	129 ± 19
2 min. recovery HR (bpm)	114 ± 11	112 ± 19
Δ HR peak to 1 min. recovery (bpm)	23 ± 6 †	35 ± 10
Δ HR peak to 2 min. recovery (bpm)	45 ± 7	52 ± 10
Δ RRI peak to 1 min. recovery (msec)	-64 ± 18 ‡	-152 ± 52
Δ RRI peak to 2 min. recovery (msec)	-107 ± 52	-181 ± 77

Mean ± SD. *interaction effect p = 0.028 vs. CON, † p = 0.002 vs. CON, ‡ p = 0.059 vs. CON

114 Board #3 May 29, 9:30 AM - 11:30 AM

Heart Rate Recovery is Associated with Central Adiposity in Obese Older Adults

Margie E. Jefferson, Michelle M. Gordon, Elizabeth A. Chmelo, Mary F. Lyles, Barbara J. Nicklas, Tina E. Brinkley. *Wake Forest School of Medicine, Winston Salem, NC.*
(No relationships reported)

Heart rate recovery (HRR) after exercise is often assessed as a measure of cardiovascular health. A decline in HRR, which has been linked to impaired autonomic function and increased risk of cardiovascular mortality, is often observed in aging and obesity. However, little attention has been given to the relationship between HRR and body composition and body fat distribution in the older adult population.

PURPOSE: We determined whether various indices of adiposity are associated with HRR in obese older adults.

METHODS: One hundred and twelve adults (27 males, 85 females) from 65-79 years with a BMI between 30-45 kg/m2 were assessed. HR was measured by electrocardiogram at rest, during a graded exercise treadmill test, and for 4 mins of recovery. HRR was defined as the difference between HR at peak exercise and at 1 (HRR1), 2 (HRR2), and 4 mins (HRR4) post-exercise. Anthropometry and dual energy X-ray absorptiometry were used to assess BMI, abdominal circumference, waist circumference, hip circumference, thigh circumference, waist-to-hip ratio, total fat mass and percent body fat.

RESULTS: Resting and peak HR were similar in men (84 ± 17 bpm, 145 ± 15 bpm) and women (86 ± 15 bpm, 143 ± 13 bpm). After exercise, HRR1 was 13 ± 10 bpm and 12 ± 13 bpm; HRR2 was 34 ± 13 bpm and 32 ± 12 bpm; and HRR4 was 51 ± 15 bpm and 48 ± 11 bpm in men and women, respectively. Overall, higher BMI, abdominal and hip circumferences, and total fat mass were associated with lower HRR4 ($p<0.04$), but not HRR1 or HRR2. Gender-stratified analyses revealed significant associations in women only. In women BMI ($r=-0.31$, $p=0.004$), waist circumference ($r=-0.29$, $p=0.007$), abdominal circumference ($r=-0.33$, $p=0.002$), hip circumference ($r=-0.33$, $p=0.002$), and total fat mass ($r=-0.26$, $p=0.01$) were correlated with HRR4, but not HRR1 or HRR2. After adjusting for peak VO2 and age, abdominal circumference remained associated with HRR4 ($\beta=-0.25 \pm 0.12$, $p=0.04$), while associations with hip and waist circumferences were attenuated ($p<0.06$). In men none of the adiposity indices were significantly associated with HRR at any time point.

CONCLUSION: Among obese older adults, abdominal circumference was independently associated with HRR at 4 mins post-exercise in women, but not in men. These results suggest that central adiposity may be an important determinant of HRR in this population.

115 Board #4 May 29, 9:30 AM - 11:30 AM

Aortic Stiffness Predicts Blood Pressure Responses to Exercise in Obese Older Adults

Tina E. Brinkley, Michelle M. Gordon, Elizabeth A. Chmelo, Margie Jefferson, Mary F. Lyles, W. Gregory Hundley, Barbara J. Nicklas. *Wake Forest School of Medicine, Winston-Salem, NC.*
(No relationships reported)

An exaggerated blood pressure (BP) response to exercise is an important predictor of cardiovascular disease risk. Age-related aortic stiffness as measured in elastic/muscular segments is associated with exercise BP, independent of BMI. However, it is unclear if exercise BP is related to aortic stiffness measured in the proximal elastic aorta, which is most affected by aging. Also, data are lacking on the influence of body composition and fat distribution.

PURPOSE: We determined associations of aortic stiffness and adiposity with BP responses to a maximal graded exercise treadmill test in 75 obese older adults (69 ± 4 yrs, BMI = 34.0 ± 3.1 kg/m2, 76% women).

METHODS: Systolic and diastolic BP were measured and pulse pressure (PP) was calculated at rest and during maximal exercise. Aortic arch pulse wave velocity (PWV) and distensibility of the ascending and descending aorta (AA, DA) were measured by MRI. Body composition and fat distribution were assessed by dual-energy x-ray absorptiometry and anthropometry.

RESULTS: During exercise there were significant increases in systolic BP, diastolic BP, and PP (all $p<0.001$), that did not differ by gender. BP values at maximal exercise were as follows: systolic = 180 ± 24 mmHg (range = 134-250 mmHg); diastolic = 87 ± 11 mmHg (range = 64-120 mmHg); PP = 93 ± 20 mmHg (range = 54-150 mmHg). In linear regression models adjusted for age, gender, VO2 peak, and standing BP, maximal systolic BP was strongly associated with PWV ($\beta = 35.4 \pm 17.4$, $p<0.05$) and modestly associated with distensibility (AA: $\beta = -25.9 \pm 13.8$, $p=0.07$; DA: $\beta = -13.3 \pm 11.6$, $p=0.25$). After separately including BMI, waist/hip/thigh circumferences, waist-to-hip ratio, total fat mass, or % body fat, PWV remained associated with systolic BP. When BMI was included in the model with AA distensibility, the association with systolic BP became significant ($\beta = -29.3 \pm 13.8$, $p=0.04$). AA distensibility was also inversely associated with PP in multivariate models that included BMI ($p=0.03$) or total fat mass ($p=0.04$). There were no significant associations with diastolic BP. Also, none of the adiposity variables were associated with BP at maximal exercise.

CONCLUSION: In obese older adults, higher aortic stiffness as measured by increased PWV and decreased distensibility, predicts a higher BP response to exercise, independent of adiposity.

116 Board #5 May 29, 9:30 AM - 11:30 AM

Effect of Continuous versus Discontinuous Aerobic Exercise on Augmentation Index in Young versus Older Adults

Michael J. Landram[1], Alan C. Utter, FACSM[2], Steve R. McAnulty[2], Carlo Baldari, FACSM[1], Laura Guidetti, FACSM[1], Scott R. Collier, FACSM[2].
[1]University of Roma “Foro Italico”, Rome, Italy. [2]Appalachian State University, Boone, NC.
(No relationships reported)

The speed at which the reflected wave within the aorta travels is directly correlated with cardiovascular disease (CVD). Exercise has shown to be an effective prophylactic to prevent and treat CVD, however many aging adults have difficulty with continuous exercise. Recently, discontinuous exercise has shown benefits comparable to continuous exercise yet direct clinical comparisons between modes have been neglected.

PURPOSE: Therefore the purpose of this study was to examine the oxygen uptake and augmentation index (AIx) differences in continuous versus discontinuous exercise in young versus older populations.

METHODS: 45 male and female subjects (young = 21.65±0.4 years; older 48.29±0.8 years) were randomly assigned to a group prior to baseline testing for VO2max and AIx. Subjects were then reassessed one month later after the control period and then one month following either a continuous aerobic (30 minutes at 70-75% HRmax) or discontinuous (3 bouts of 10 minutes of exercise at 70-75% HRmax) protocol.

RESULTS: Both continuous and discontinuous groups demonstrated a significant improvement in VO2max ($p<0.001$), heart rate max ($p<0.05$), while group differences were greater in the older population for AIx.

CONCLUSIONS: AIx improved to a greater degree in the middle aged population when compared to the younger regardless of the training mode.

117 Board #6 May 29, 9:30 AM - 11:30 AM

Small and Large Arterial Stiffness and Aging in Highly Active People

Maleah Holland. *Indiana University, Bloomington, IN.*
(No relationships reported)

Age-related stiffening of the arteries is a strong marker for future cardiovascular complications with small arterial stiffness shown to be a better indicator of cardiovascular health than large arterial stiffness. Findings on the relationship of small arterial stiffness with age in highly active individuals are limited as the large artery has been the primary focus in cardiovascular health studies.

PURPOSE: The aim of this study is to describe the relationships between habitually high levels of physical activity, age and arterial stiffening.

METHODS: 38 young (Y) college students (20.6 ± 1.3 yrs), 24 men, 14 women, and 49 older (O) adults (57.6 ± 10.5 yrs), 21 men, 25 women were categorized as highly active (HA) (17 Y, 25 O) or general population (GP) (21 Y, 20 O) based on self-reported physical activity questionnaires and heart rate/accelerometer monitors. Resting cardiovascular measurements including large (C1) and small (C2) arterial compliance were recorded. Statistical analysis included t-tests with $p<0.05$.

RESULTS: Men and women were pooled in both the Y and O groups, as no sex differences were found. The YGP demonstrated greater C1 and C2 than the OGP (18.5 ± 3.8, 8.0 ± 1.9 vs. 12.8 ± 3.0, 4.6 ± 2.6 mL/mmHgx10, respectively), whereas, the YHA demonstrated greater C2 but not C1 than the OHA (10.4 ± 2.5, 18.2 ± 4.0 vs. 6.9 ± 3.7, 18.4 ± 5.2 mL/mmHgx10, respectively). In regards to age-matched activity level comparisons, YHA demonstrated a greater C2 but not C1 than YGP (10.4 ± 2.5, 18.2 ± 4.0 vs. 8.0 ± 1.9, 18.5 ± 3.8 mL/mmHgx10, respectively), and OHA demonstrated greater C1 and C2 than OGP (18.4 ± 5.2, 6.9 ± 3.7 vs. 12.8 ± 3.0, 4.6 ± 2.6 mL/mmHgx10, respectively).
CONCLUSION: Similar to our findings, the literature suggests that activity may reduce age-related stiffening in the large artery. Our cross-sectional study demonstrated that at a younger age, high levels of activity seemed to benefit C2 but not C1. With age and possibly more time to develop structural changes in the arteries, our study demonstrated that activity benefited both C1 and C2 as the older habitually highly active showed less stiffness than their age-matched relatively inactive peers. Therefore, high levels of habitual exercise may help reduce the risk for cardiovascular complications by minimizing age-related small and large arterial stiffness.

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118 Board #7 May 29, 9:30 AM - 11:30 AM

Age-related Differences Of The Athlete`s Heart

Zsuzsanna Kneffel. *Qatar University, Doha, Qatar.*
(No relationships reported)

PURPOSE: Analyzing at which age exercise training induces modifications of heart and which of the characteristics of the athlete's heart develops in the different ages.
METHODS: A systematic literature review (meta-analyzis) of 66 echocardiography studies.
RESULTS: In children age (<10-12 years) usually no or a small training effect can be detected. Approximately two years of intensive training are necessary to induce definite training effects. In the adolescent and young athletes (14-18 years), the left ventricle (LV) hypertrophy is already manifest. Left ventricle muscle mass (LVMM) is higher in older (50-80 years) endurance athletes than in age-matched non-athletes but the difference between athletic and non-athletic subjects decrease continuously or disappears during the ageing. The long-lasting, high-intensity endurance trainings are the most effective ways to activate mechanisms, inducing the development of coronary circulation. No difference was seen between athletic and non-athletic children comparing their diastolic function (E/A). In the competitive age (19-35 years) athletes have a higher E/A than non-athletes (1.98 ± 0.37, vs. 1.73 ± 0.31, p = 0.013). In the 36-55 yr. age range physically active persons showed a higher E/A quotient than passive ones (1.574 ± 0.186 vs. 1.383 ± 0.069, p = 0.0327). At the older age in (age>55 years) active subjects also displayed significantly higher E/A quotients (1.104 ± 0.093) than passive persons (0.917 ± 0.104), p = 0.004. According to the Tissue Doppler Imagining (TDI) the mitral lateral annulus seems to be the most sensitive region to detect difference in the E'/A' quotient. At the competitive age difference between athletes and non-athletes was significant (3.21 ± 0.64 vs. 2.32 ± 0.55, p = 0.0265) similarly to the result of transmitral E/A (1.97 ± 0.37 vs. 1.73 ± 0.31, p = 0.0228, < 0.05).
CONCLUSIONS: Different characteristics of the athlete's heart are manifested unequally during the lifetime: LV hypertrophy develops at the young age; differences reach the maximum in young adults (36-55 years) and are less marked in older subjects. Coronary capillary network seems to develop mostly in younger athletes, while a difference in diastolic function seems to be more manifest in the competitive age but also appear in older subjects.

A-30 Free Communication/Slide - **Determinants of Body Weight and Weight Loss**

May 29, 2013, 9:30 AM - 11:00 AM
Room: Wabash 3

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119 **Chair:** Ellen Evans, FACSM. *University of Georgia, Athens, GA.*
(No relationships reported)

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120 May 29, 9:30 AM - 9:45 AM

Effect of a Lifestyle Intervention Prior to Bariatric Surgery on Objectively Measured Physical Activity in Severely Obese Adults

John M. Jakicic, FACSM, Melissa A. Kalarchian, Marsha D. Marcus, Anita P. Courcoulas, Michele D. Levine. *University of Pittsburgh, Pittsburgh, PA.*
(No relationships reported)

It is common for obese adults to be required to engage in a weight loss intervention prior to undergoing bariatric surgery. Few studies have quantified the effect that this requirement has on changes in objectively measured physical activity prior to bariatric surgery.
PURPOSE: To examine the effect of a 6-month behavioral lifestyle intervention (BLI) on physical activity compared to usual care (UC) prior to bariatric surgery.
METHODS: Data from 97 severely obese adults (BMI=47.0±5.9 kg/m2) seeking bariatric surgery were used for this study. These 97 subjects are a subset from a larger trial who provided complete physical activity and weight data. Subjects were randomized to UC (N=46) or BLI (N=51) for 6 months prior to approval for surgery. UC completed a non-standardized, physician supervised diet and activity program in the context of routine pre-surgical care. BLI consisted of 12 in-person sessions and 12 telephone contacts delivered over 6 months, and a diet and physical activity prescription of 1200-1400 kcal/d and 30 minutes per day, 5 days per week. Weight and objectively measured physical activity (SenseWear Pro Armband) were assessed at 0 and 6 months. Moderate-to-vigorous intensity physical activity (MVPA) was defined as bouts that were >10 minutes in duration and >3.0 METS (MVPA-10) and total minutes >3 METS (MVPA-TOT). Light physical activity (LPA) was defined as total minutes of activity between 1.5 to <3.0 METS.
RESULTS: MVPA-10 and MVPA-TOT increased in BLI (+24.4 min/wk and 39.4 min/wk, respectively) and decreased in UC (-11.0 min/wk and -53.7 min/wk, respectively) (p>0.005). LPA increased in BLI (+71.7 min/wk) and decreased in UC (-117.2 min/wk) (p=0.005). Weight loss was significantly greater in BLI (-9.6±7.7kg; -7.3±5.8%) versus UC (-3.8±5.3kg; -3.0±4.2%) (p<0.001).
CONCLUSION: In severely obese adults, participation in BLI resulted in modest increases in LPA and MVPA, which may have prevented decreases in MVPA and LPA as observed in UC. This may have contributed to the improved weight loss observed in BLI compared to UC. Further investigation is needed to determine whether these differences in physical activity pre-bariatric surgery influence weight loss success and physical activity behavior post-bariatric surgery.
Supported by the National Institutes of Health (R01 DK077102)

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121 May 29, 9:45 AM - 10:00 AM

Energy Intake, Non-exercise Physical Activity And Successful Weight Loss: The Midwest Exercise Trial-2 (met-2)

Stephen D. Herrmann, Jeffery J. Honas, Erik A. Willis, Richard A. Washburn, FACSM, Joseph E. Donnelly, FACSM. *University of Kansas Medical Center, Kansas City, KS.*
(No relationships reported)

Changes in energy intake (EI) or non-exercise physical activity (NEPA) may affect the weight loss response to aerobic exercise training.
PURPOSE: To evaluate differences in EI and NEPA between responders (RS; weight loss ≥ 5%) and non-responders (NR; weight loss < 5%) performing 10 months of supervised aerobic exercise training.
METHODS: Seventy-four overweight/obese (BMI 25-39.9) sedentary young adults (18-30 years) completed a 10-month trial (i.e., ≥ 90% scheduled exercise sessions) of treadmill exercise (5 d.wk-1,70-80% max heart rate, supervised ≥4 d.wk-1) at either 2,000 (n = 37; 19 females) or 3,000 (n = 37; 18 females) kcal.wk-1. EI (kcal.d-1) was measured by picture-plate-waste and NEPA (min.d-1 of sedentary and moderate-to-vigorous activity [MVPA]) were assessed by Actigraph GT1M accelerometer over 7 consecutive days at baseline, and at months 3.5, 7, and 10. Participants were instructed to maintain baseline EI and NEPA during the 10 month intervention. T-tests for independent samples and Chi-Squares were used to assess statistical significance.