2015

Effect of high school sport participation on bone density of college-aged females

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2586 May. 29 1:55 PM - 2:20 PM

miRNA Responses to Cyclic Compressive Loading (Massage) During Muscle Recovery from Atrophy

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(No relationships reported)

Massage is a manual therapy modality used most often to release pain, decrease stress, and aid in the recovery after strenuous exercise. Interestingly, we recently showed that massage also aids in muscle regrowth after atrophy not only in the massaged, but also in the contralateral untreated muscle. Underlying mechanisms for this growth promoting effect of massage are currently unknown. Since miRNAs are involved in determining protein content and composition and are known to be able to travel in the serum through exosomes, we decided to perform a miRNA analysis.

PURPOSE: To determine miRNA response to massage in the form of cyclic compressive loading (CCL) in gastrocnemius muscles of rats recovering from atrophy.

METHODS: Fisher344/BN male rats (n=6 per group) were hind limb suspended for 14 days to induce atrophy and allowed to reambulate with and without 4 bouts of CCL for 8 days. Total RNA was isolated from gastrocnemius muscles and the abundance of miRNAs was determined using Taqman low density arrays which contain 641 unique miRs. Serum was collected and some exosomal miRs were determined.

RESULTS: A total of 327 miRs were detectable in muscle of which 24 were differentially expressed ($p<0.05$) between massaged and non-massaged muscles: 20 miRs were downregulated while only 4 were upregulated with massage. Dicer mRNA was not changed with massage. The 5 most down regulated miRs were: miR-138, -345, -322, 106b and -25 which were lower by a range of 100-2.5 fold. The upregulated miRs were: miR-133, -673, -503, and -874 and they were upregulated by 2-3.5 fold. Predicted targets of potential interest for muscle growth were: IGFR (targeted by 2 downregulated miRs), MAPKKK (targeted by 3 down regulated miRs), and glucose transporters (targeted by 2 upregulated miRs). Some Ca^{2+} regulatory genes were also targeted by the differentially expressed miRs. Exosomal miRs tested were miR-1, -182, and -206, since these are known miRs to influence muscle, but they did not show a difference in abundance in exosomes between the two groups.

CONCLUSION: A distinct group of miRs responds to changes in loading due to simulated massage in muscles undergoing regrowth after atrophy. Future studies need to be directed toward determining targets of the miRs involved in muscle recovery after disuse. Supported by funds from NIH (AG042699) and UKCHS Research.

F-12 Thematic Poster - **Bone Mineral Density in Athletes**

Friday, May 29, 2015, 1:00 PM - 3:00 PM
Room: 28E

2612 **Chair:** Robert L. Franco. *Virginia Commonwealth University, Richmond, VA.*

(No relationships reported)

2613 Board #1 May 29, 1:00 PM - 3:00 PM

Effect of High School Sport Participation on Tibia Bone Density and Geometry in College-Aged Females

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(No relationships reported)

Studies show that regular physical activity (PA) during youth positively impacts bone structure and strength. Further, research suggests that these strength gains during youth may persist into adulthood.

PURPOSE: To examine the influence of high school sport participation on bone structure and strength among college-aged females.

METHODS: Peripheral quantitative computed tomography was used to assess bone density and strength among 18-25 year old females with varying levels of high school sport participation (n=31; n=10 multiple sport athletes (MSA), n=11 single sport athletes (SSA), n=10 no sport control (NSC)). Tibia total bone area (ToA), total volumetric density (ToD) and an estimate of bone compressive strength (bone strength index (BSI) were measured at the distal (4%) site. Cortical bone area (CoA), cortical density (CoD), and bone bending strength (section modulus, Z) were measured at the midshaft (66%) site. Body composition (total body mass, kg; fat mass, kg; fat-free mass, kg) was measured using air displacement plethysmography. Typical PA levels were assessed using the International Physical Activity Questionnaire.

RESULTS: MSA were 24-26% heavier than both SSA and NSC; MSA had 16% greater muscle mass and SSA had 11% less fat mass than NSC (all $p<0.05$). At the tibia 4% site, MSA had 18% greater ToD, resulting in 32% higher BSI than NSC (both $p<0.05$). At the tibia 66% site MSA had 2% greater CoD and 17% greater CoA, which resulted in 17% higher bone strength (Z) compared to NSC (all $p<0.05$). SSA had 5% greater CoA than NSC ($p<0.05$), but no difference in bone strength compared to NSC. Current physical activity levels were not different between groups.

CONCLUSIONS: Results showed that participation in multiple sports during high school led to more robust tibial bone structure and strength compared to females who participated in a single or no sport. Further, multiple sport participants had higher total body and fat-free mass than those who did not participate in high school sports. Given similar current levels of PA, multiple sport participation among females during youth appears to positively influence bone strength in young adulthood. Further research should investigate the effect of specific sports and differing current levels of PA.

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2614 Board #2 May 29, 1:00 PM - 3:00 PM

Bone Functionality and Collegiate Cross Country Athletes

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(No relationships reported)

PURPOSE: High impact repetitive loading associated with most sports is beneficial to the skeletal system (Kohrt 2004). Collegiate athletes should have stronger, more functional skeletons compared to the general public. However, a relatively large percentage of athletes get stress fractures (Fredericson 2006). Bone strength is adapted by a set of multiple bone traits including bone mass, density and geometry (distribution of the bone) and therefore no one variable can indicate a bone's positive or negative adaptation (Jepsen 2013). Our purpose was to determine if collegiate cross country athletes had functionally adapted tibia for their sport.

METHODS: Cortical area (Ct.Ar), cortical bone mineral density (cBMD), moment of inertia (J) and bone strength (polar Strength-strain Index, SSI) were measured in 16 athletes from CSU East Bay Cross Country team (7 females and 9 males (age: 19.7 ± 1.4 yrs., body fat % 14.9 ± 6.9)) using peripheral quantitative computed tomography (pQCT) at 25% tibial length.
Bone functionality was assessed by plotting bone strength vs loading (body weight x tibial length). Based on the residuals from the linear regression, an athlete's individual functionality was determined and two groups were formed (functionally adapted and less adapted). Student's t-test detected differences in bone traits and anthropometric variables.