CONCLUSION: Damaging exercise increases muscle injury markers and decreases strength and redox status irrespective of SC content in human skeletal muscle. Higher SC content is associated with lower levels of DOMS during the initial phase of recovery.

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Deoxyhemoglobin Kinetics And Fatigability Of The Knee Extensors In Young And Older Adults

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Adult aging is accompanied by increased fatigability of limb muscles (exercise-induced loss of power) during moderate- to high-velocity dynamic contractions. However, the mechanisms for the age-related increase in fatigability are unclear.
PURPOSE: Determine if the age-related increase in fatigability is associated with altered deoxyhemoglobin (deoxy[heme]) kinetics during exercise.
METHODS: Knee extensor fatigability and deoxy[heme] kinetics were quantified in 13 young (23 ± 4 yrs; 7 women/6 men) and 12 older (75 ± 5 yrs; 4 women/8 men) adults during a 4 min fatiguing exercise task. The exercise task consisted of 80 maximal-velocity contractions (1 contraction every 3 s) of the knee extensors lifting a load equivalent to 20% of the maximal voluntary isometric contraction. Local muscle deoxy[heme] of the rectus femoris was measured during exercise with near-infrared spectroscopy and is expressed as a percent of the physiological range obtained during 5 min of ischemia. The deoxy[heme] response during the transition from rest to exercise was fit using a mono-exponential model with a time delay.
RESULTS: Fatigability (percent reduction in power) was less in young (20 ± 9 %) compared with older adults (36 ± 12 %, $p = 0.04$, $d = 0.86$). The deoxy[heme] time delay was not different between young (5.3 ± 0.7 s) and older adults (5.7 ± 1.5 s, $p = 0.30$, $d = 0.42$) nor was tau (young: 6.9 ± 2.6 s, older: 6.0 ± 3.2 %, $p = 0.47$, $d = 0.29$). Thus, the mean response time (time delay + tau) of deoxy[heme] was also not different between young (12.1 ± 2.7 s) and older adults (11.8 ± 3.0 s, $p = 0.75$, $d = 0.13$). Pre-exercise deoxy[heme] (% of physiological range) was not different between young (7 ± 6 %) and older adults (6 ± 5 %; $p = 0.91$, $d = 0.05$). However, there was a moderate effect of age on maximal deoxy[heme] (young: 64 ± 18 %, older: 51 ± 18 %, $p = 0.08$, $d = 0.74$). The R^2 for fatigability and maximal deoxy[heme] was 0.14 ($p = 0.07$).
CONCLUSIONS: These data suggest that deoxy[heme] kinetics during the transition from rest to exercise, which reflect the balance between oxygen utilization and oxygen delivery, are not altered with aging. However, the lower maximal deoxy[heme] observed in older adults indicates that a decreased ability for oxygen extraction may play a small role in the age-related increase in fatigability.

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Load Dependent Modifications To Stimulated Concentric Torque-frequency And Angular Velocity-frequency Relationships In Human Knee Extensors

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PURPOSE: To compare electrically stimulated concentric torque-frequency and angular velocity-frequency relationships during isotonic contractions at two loads.
METHODS: In a Cybex dynamometer the right knee extensors of 10 healthy young (26 ± 4 years) adults were tested. Stimulating electrodes were placed transversely over proximal and distal portions of the knee extensors. Electrical current level was set to produce 50% isometric maximal voluntary contraction (MVC) torque at 100 Hz. In the "isotonic mode" dynamic contractions were stimulated through a range of motion from 90 - 150°. With the dynamometer load set to 0% and 15% MVC, contractions were stimulated in ascending frequency at 1, 5, 7.5, 10, 12, 15, 17, 20, 25, 30, 40, 50, 75 and 100 Hz, with 20s of rest between contractions. Stimulation pulses ceased once full range of motion was achieved or when full range of motion was unachievable.
RESULTS: Data are presented as a percentage of relative peak concentric torque or peak velocity for 100 Hz. For unloaded isotonic contractions, at 1 and 5 Hz velocity was ~58 and ~24 % lower than torque (both $p < 0.003$), with no difference at 7.5 Hz ($p = 0.8$). From 10 - 30 Hz velocity was 5 - 13 % greater than concentric torque ($p = 0.0006$ - 0.04). At 40 - 100 Hz there were no statistical differences ranging from 0 - 3%. During loaded isotonic contractions, frequencies up to 7.5 Hz did not produce enough torque to generate joint rotation and thus velocity was 0%. From 10 - 15 Hz peak velocity was 35-95% lower than torque (all $p<0.001$). From 17 - 40 Hz velocity was 5 - 35% lower than torque (all $p<0.05$). From 50 - 100 Hz differences were not statistically different (0 - 3%).
CONCLUSIONS: During unloaded isotonic contractions stimulated at 10-30 Hz, the angular velocity-frequency relationship was shifted leftward relative to the concentric torque-frequency relationship. Conversely, during a moderately loaded isotonic contraction stimulated at 10 - 40 Hz, the angular velocity-frequency relationship was rightward shifted relative to the concentric torque-frequency relationship. Thus, altering the load during an isotonic contraction modifies both the angular velocity- and concentric torque-frequency relationships at moderate stimulation frequencies. Supported by NSERC.

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Serum Myonectin Correlates With Abdominal Adiposity But Not With Serum Or Intramuscular Lipids In Adults

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Myonectin is a myokine that has favorable effects on serum lipid regulation in murine models, but human studies have shown conflicting results. Also, the function of myonectin in humans can be more comprehensively addressed by extending the analysis to its relationship with the accumulation of lipids in natural and ectopic depots.
PURPOSE: To assess the relationship between serum myonectin and lipids in three different compartments, named, serum, global and regional fat mass, and intramuscular lipid content, in adults with metabolic risk factors.
METHODS: Cross-sectional study carried out in adults who met at least one metabolic criterion of the metabolic syndrome (MS). Serum myonectin was determined by enzyme-linked immunosorbent assay, lipid profile by conventional techniques and free fatty acids by gas chromatography. Total and regional fat mass was studied by dual-energy X-ray absorptiometry. Intramuscular lipid (intramyocellular (IMCL) and extramyocellular (EMCL)) content was assessed through proton nuclear

magnetic resonance spectroscopy in the right *vastus lateralis* muscle.
RESULTS: The subjects (n=90) had a (median (interquartile range)) age of 51.5 (46.0–56.0) years, 71% of which were women. The whole sample had a serum myonectin of 1.08 (0.89–1.48) ng·mL^{-1}, triglycerides (mean±standard deviation) of 167.8±91.9 mg·dL^{-1}, high density lipoproteins of 46.7±11 mg·dL^{-1}, low density lipoproteins of 146.2±46.8 mg·dL^{-1}, palmitic acid of 0.196±0.108 µg·dL^{-1} and stearic acid of 0.096±0.058 µg·dL^{-1}. Their body mass index was 29.4±4.2 kg·m^{-2}, fat mass index 11.1±3 kg·m^{-2} and android/gynoid ratio 0.58±0.17. IMCL, EMCL and total intramuscular lipids were 9.5 (5.7-13.9), 28.1 (19.7-42.5) and 40.6 (27.9-59.6) mmol·kg^{-1} ww, respectively. Multiple linear regression models adjusted for age, sex, fat mass index and lean mass index showed that myonectin was negatively correlated only with the android/gynoid ratio (R^2=0.48, P<0.01), but not with any other variable of the study.
CONCLUSION: Myonectin may have a role in the pathophysiology of the MS by negatively
regulating the accumulation of fat in abdominal depots. CODI-UdeA 58-1-948 (2020-34909, 2021) and 102 (2021-40430, 2021).

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Are There Age-Related Differences In Contraction-Induced Accumulation Of Intramyocellular H^+ And Pi In Vivo?

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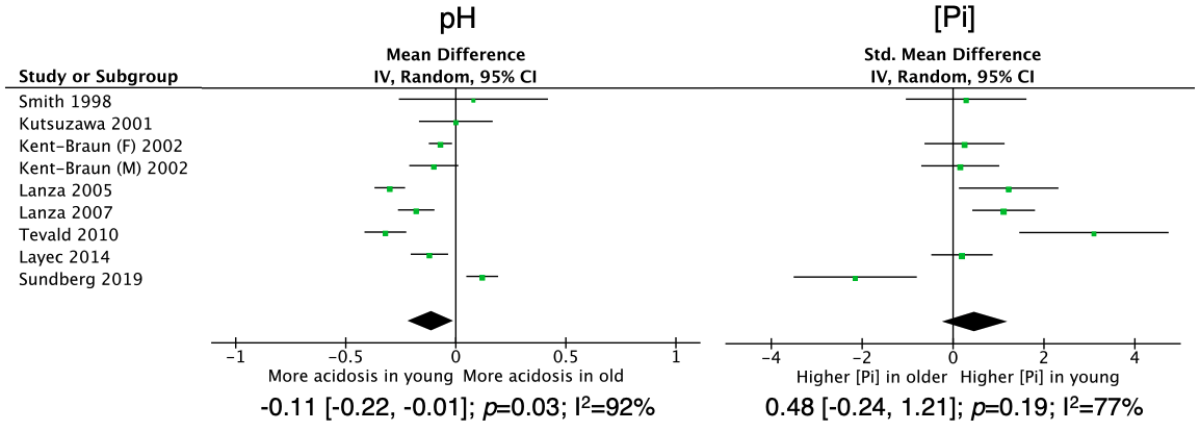
Although it is clear that the metabolic basis of skeletal muscle fatigue (a transient decrease in peak torque or power in response to contraction) involves the accumulation of intracellular H^+ (decreased pH) and inorganic phosphate (Pi), the effects of age on contraction-induced accumulation of these metabolites has not been evaluated systematically.
PURPOSE: Compare pH and [Pi] in young (18-45 yr) and older (55-85 yr) muscle *in vivo* following contractions and evaluate the influence of contraction mode.
METHODS: PubMed, Web of Science, and SPORTDiscus were searched and returned 2,855 results. Titles and abstracts were screened by 2 reviewers and 120 articles were included for full-text review. Protocols designed to limit acidosis were excluded. Eight articles (9 effects) fit the inclusion criteria. Participant characteristics, pH, [Pi], and contraction mode (isometric, dynamic) were extracted. A random-effects model was used to calculate the overall mean difference (MD) and standardized mean difference (SMD) for pH and [Pi], respectively, along with 95% confidence intervals (CI). Subgroup analysis by contraction mode was also investigated. A negative value indicated lower pH in young and higher [Pi] in older.
RESULTS: There was a significant overall effect for pH (*k*=8) such that young acidified more than older, with no overall effect for [Pi] (*k*=7), Figure 1. The effect for isometric contractions was significant for pH (MD = -0.19; 95% CI, -0.30, -0.09; *k*=4) and [Pi] (SMD = 0.99; 95% CI, 0.22, 1.75; *k*=4), but not for dynamic contractions (pH: MD = 0.01, 95% CI, -0.14, 0.16; *k*=4; [Pi]: SMD = -0.49, 95% CI, -1.90, 0.92; *k*=3).
CONCLUSION: This analysis indicates that working muscle acidifies less in older than young *in vivo*, with this difference mainly established by isometric contractions. These results may be modified by additional factors such as sex, muscle group, or physical activity, but more research will be needed to make that determination.

Figure 1. Overall effects for age-related differences in muscle acidosis and [Pi] following contractions *in vivo*.



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Instantaneous Fatigue Measured With Electrical Stimulation And Accelerometer

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Muscle fatigue is an important consequence of muscle activity. Measuring muscle fatigue require voluntary and maximal efforts that are often performed after the muscle activity has finished.
PURPOSE: Measure the time course of muscle fatigue during and after a strenuous bout of exercise using electrically induced twitch contractions and muscle acceleration.
METHODS: Healthy male and female, college-aged participants were tested (n=8, 4 women and 4 men, age=20±1.4yrs, BMI=24.3±3.3Kg/M^2). A triaxial accelerometer and two stimulation electrodes were placed on the medial gastrocnemius muscle. Subjects performed 60 seconds of single-leg (~0.5Hz) calf raises.