

correlated to percentage of energy intake from saturated fatty acids ( $r_s = 0.431, p < 0.05$ ) and trunk flexibility ( $r_s = -0.504, p < 0.05$ ). As for women, there was a significant and negative relation between trunk EI and baPWV ( $r_s = -0.504, p < 0.05$ ).

**CONCLUSIONS:** Factors associated with trunk EI were different between younger men and women. Flexibility and dietary fatty acid intake may significantly relate to skeletal muscle quality in younger men. In younger women, arterial stiffness may significantly affect to quality of trunk skeletal muscle.

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### History Of Exercise Associated Muscle Cramping Among 10973 Comrades Ultramarathon Race Entrants - A Safer Study

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**PURPOSE:** The prevalence of a history of exercise-associated muscle cramps (hEAMC) among ultramarathon runners is high. While the Comrades is one of the most popular community-based mass participation ultramarathons (90km) globally, research on the epidemiology and clinical characteristics of entrants' lifetime hEAMC is scarce. The purpose of this paper is, therefore, to describe the epidemiology and clinical characteristics of hEAMC among the 2022 Comrades ultramarathon entrants.

**METHODS:** This retrospective, cross-sectional study investigated 10973 consenting race entrants of the 2022 Comrades ultramarathon (90km). Entrants completed a pre-race medical questionnaire that included questions related to the lifetime prevalence (%; 95% CI), severity, and treatment of EAMC.

**RESULTS:** The lifetime and 12-month prevalence of hEAMC were 14.4% (95% CI: 13.8%-15.1%) and 9.1% (95% CI: 8.6%-9.6%), respectively. The lifetime hEAMC was higher among males (16.1%; 95% CI: 15.3-16.9%) than females (8.3%; 95% CI: 7.3-9.5%;  $p < 0.0001$ ). Across age groups ( $\leq 30$ ; 31-40; 41-50, >50 years), lifetime hEAMC was similar (14.1%-15.8%). The muscle groups most commonly affected were the calf (37.5%) and hamstring (33.7%) muscles, and hEAMC was mostly reported during the race's fourth quarter (50.6%). Most (67.5%) cramping episodes lasted less than five minutes and did not prevent entrants from finishing the race or training session. To relieve an acute cramp, entrants mostly stretched (88.6%) and rested (81.0%). Few entrants (3.0%) required hospitalization, had dark urine or experienced confusion after an EAMC episode.

**CONCLUSIONS:** There is a high prevalence of calf cramping during the race's final quarter, especially among male entrants <30 years. Prevention and management programs should incorporate strategies to offset the risk of EAMC in this group. Findings from this study can assist medical personnel of ultramarathons to adequately plan for race day in order to navigate EAMC-related complications effectively. Research should compare the prevalence of hEAMC among participants of the 90km comrades and other ultra-marathon races. Multivariate risk models should also be considered to identify risk factors associated with hEAMC among ultramarathon runners.

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### Joint Angle And Anchoring Scheme Affects Performance Fatigability And Electromyographic Responses Following Fatiguing Isometric Tasks

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**PURPOSE:** The purpose of this study was to examine the effects of joint angle and anchoring scheme on MVIC and electromyographic (EMG) responses at task failure following sustained, isometric forearm flexion tasks in women.

**METHODS:** Ten women (age:  $21.0 \pm 2.8$  yrs; height:  $168.5 \pm 7.2$  cm; body mass:  $68.0 \pm 7.2$  kg) performed 2, 3 s MVICs at joint angles (JA) of 75°, 100°, and 125° (randomized) before and after sustained, fatiguing isometric forearm flexion tasks to failure at joint angles (FJA) of 75° and 125° (dominant arm), anchored to a rating of perceived exertion (RPE) of 8 (RPE = 8) and the initial torque that corresponded to RPE = 8 (TRQ), while EMG signals were recorded from the biceps brachii. For the RPE = 8 visits, task failure was defined as RPE > 8 or torque reduced to zero. For the TRQ visits, task failure was defined as the inability to maintain the target torque. Separate 2 (Anchoring Scheme: RPE = 8 and TRQ) x 2 (Fatiguing Joint Angle: 75° and 125°) x 3 (MVIC Joint Angle: 75°, 100°, and 125°) repeated measures ANOVAs were performed for percent changes in MVIC, EMG amplitude (AMP), and EMG mean power frequency (MPF).

**RESULTS:** The pre-test MVIC at JA100 was significantly greater than both JA75 ( $p = 0.001$ ) and JA125 ( $p = 0.002$ ). There was no significant ( $p = 0.369$ ) mean difference in time to task failure (TTF) for FJA75 ( $73.9 \pm 38.4$  s) versus FJA125 ( $80.8 \pm 76.5$  s) when anchored to TRQ, but when anchored to RPE = 8, FJA75 ( $361.7 \pm 260.0$  s) was significantly greater ( $p = 0.009$ ) than FJA125 ( $152.3 \pm 90.4$  s). For the percent change in MVIC, MVIC JA125 (23.7%) was significantly greater ( $p < 0.001$ ) than MVIC JA75 (15.3%), but not MVIC JA100 (19.6%,  $p = 0.038$ ). During the fatiguing tasks at FJA75, EMG AMP decreased for MVIC JA100 (16.7%) and MVIC JA125 (16.3%), but MVIC JA100 had a significantly greater (16.7%,  $p = 0.004$ ) percent change than MVIC JA75 (-1.5%). For EMG MPF, there were decreases for both anchoring schemes, but TRQ had a significantly greater (11.5%,  $p = 0.003$ ) percent change than RPE = 8 (2.7%).

**CONCLUSIONS:** Following the fatiguing tasks at FJA75 (RPE = 8 and TRQ), the decreases in EMG AMP and MVIC at MVIC JA100 and MVIC JA125 suggested that both central and peripheral fatigue contributed to the decline in MVIC. For MVIC JA75, however, the decline in MVIC, but increase in EMG AMP were likely due to peripheral fatigue.

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### A New Model For Non-invasive Estimation Of Muscle Composition In Team Sport Athletes

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The fiber type composition of the athletes can be studied by muscle biopsy. However, it is an invasive, thus discouraged procedure. We standardized a method to non-invasively estimate the area occupied by type II fibers (FTII) in the vastus lateralis muscle (VLM) based on the quantification of intramuscular carnosine by proton

magnetic resonance spectroscopy (<sup>1</sup>H MRS). Carnosine is enriched in FTII in athletes.

**PURPOSE:** To develop a simple and easy-to-apply model for estimating muscle fiber types composition in team sports athletes using <sup>1</sup>H MRS as gold standard.

**METHODS:** Cross-sectional study with 51 high-performance, young athletes (20.6±2.9 years, 58% women), of team sports (26% handball, 22% basketball, 22% floor volleyball, 18% softball, 8% beach volleyball, 6% indoor soccer). The area occupied by FTII in the VLM was estimated by quantifying carnosine by <sup>1</sup>H MRS in a 3T scanner using a surface coil. Field tests (speed, jump, maximum oxygen uptake), anthropometric measurements and demographic variables were obtained. A multiple linear regression model was built based on biological plausibility and Hosmer-Lemeshow criterion. The model with the highest R<sup>2</sup> and the lowest value of the Akaike Information Criterion was selected. The assumptions of normal distribution of the errors were verified using the Shapiro-Wilk test, homoscedasticity with the Breusch-Pagan test, and non-correlation with Durbin-Watson d statistic.

**RESULTS:** The population had an FTII of 32.9±8.9%, speed of 7.3±0.5 m/s, counter movement jump (cmj) of 34.0±7.3 cm and body fat percentage of 16.7±6.3%. Men had a higher FTII (38.3±8.8%) than women (29.1±6.9%) (p<0.001). A significant correlation of the FTII with speed (r=0.528; p<0.001), cmj (r=0.509; p<0.001) and body fat percentage (r=-0.335; p=0.019) was found. The model complied with the assumptions and has a predictive scope: FTII (%)=3.04+2.30\*(speed in m/s)+0.56\*(cmj in cm)+0.58\*(body fat in %)-0.92\*(age in years)+7.68\*(sex; male=1; female=0).

**CONCLUSION:** The selected independent variables explained by 42% the variability of the area occupied by FTII in team sport athletes. This new model for estimating the composition of skeletal muscle fibers depends on field tests, anthropometric measurements and demographic variables that are very easy to obtain in clinical practice.

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### Effects Of Collagen Peptide Supplementation On Biomarkers Of Connective Tissue Turnover: CTX/P1NP Ratio

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**BACKGROUND:** Connective tissue (CT) dysfunction is a hallmark of aging, with decreased tissue turnover leading to decrements in body-wide structure and function. While age related tissue turnover in muscle and bone is associated with declines in synthesis, recent evidence using deuterium in adult compared to aged mice suggests collagen remodeling declines with age due to decreased degradation rather than synthesis of collagen fibrils. This results in stiff fibrotic CT with diminished force production and high susceptibility to injury and disease. Collagen peptides (CP) are thought to exert positive effects on bone and connective tissue remodeling. Serum C-terminal telopeptide (CTX) and procollagen type-I N-terminal propeptide (P1NP) are measures of bone and collagen turnover and are strongly correlated with changes in bone mineral density. Although, directionality is dependent on intervention and mechanisms of action, and tissue measured. Therefore, the purpose of this double-blind randomized placebo-controlled trial was to characterize the effects of daily consumption of CP (SOLUGEL<sup>®</sup>) over 6-months on CTX and P1NP concentrations in middle-aged active adults.

**METHODS:** Participants (N=58) were randomized into 3 groups: 20 g/d CP (n=19), 10 g/d CP (n=19), or placebo (n=20). Serum was collected at baseline, 3 months, and 6 months to assess changes over time in CTX and P1NP. A mixed model ANOVA was used to assess CTX/P1NP ratio. Pairwise comparisons were used for post hoc analyses of significant interactions with Bonferroni correction for multiple comparisons. Data are mean ± standard deviation.

**RESULTS:** A significant interaction between the treatments and time on CTX/P1NP concentrations was observed,  $F(4, 110) = 3.552, p = .009, \eta_p^2 = .114$ . CTX/P1NP levels significantly increased from baseline (.00658 ± .00288 ng/mL) to 6 months (.00879 ± .00287 ng/mL) in the 10 g/d group (p = .001). No significant changes were observed in the 20 g/d or placebo groups.

**CONCLUSIONS:** Six months of daily collagen peptide supplementation of 10 g, but not 20 g or placebo, yielded significant increases in CTX/P1NP ratio. These findings suggest 10 g/d is effective for promoting collagen turnover. Therefore, CP supplementation may play an important role in tissue growth and repair via connective tissue remodeling.

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### Ultrasound Shear Wave Speeds Following Hamstring Strain Injury & Return To Sport

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Ultrasound (US) and magnetic resonance imaging (MRI) aid in visualizing structural disruption following hamstring strain injury (HSI). However, traditional measures do not provide insight into altered tissue material properties, which relate to muscle performance. US shear wave speed (SWS) is an emerging quantitative imaging technique that can provide insight into characterizing tissue material properties after HSI.

**PURPOSE:** To determine between-limb differences in SWS at time of injury (TOI), return to sport (RTS), and 12 weeks post-RTS (12wks) in a cohort of collegiate athletes following an HSI.

**METHODS:** US SWS imaging was performed at TOI, RTS, and 12wks concurrently with MRI in Division I student-athletes participating in either football, soccer, or track and field. SWS maps were acquired by a musculoskeletal-trained sonographer using a commercial US (Aixplorer, Supersonic Imagine) and linear array transducer (2-10 MHz) at the HSI location and location-matched on the contralateral limb. Injury location and primary muscle of injury were confirmed via MRI at TOI. Athletes were only included if they had evidence of edema on MRI at TOI. Athlete demographics are reported as mean (standard deviation) and days to RTS as median (interquartile range). Separate paired t-tests for each time point were performed to compare between-limb differences in SWS (*Healthy - Injured*, presented as mean difference [95% confidence interval]).

**RESULTS:** A total of 23 unique injuries occurred (2 female; age = 19.9 (1.49) years, 182.2 (6.8) cm, 84.6 (16.9) kg). Of these, 13, 9, and 5 injuries were included at TOI, RTS, and 12wks, respectively. Median time to RTS was 33 (20, 50) days. Edema was present in 8/9 athletes at RTS and 2/5 athletes at 12wks. Significant between-limb differences in SWS were observed at TOI (0.21 m/s [0.07, 0.35], p=0.007) and RTS (0.25 m/s [0.12, 0.38], p=0.002). No differences were detected between limbs at 12wks (-0.02 m/s [-0.31, 0.27], p=0.84).

**CONCLUSIONS:** Lower SWS in the injured limb may correspond to both edema presence and disruption of the perimysium. Resolution of SWS differences between RTS and 12wks may relate to perimysium maturation (~8 weeks post-injury) but needs clinical validation.

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