A-47 Free Communication/Poster - Age-Dependent Physiology

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM
Room: CC-Hall WA2

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An Investigation Into Age-related Sarcopenia In Rodents

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(No relevant relationships reported)

With aging, there is a decline in both skeletal muscle size and quality. This occurrence is known as sarcopenia and the implications due to this decline can be debilitating. Previous research has elucidated genes that are associated with muscle sarcopenia and how a change in expression can affect both muscle protein synthesis and degradation, which can affect skeletal muscle size and quality. **PURPOSE:** To investigate the expression of genes relating to skeletal muscle growth, collagen synthesis, and inflammation across the lifespan of rats. **METHODS:** Sedentary male Fischer 344 rats were fed ad libitum and were aged to 3 and 24 months (mo) (n=8 per age group) and then sacrificed. Body and gastrocnemius (gastroc) weights were collected and muscle was processed for RNA isolation and sent out for RNA sequencing. The following genes relating to muscle growth, collagen synthesis and inflammation were analyzed: Myostatin (MSTN), Insulin-like Growth Factor 1 (IGF-1), Insulin-like Growth Factor 2 (IGF-2), phosphorylated Mechanistic Target of Rapamycin (mTOR), Collagen Type I Alpha 1 Chain (COL1a1), Collagen Type I Alpha 2 Chain (COL1a2), Collagen Type IV Alpha 1 Chain (COL4a1), Lysyl Oxidase (LOX), Nuclear Factor Kappa B Subunit 1 (NFkB1), Tumor Necrosis Factor (TNF), Interleukin 6 (IL-6), and Interleukin 1 Beta (IL-1B). **RESULTS:** MSTN expression was significantly higher in 3 vs. 24 mo rats ($p = 0.018$), and was positively correlated to relative gastroc weights ($R = 0.663$, $p = 0.005$). All genes related to collagen synthesis were significantly higher in 3 vs. 24 mo rats (COL1a1, $p < 0.001$; COL1a2, $p = 0.007$; COL4a1, $p = 0.030$; LOX, $p = 0.046$). Furthermore, COL1a1 and COL1a2 were positively correlated to relative gastroc weight ($R = 0.649$, $p = 0.007$; $R = 0.730$, $p = 0.001$, respectively). However, no genes related to inflammation were significantly different between age groups, but there was a negative correlation between IL-6 gene expression and relative gastroc weights ($R = -0.546$, $p = 0.028$).**CONCLUSION:** We suspect 24-month old rodents may be too young to capture the sarcopenia symptoms that occur with aging. However, the relationship between inflammation and relative gastrocnemius muscle weight may warrant further investigations in rodents older than 24 months.

contractile function was assessed by Biodex. These variables were further explored in participants that were classified as sarcopenic (n=6) or non-sarcopenic (n=15). Muscle biopsies of the vastus lateralis were obtained to determine fiber type proportion and cross-sectional area by immunohistochemistry. RESULTS: Several resting phosphorus metabolites were related with muscle size and function in older adults. In particular, a phosphodiester peak (PDE2), considered a marker of membrane integrity, was negatively associated with skeletal muscle mass index ($r = -0.38$, $p < 0.01$), muscle volume ($r = -0.37$, $p < 0.01$), and peak power ($r = -0.38$, $p < 0.01$). PDE2 was elevated in sarcopenic patients in comparison to non-sarcopenic controls (2.48 ± 0.11 mM vs. 1.92 ± 0.08 mM, $p < 0.01$). ATP_{max} was not different between sarcopenic and non-sarcopenic individuals. At the cellular level, PDE2 was negatively correlated to myofiber area ($r = -0.51$, $p = 0.03$) but not fiber type proportion. CONCLUSION: Elevated resting PDE2 levels in muscle were associated with lower muscle mass and strength in older sarcopenic adults. While ATP_{max} was not related to the sarcopenic phenotype, our results reveal that resting *in vivo* phosphorus metabolite profiles may be a viable cellular marker of muscle quality in older adults. Supported by NIH Grants K01 AG04437 and R01 AG021961

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Amount and Variability of Adipose Tissue Content in Human Quadriceps Muscles of Older Adults

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INTRODUCTION: Obesity is a significant health problem that can compound health-related morbidities in aging adults. While substantial research has elucidated many of the metabolic consequences of obesity, much less is known about the effects of adipose tissue (fat) deposition on skeletal muscle function. Some evidence exists to suggest that obesity may interfere with muscle force production, but this is an understudied area of research. **PURPOSE**: To quantify *in vivo* the amount and distribution of fat and lean muscle tissue in the quadriceps muscles of healthy older adults. **METHODS**: The dominant legs of 8 healthy, sedentary adults (71 ± 4 yrs, mean $\pm$ SD; 4 men; BMI: 25.1 ± 3.3 kg·m^{-2}) were evaluated using a 6-point Dixon imaging technique in a 3 tesla magnetic resonance system. Axial slices (5 mm thick) were acquired for the entire thigh, and each image in which all 4 quadriceps muscles were visible was analyzed to determine fat and muscle volumes (cm^3), and fat fractions (fat/total*100; %). The location (% muscle length) of peak muscle volume and fat fraction, as well as the deviation from the line of best fit (2nd order polynomial) of these variables were calculated as measures of tissue distribution and heterogeneity. Differences in means were evaluated by paired t-tests. **RESULTS**: Fat-free muscle volume, fat volume, and fat fraction were 821 ± 287 cm^3, 75 ± 26 cm^3 and 8.6 ± 1.1%, respectively. Peak muscle volume and fat fraction occurred in different locations (70.7 ± 7.7 vs. 19.3 ± 23.2% length, $p=0.001$), with a 3-fold greater coefficient of variation for fat fraction than muscle volume. Likewise, slice-to-slice variability of fat fraction was greater than for muscle volume (4.7 ± 1.5 vs. 1.2 ± 0.3%, $p<0.001$). **CONCLUSIONS**: These data show greater spatial variability of fat deposition in comparison to lean tissue in the quadriceps muscles of older adults. Combining these measures with traditional indices of muscle function may provide additional insight about the mechanical impact of intramuscular adipose tissue deposition *in vivo*.
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