Fibre and region specific differences in the subcellular distribution and morphology of lipid droplets in skeletal muscle of trained, sedentary, obese and type 2 diabetic males

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The athletes' paradox describes the phenomenon whereby both highly trained athletes and type 2 diabetes (T2D) patients store large quantities of lipid in skeletal muscle however the athletes remain highly insulin sensitivity whilst T2D patients are insulin resistant. Intramuscular triglycerides (IMTG) are stored in lipid droplets (LD) in skeletal muscle, and it is thought that fibre type distribution, subcellular location, size and number of LDs relate to insulin sensitivity more so than IMTG content, however this is yet to be investigated in human skeletal muscle. The aims of the study were to examine differences in LD distribution and morphology in skeletal muscle and acquire a better understanding of the relationship between LD distribution, morphology and insulin resistance. Eight lean, trained males (age: 21±1y; stature: 1.79±0.03m; body mass (BM): 72.3±1.4kg), 8 lean, sedentary (LS) males (age:67±1y; stature: 1.78±0.14m; BM: 76.7±2.9kg), 8 obese, males (age: 60±4 y; height: 1.76±0.02m; BM: 97.0±4.0kg) and 8 obese, male T2D patients (age: 61±3y; height: 1.76±0.17m; BM: 109.7±5.4kg) donated muscle biopsies. Cryosections (5µm) were labelled using primary antibodies MHCI and MHCIIa in addition to appropriate secondary antibodies and the cell border stain WGA-633. LDs were stained using BODIPY. Images were obtained using confocal immunofluorescence microscopy. Total LD content was not different between groups in type I or type IIx fibres (P>0.05). However, in type IIa fibres, LD content was significantly higher in the LS group (6.12±2.2%) compared to the trained group (2.46±2.0%; P=0.018). In the peripheral region (5µm beneath the plasma membrane), the LD content in TIIa fibres was significantly greater in the LS group (7.16±2.7%) than in trained individuals (2.82±2.4%, P=0.030). In the central region of the cells, the LD content was higher in LS (6.2.8±2.6%) individuals compared to T2D individuals (2.79±2.0%; P=0.034) and trained individuals (2.42±1.9%; P=0.016). In type IIa fibres there was greater LD size in the LS group (0.64±0.04 µm^2) compared to obese (0.39±0.05 µm^2; P=0.013), T2D (0.42±0.07 µm^2; P=0.022) and trained (0.37±0.05 µm^2 P=0.005). There were no significant differences in LD density between groups in any of the regions investigated (P>0.05). These data suggest that the differences in LD content predominate in TIIa fibres and are mostly driven through an increased LD size in lean sedentary individuals. This data shows a different relationship to the athlete's paradox whereby older age and inactivity may be a more important determinant of LD content than body mass and insulin sensitivity.

The effect of high-intensity interval training on the synthesis of muscle protein in obese men

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Obesity and physical inactivity are risk factors for hypertension, type 2 diabetes and cardiovascular disease. A deterioration in skeletal muscle quality may contribute to the development and progression of these risk factors whereas exercise training, in particular high-intensity interval training (HIIT), may counteract these detrimental processes. The rate of synthesis of proteins may affect the protein quality and function, therefore the aim of this study was to investigate the effects of HIIT on the synthesis of individual proteins in obese humans. Four males (age = 38 ± 4 y, body mass index, 34 ± 5 kg/m^2, maximum oxygen uptake 26 ± 4 ml/kg/min^{-1}) gave their informed consent to the ethically reviewed procedures, and consumed deuterium oxide (D_2O, 200 ml/d) to label newly synthesised proteins during two 14-day periods either prior to HIIT (baseline) or during weeks 9 and 10 of a 10-week HIIT cycling protocol (post-exercise). HIIT consisted of 4 × 1-minute bouts interspersed with one minute active rest and was progressed by the addition of one extra repetition at 2-week intervals. Saliva samples were collected daily, and blood and muscle samples were collected on days 0, 4, 9 and 14 of each D_2O consumption period. Reported here is the analysis of muscle (vastus lateralis) protein using 1-dimensional gel electrophoresis and matrix-assisted laser desorption ionisation time of flight mass spectrometry. Protein abundance was measured by densitometry of gel bands and the synthetic rate of proteins was calculated from the change in peptide mass isotopomer distribution due to incorporation of D_2O. Creatine Kinase M-type (KCRM) was confidently identified (MOWSE score = 75) by searching peptide mass spectra against the Swiss-Prot database and mass isotopomer distribution analysis of 5 KCRM-specific peptides was used to calculate synthesis rate in each participant. There was no change in the relative abundance of KCRM in muscle after HIIT (P = 0.245). The rate of synthesis of KCRM at baseline was 0.9 ± 0.7%·d and was not significantly (P = 0.702) different to the rate (1.4 ± 0.9%·d) measured during the final 2 weeks of HIIT. The rate of synthesis of KCRM reported here is similar to recent literature in sprint-trained men (Shankaran et al. [2015] Journal of Clinical Investigation *126,* 288-302; ~1.4%·d), but differs from that (Camera et al. [2017] FASEB Journal*, 31,* 5478-5494; ~4.1%·d) reported in men who undertook resistance exercise. The current work supports previous work the use of D_2O as a potential technique to measure abundance and synthetic rates of proteins in humans.

The effects of duration and intensity of High Intensity Interval Training on cardio-metabolic health in inactive individuals

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In the current UK population, more than 50% of adults are physically inactive, with lack of time being frequently reported as a cause for physical inactivity. High intensity interval training is a time-efficient and effective exercise approach to improve cardio-metabolic health. To date, the two most commonly used protocols in the literature consist of performing repeated intervals of 30 or 60 seconds sprint cycling above VO_{2max}. The aims of the present study were; 1) to determine the most effective HIT protocol to improve aerobic capacity and markers of cardio-metabolic health, and 2) to investigate how individual differences in heart rate (HR) and power output responses relate to changes in VO_{2peak}. In a randomised crossover design, 42 participants not currently meeting the recommended exercise guidelines (<150 min moderate-intensity exercise per week) completed two different exercise protocols across 6 weeks: 4-8 × 30s "all out" sprints; 2 min active recovery (30HIT) or 6-10 × 60s "all out" sprints; 60s active recovery (60HIT). Training sessions were completed on a Wattbike, 3 times per week. Participants were instructed to reach >80% of predicted maximal heart rate (HR_{max}). HR and power output data from each training session was obtained along with pre and post-training measures of VO_{2peak}, body composition and blood pressure. VO_{2peak} increased post intervention by 2.3±1.1ml·min^{-1}·kg^{-1} in 30HIT and 2.9±0.2ml·min^{-1}·kg^{-1} in 60HIT (P<0.001), with no difference between training protocols (P=0.445). Total body fat percent decreased post intervention by 3.5% in 30HIT and 6.3% in 60HIT (P<0.05), however there was no difference between training protocols (P=0.067). Mean arterial pressure (MAP) decreased post intervention by 1.9±0.1mmHg in 30HIT and 3.0±0.1 in 60HIT (P<0.001), with no difference between training protocols (P=0.352). In 60HIT, participants producing a higher percentage of their predicted HR_{max} (top 25%) improved their VO_{2peak} to a value greater than 3.5ml·min^{-1}·kg^{-1} (5.4 ml·min^{-1}·kg^{-1}), significantly higher than those producing a low percentage of HR_{max} (bottom 25%) (2.2ml·min^{-1}·kg^{-1}; P<0.05); however, no significance was found in 30HIT. The same was true for 60HIT when normalized to mean HR and peak power output (P<0.05). These data demonstrate that both 30HIT and 60HIT increased VO_{2peak} and decreased blood pressure and total body fat percentage. However, in 60HIT a higher peak HR and power output were associated with larger increases in VO_{2peak}. Importantly, the increase in VO_{2peak} was greater than ~3.5 ml·min^{-1}·kg^{-1}, which is linked to a reduction in all-cause mortality, highlighting the effectiveness of HIT to improve cardio-metabolic health in a time-efficient manner.

Dehydr8 and deactiv8: The impact of a typical 8-day course of 'target weight' driven haemodialysis on the hydration status and physical function of adults with end-stage renal disease

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Maintenance haemodialysis (HD) is used as a treatment of end-stage renal disease (ESRD), which aims to avoid hypervolemia. Consequently, HD can result in intradialytic hypotension, which is known to worsen both cardiovascular and physical function. A paucity of research has investigated the hydration status of these individuals and whether (de)hydration may impact upon their physical function. The present study therefore aimed to characterise the effects of HD on the hydration status and physical function of adults with ESRD undergoing in-hospital maintenance HD. Preliminary data from a larger ongoing project is presented. Eight adults (5 male; age: 59 ± 10 years) undergoing thrice-weekly HD at the Wessex Kidney Centre (Queen Alexandra Hospital, Portsmouth) participated, which had received ethics approval from the NHS Local Research Committee. Hydration status was measured using saliva flow rate (SFR), plasma osmolality (P_{osm}) and thirst perception (TP; measured using a visual analogue scale). Muscular endurance was assessed using the 30 s sit-to-stand test (STS30), heel raises and toe lifts to exhaustion. The maximal handgrip strength test assessed muscular strength and Moberg's picking-up test (MPUT) assessed fine motor skills. Due to lethargy-induced temporary withdrawal, 109 / 160 (68%) physical function tests were successfully completed pre-HD whilst 102 / 160 (64%) tests were completed post-HD. Pre-HD SFR (0.12 ± 0.17 mL·min^{-1}) was not significantly reduced compared to post-HD SFR (0.27 ± 0.47 mL·min^{-1}; P = 0.75). P_{osm} resulted in a significantly lower concentration post-HD (299.8 ± 7.2 Osm) when compared to pre-HD (307.5 ± 6.2 Osm; P = 0.05). No significant difference was apparent for TP (pre-HD: 6.1 ± 2.2 cm *vs.* post-HD: 5.1 ± 3.5 cm; P = 0.20). There were no significant differences between pre- and post-HD STS30 (10 ± 4 repetitions (reps) *vs.* 9 ± 5 reps; P = 0.34), heel raises (27 ± 25 *vs.* 19 ± 16 reps; P = 0.20), toe lifts (15 ± 6 *vs.* 14 ± 9 reps; P = 0.78), and grip strength (26.1 ± 9.0 *vs.* 23.8 ± 8.3 kg; P = 0.06). There was no significant difference in MPUT performance pre- versus post-HD with either eyes open (12 ± 1 *vs.* 12 ± 3 s; P = 0.83) or closed (29 ± 27 *vs.* 27 ± 19 s; P = 0.74). The present findings highlight a conflicting relationship between SFR, P_{osm}, and TP, which warrants further investigation.

The feasibility and utility of alternative hydration markers in adults with end-stage renal disease receiving 'target weight' driven haemodialysis

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Maintenance haemodialysis (HD), involving ultrafiltration of blood plasma, is a primary treatment modality for individuals with end-stage renal disease (ESRD). Presently, HD aims to remove excess fluid to prevent hypervolaemia. However, this can lead to severe dehydration and increased risk of mortality. Bioelectrical impedance analysis (BIA) is currently considered as the 'gold standard' assessment for hydration status. However, its clinical utilisation and understanding is limited. Despite this, a paucity of research has sought to investigate alternative markers of hydration status in this population. Therefore, the aim of this cross-sectional study was to investigate the feasibility and utility of *(1)* saliva flow rate (SFR), *(2)* saliva osmolality (S_{osm}) and *(3)* plasma osmolality (P_{osm}) as markers of hydration in adults with ESRD undergoing in-hospital HD, compared with BIA measures. Six adults (mean ± SD age 62.0 ± 9.6 years) receiving thrice weekly in-hospital HD sessions at the Wessex Kidney Centre at Queen Alexandra Hospital participated in the study, which had received NHS Local Research Ethics Committee approval. Assessments of hydration status were collected pre- and post-HD. SFR was calculated by collecting unstimulated saliva samples in pre-weighted tubes over 2 min using a swab placed under the tongue. S_{osm} was determined using the freezing point depression method and achieved through spinning the salivette centrifuge tube (3000 g for 5 min at room temperature), allowing the analysis of accumulated saliva. P_{osm} was calculated using the freezing point depression method from blood samples aspirated from the fistula graft, which was centrifuged at 1500 g for 15 min. Pre- and post-HD thirst perception (TP) using visual analogue scale and body mass were also collected. TP was significantly reduced following HD (3.71 ± 3.36 vs. 5.41 ± 2.91 cm; $P = 0.03$). No significant differences were found between pre- and post-HD SFR (0.06 ± 0.30 vs. 0.04 ± 0.01 mL·min^{-1}; $P = 0.06$). There were no significant changes in the concentration of either S_{osm} (154.86 ± 20.18 vs. 128.57 ± 28.08 Osm; $P = 0.24$) or, P_{osm} following HD (304.00 ± 2.19 vs. 297.43 ± 3.66 Osm; $P = 0.62$). *This study is ongoing with results pending.* These findings were unexpected and suggest that the use of SFR, P_{osm}, S_{osm} and TP may not be suitable as hydration makers in this population, warranting further research. In addition, the current study highlighted the potential inaccuracy of BIA and its limited clinical utility.

The effect of footwear on stride length and knee joint loading in over-ground running in recreational endurance runners

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Running injury rates are reported anywhere between 20 and 79%, with the knee cited as the most common site of injury (van Gent et al. [2007]. British Journal of Sports Medicine, *41*, 469-480). The inability of the lower extremities to deal with loads applied during initial stance phase has been identified as a causal factor for injury. Specifically, an increased sagittal-knee-joint moment is believed to be associated with patella-femoral pain (Kerrigan et al. [2009]. PM&R, *1*, 1058-1063). Following this, barefoot running and minimalist-running shoes have been employed to reduce knee-joint loads, with reduced stride length associated with decreased lower-limb-joint loading (Schubert et al. [2014]. Sports Health, *6*, 210). As barefoot and minimalist running conditions can decrease joint loading, it can be hypothesised that maximally-cushioned shoes might increase sagittal-knee-joint loading. This has not been examined despite 'maximally-cushioned' shoes gaining popularity. The purpose of this study was to compare the effects of barefoot, minimalist and maximally-cushioned shoes on stride length and sagittal-knee-joint loading in over-ground running. With institutional ethical approval, 15 participants agreed to have kinematics and kinetics recorded by 14 optoelectronic cameras and embedded-force platforms during over-ground running. Participants were habituated during a 30 min run in each footwear condition (barefoot, minimal shoes, maximally-cushioned shoes). The order of conditions was counterbalanced with 24 hrs between conditions and all trials within a participant conducted at the same time of day. Post habituation, participants ran over a 20 m indoor track and through a gait lab where kinematic and kinetic data were collected. Stride length and peak-knee-flexion moment were compared with speed adjusted 90% CIs. Stride length was shorter in barefoot than in minimal (−0.073 to −0.024 m) and maximally-cushioned shoes (−0.111 to −0.055 m) and shorter in minimal than maximally-cushioned shoes (−0.059 to −0.011 m). Peak-knee-flexion moment was lower when barefoot than in minimal (−0.296 to −0.006 $Nm \cdot kg^{-1}$) and maximally-cushioned shoes (−0.462 to −0.130 $Nm \cdot kg^{-1}$) and was lower in minimal than maximally-cushioned shoes (−0.286 to −0.004 $Nm \cdot kg^{-1}$). There were positive correlations between stride length and peak-knee-flexion moment in all conditions (r =0.67, P = 0.01; r=0.53, P=0.04; r=0.73, P<0.01 for barefoot, minimal and maximally-cushioned shoes respectively). Results suggest that moving from barefoot to minimal to maximally-cushioned shoes increases stride length and peak-knee-flexion moment. An increased posterior braking force with longer stride lengths could explain this. Furthermore, an increased stride length was associated with increased knee-flexion moment. Future studies designed to reduce sagittal-knee-flexion moment should consider footwear choice and stride length reduction as potential interventions.

Large inter-individual differences in the shoe longitudinal bending stiffness associated with optimal performance during sprinting and jumping

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The manipulation of the design and material characteristics of the sole of sports shoes can influence both sprinting and jumping performance (Worobets & Wannop [2015]. Sports Biomechanics, *14*, 351-360). Increasing the longitudinal bending stiffness and the incorporation of a greater toe-spring can lead to an anterior shift in point of application of the ground reaction force (GRF), and ultimately impact sprint and jump performance (Stefanyshyn & Nigg [2000]. Medicine and Science in Sports and Exercise, *32*, 471-476). However, optimal bending stiffness for performance appears to be subject-specific and possibly related to plantar flexion strength (Smith et al. [2014]. Journal of Applied Biomechanics, *30*, 206-212). This study examined whether individual plantar flexion strength was associated with improved explosive performance in stiff shoes with greater toe-spring. With institutional ethical approval, 30 healthy, varsity standard, athletes performed singular maximal counter movement jumps, 20m sprint tests, and 5m accelerations in four different shoe conditions with modified bending stiffness and toe-spring (New Balance, kick xc900v2). Jump height and sprint times collected, along with peak propulsive forces and average trunk acceleration measured using high-speed kinematics and GRF during the maximal accelerations, were analysed across shoe conditions using a repeated measures ANOVA (P<0.01). There were large significant between-subjects differences for all of the performance variables across shoe conditions (P < 0.0001) indicating that optimal shoe stiffness and toe spring was specific to the individual. These individual optimal shoe stiffnesses were not significantly correlated to their plantar flexion strength (Pearsons correlation = 0.15) and there were no significant differences in jump height or trunk acceleration found across shoe conditions. Significant differences with medium to large effect sizes were seen between shoe conditions in the 20m sprints (P = 0.02, η_p^2 = 0.11) and peak propulsive force (P < 0.01, η_p^2 = 0.18) with a flexible, increased toe-spring shoe providing the best performance. These findings agree with previous findings of individual optimal shoe stiffness for performance (Smith et al. [2014]) leading to some performance variables (i.e. jump height) having no significant group effects across shoe conditions. It is unclear why a proportion of the participants preferred the flexible shoes for sprint and acceleration performance rather than the stiff shoes. As plantar flexion strength is unable to help explain individual optimal shoe stiffness, it is plausible that individual flexibility and stiffness characteristics of the metatarsophalangeal joint might play a role and will be explored in further work.

The effect of an ankle support upon landing biomechanics during netball-specific tasks

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On average, a netballer performs 28 leaps and 160 jumps per match (Attenborough et al. [2017], Physical Therapy in Sport*, 23*, 31-36). Ankle injuries are common at all levels, accounting for 14% of netball injuries (Hume & Steele, [2000], Journal of Science and Medicine in Sport*, 3*, 406-413). These injuries mainly occur due to landing with excessive degrees of inversion or eversion. Research has demonstrated that wearing ankle supports may however, restrict motion in the frontal plane (DiStefano, Padua, Brown, & Giskiewics, [2008], Journal of Athletic Training*, 43, 234-241*). Therefore, the aim of the study was to analyse the effects of ankle supports on the lower-limb biomechanics of netball players during two netball specific landing tasks. Fourteen female university players (aged: 20 ±2 years, stature: 165.1 ± 9.16 cm, body mass: 60.0 ± 8.9 kg), with no current or pervious lower limb injury in the last 6 months, participated in the study. Each participant performed ten 45° cutting maneuvers around a defender, at an approach speed of 4 m/s, before receiving a ball from a feeder. They also performed ten single leg jump landings at 4 m/s receiving a ball on landing. Landings were performed on both legs, with and without a Mueller ATF2 ankle support, and the order of conditions were randomised. GRF, ankle/ knee ROM and peak ankle/ knee moments were collected using seven Qualisys OQUS 7+ cameras at 300 Hz and a Kistler 9281CA force platform at 900 Hz. Results were obtained using Visual 3D and paired sampled t-tests were performed in SPSS. For the cutting manoeuvres, the ankle support reduced the ankle joint range of motion (ROM) in both the sagittal (P = 0.005) and frontal planes (P = 0.014) and the ankle (eversion) moment (P = 0.001) was also lower. For the single leg landings, significant reductions were found in ankle ROM (all three planes; P > 0.05) and knee ROM (sagittal; P = 0.016). These findings provide further evidence that wearing an ankle support may decrease the chances of an inversion or eversion sprain, by reducing ankle joint motion during netball specific tasks.

Can New Zealand blackcurrant extract improve postprandial glucose and triglyceride responses to a mixed meal? A dose response study

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Consumption of low-quality, high-energy diets in combination with a sedentary lifestyle have made obesity, metabolic syndrome and type 2 diabetes (T2D) into worldwide epidemics. Obesity is characterised by visceral adiposity, dyslipidaemia, low-grade systemic inflammation and endothelial dysfunction which together contribute to the development of insulin resistance and progression to T2D. Regular consumption of flavonoids (such as anthocyanins) may reduce the risk of developing T2D. Blackcurrants contain the highest concentration of anthocyanins and 7 days supplementation with powdered blackcurrant extract can improve glucose and insulin responses to a glucose challenge in healthy individuals. In this study we aimed to examine whether a single bolus of New Zealand blackcurrant extract (NZBC) can improve glucose responses to a mixed-meal in sedentary overweight/obese individuals. We also aimed to determine whether a dose-response relationship exists for improved postprandial glucose responses. Once ethical approval had been obtained, in a double-blind, randomised, placebo-controlled design, 16 sedentary overweight/obese office workers (25-55 years, BMI >25 $kg \cdot m^{-2}$) undertook 4 experimental trials separated by at least 1 week. Trials were identical in all respects, except for the dose of NZBC provided (300 mg, 600 mg, 900 mg or a placebo). The supplement was ingested 30 min prior to consuming a mixed-meal test drink (75g carbohydrate, 50g fat). Intermittent blood sampling was then undertaken from an indwelling cannula; samples were drawn every 15 mins for the first hour and then every 30 mins for a further 2 hours, with blood samples analysed for glucose and triglyceride concentrations. Although there was a main time effect for glucose during the postprandial period ($P<0.05$), there was no significant difference for glucose area under the curve (AUC) ($P=0.918$) when comparing placebo to any of the NZBC doses. Similarly, triglyceride AUC during the postprandial period was unchanged when comparing placebo to any of the NZBC doses ($P=0.032$). Despite using three different doses of NZBC extract containing increasing quantities of anthocyanins, it is clear that a single bolus of NZBC extract is unable to alter postprandial blood glucose and triglyceride responses to a mixed meal in overweight and obese individuals. The limited bioavailability of anthocyanins may mean that chronic periods of supplementation are required to determine whether NZBC extract is a potential strategy to improve postprandial glycaemic responses to individuals at risk of developing T2D.

Acute effects of dietary nitrate vs. New Zealand blackcurrant extract on 8 km cycling performance

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Performance enhancing supplements are used as a means of improving endurance performance. Despite research demonstrating positive effects of particular supplements, minimal literature exists on whether the purported effects of multiple ergogenic aids have been compared in a single study. Dietary nitrate (NO_3^-), commonly taken in the form of beetroot juice (BRJ) has been shown to have an acute effect on cycling time trial (TT) performance by reducing oxygen (O_2) cost during exercise (Lansley et al., [2011]. Journal of the International Society of Nutrition, *5*, 1-8). New Zealand blackcurrant extract (NZBC) is another supplement that has been studied extensively with regards to its effects on cardiovascular parameters and performance. But despite research demonstrating beneficial effects of NZBC following 7 days of supplementation (Cook et al., [2015]. European Journal of Applied Physiology, *115*, 2357-2365), literature on the acute effects is scarce. Accordingly the aims of the study were: 1) to identify whether BRJ and NZBC supplementation produced an acute effect on 8 kilometre (km) time trial (TT) cycling performance and 2) whether either of these supplements solicited a significantly greater influence on TT performance and various cardiorespiratory parameters. In a repeated measures, crossover design, eight physically active males performed four 8-km TT cycles on a Wattbike ergometer. After a familiarisation trial, participants received either BRJ (NO_3^-; 70 ml; 0.4 g), NZBC (0.3-0.6 g) or placebo (PLA; cornflour; 0.3 g) 60 minutes prior to TT. During exercise, power output (PO), oxygen $\dot{V}O_2$) and respiratory exchange ratio (RER) were measured after every KM. [La] was measured at baseline and every two minutes following completion of the time trial to determine differences in lactate accumulation. A one way within-subjects ANOVA determined no significant difference between groups for TT performance (BRJ 855 ± 85; NZBC 822 ± 78; PLA 829 ± 75 s, $F_{2,14} = 1.58$, $P > 0.05$, $\eta\rho^2 = 0.184$). PO and RER values during TT were insignificant between conditions as was post-exercise [La] accumulation ($P > 0.05$). However, $\dot{V}O_2$ consumption values were significantly lower compared to NZBC and PLA (BRJ 2.35 $\pm$ 0.52 $L \cdot Min^{-1}$; NZBC 2.67 $\pm$ 0.55; PLA 2.53 $\pm$ 0.49 $L \cdot Min^{-1}$, $F_{2,14} = 5.32$, $P < 0.05$, $\eta\rho^2 = 0.432$). Results of this study demonstrate that acute BRJ and NZBC supplementation produce no significant effects on short term TT cycling performance. However, acute BRJ supplementation decreases the O_2 cost of exercise to a significantly greater extent than NZBC.

The physiological and ergogenic effects of New Zealand blackcurrant in female middle-distance runners

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New Zealand Blackcurrant (NZBC) has been proposed as an ergogenic aid due to its high concentration of anthocyanin. Anthocyanin-induced vasodilation may increase blood flow and increase fat oxidation rates during exercise (Cook et al., [2015]. European Journal of Applied Physiology, *11*, 2357 - 2365), and enhance cycling performance (Lyall et al, [2009], American Journal of Physiology-Regulatory Integrative Comparative Physiology, *1*, R70-81). Success in middle-distance running is also dependent on substrate efficiency and O_2 availability yet, the ergogenic potential of NZBC in middle-distance running has not been tested. Accordingly, this study examined the effects of NZBC on indices of gas exchange, blood lactate concentration, and heart rate during submaximal running in female middle-distance runners. Moreover, we assessed the influence of supplementation on simulated 1500 m time-trial (TT) performance. It was hypothesised that NZBC would increase fat oxidation and improve 1500 m time. Twelve healthy, female distance-runners were recruited for the study. Inclusion criteria were: 16-55 y; free from known cardiorespiratory disorders; currently training ≥2 times per week. Preliminary testing comprised anthropometric measures (stature, body mass, body fat percentage), and a ramped $\dot{V}O_2$max test on a motorized treadmill (HP Cosmos Pulsar, Nussdorf-Traunstein, Germany). Experimental trials were conducted in a randomised, double-blind, crossover design. Participants were supplemented for seven days with one capsule of either NZBC (300 mg·day^{-1}, equivalent to 105 mg anthocyanin), or a dextrose placebo matched for colour, separated by a 1-week washout. Following supplementation, participants completed a 20-minute steady-state run at a treadmill speed equivalent to 65% $\dot{V}O_2$max. Continuous measures of gas exchange were made to determine O_2 economy and respiratory exchange ratio (RER). Heart rate, rating of perceived exertion (RPE) and blood lactate concentration were recorded at rest and at 5 minute intervals. Blood pressure was recorded at rest and within 2 minutes of exercise cessation. Following 10 minutes passive rest, participants performed a simulated 1500 m TT on a self-powered treadmill (Woodway Curve, Waukesha, WI), with time to completion, average and maximum speeds recorded. Two-days before either experimental trial, participants completed a food diary, and were required to replicate their diet before the next session. Food diaries were analysed using online software (Nutritics Ltd., Co. Dublin, Ireland). Descriptive and inferential statistics were calculated using SPSS 24 for Windows (IBM; Chicago, IL). Physiological responses to submaximal exercise were compared using a repeated-measures ANOVA, and data from the time trials were compared using a paired samples *t*-test.

Effect of New Zealand blackcurrant on recovery from eccentric muscle damage in triathletes

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Triathletes require optimal recovery to combat the negative effects of increasing competition demands. The efficacy of supplements and functional foods, such as cherry and pomegranate, to enhance recovery is of interest due to anti-inflammatory and antioxidant properties (Willems et al. [2015] International Journal of Sport Nutrition and Exercise Metabolism, *25*, 367-74). This study aims to investigate the effect of New Zealand blackcurrant (NZBC) supplementation on recovery from eccentric muscle damage (EIMD) in triathletes. Sixteen recreational male and female triathletes, aged 18-45 and recreationally active in running and cycling for at least six months, will complete a double-blind, randomised, parallel-design experiment. Participants will complete eight consecutive days of supplementation with either two 300-milligram capsules (600 mg) CurraNZ (Health Currancy Ltd., Surrey, UK) (210 mg anthocyanins) or cornflour placebo. An EIMD protocol will be completed on day five with three days of follow-up measures. This involves 10 sets of 10 maximal eccentric quadricep repetitions via isokinetic dynamometry (System 3 Pro, Biodex Medical Systems Inc., USA) interspersed by two minutes of passive rest, similar to Sumners et al. ([2011] Medicine and Science in Sports and Exercise*, 43,* 1544-1551). A familiarisation session will be performed at least two days prior. The non-dominant limb will be involved. Range of motion will be 70° during EIMD. Measures include creatine kinase (CK) via fingertip blood sampling, perceived soreness (DOMS) using visual analogue scales, flexibility (ROM), rate of force development (RFD), and maximal voluntary isometric contraction (MVIC) of the non-dominant quadricep; in this order. The sit and reach test will assess ROM, with a Kistler portable force plate measuring RFD and isokinetic dynamometry quantifying MVIC. Measures will be taken immediately before, after, and 24 h, 48 h, and 72 h post-exercise. A pilot study will confirm the protocol increases CK and DOMS significantly, with decreased ROM, RFD and MVIC. Self-reported dietary intake will be collected for the 48 h before the protocol, with isocaloric meals post-exercise ensuring dietary standardisation. Ethical approval was received by the Sheffield Hallam University Ethics Committee. Results will be produced when the data is collected.

The effect of acute Montmorency Tart Cherry juice supplementation on muscle damage in resistance trained athletes

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Exercise-induced muscle damage (EIMD) occurs after predominantly eccentric and unaccustomed exercise with increased intensity or duration, such as resistance training. This EIMD results in decrements in muscle function and performance that can peak at 24-48 h after exercise. Consequently, several nutritional interventions have been employed to ameliorate recovery after EIMD. (Howatson et al., [2010]. Scandinavian Journal of Medicine & Science in Sports, *20,* 843-852). Montmorency Tart Cherries are high in anthocyanins, which are thought to have anti-oxidant and anti-inflammatory properties. However, no study has investigated the effect of a single acute dose of Montmorency Tart Cherry juice on EIMD. Therefore, the aims of this study were to evaluate whether acute supplementation of Montmorency Tart Cherry Juice can reduce EIMD. In an independent groups design, sixteen resistance trained participants performed a German Volume Training muscle damaging protocol (10 × 10 squats at 60% 1RM). Preceding the muscle damaging protocol, participants consumed either 30ml Cherry concentrate (*n* = 8) or placebo (*n* = 8). Muscle soreness of the knee and hip extensors, range of motion of the knee and hip flexors, leg circumference, and power at 30% and 80% 1RM during a squat exercise were measured pre, 0, 24 and 48 h post-EIMD. There was a reduction in power output at 80% 1RM at 0 (P <0.001; ES, −1.42), 24 (P <0.001; ES, −1.27) and 48 h (P = 0.02; ES, −0.84), with no difference between groups. Soreness of the knee and hip extensors were increased at 0 (KE: P <0.001; ES, 1.66, HE: P <0.001; ES, 1.70), 24 (KE: P <0.001; ES, 1.72, HE P <0.001; ES, 1.72) and 48 h (KE: P <0.001; ES, 1.72, HE: P <0.001; ES, 1.67), however, this was not different between groups. Range of motion of knee flexors were decreased at 24 (P = 0.009, ES = -0.94) and 48 h (P = 0.034, ES = -.077), and the hip flexors were decreased at 0 (P <0.001; ES, −1.25), 24 (P = 0.02; ES, −0.84) and 48 h (P <0.001; ES, −1.30), with no difference between groups. There was no change in leg circumference. This study is the first to demonstrate that a single acute dose of Montmorency Tart Cherry juice has no positive effect on symptoms of EIMD, suggesting that such a dosing procedure is not as effective as chronic doses used previously (Connolly et al., [2006]. British Journal of Sports Medicine, *40*, 679-683).

A validation study of field-based tests for maximal aerobic speed compared to a laboratory-based treadmill test

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Maximum Aerobic Speed (MAS) is a term used to describe the velocity required to elicit maximal oxygen uptake (vVO_{2max}), when measured in the absence of gas analysis. The MAS acquired using field-based tests, whilst useful for applied practitioners, may not accurately represent the vVO_{2max} it is intended to describe. This raises issues pertaining to the intensities prescribed using field-based MAS measurements and if practitioners are targeting the energy systems intended, to elicit specific adaptations. To date, numerous field-based tests have been designed, all providing measurements of MAS, however, many have not been directly compared against the vVO_{2max} derived from a laboratory-based treadmill test with gas analysis. Rather, recent field-based tests have been compared against a previously validated field-based test called the University of Montreal Track Test (UMTT), however, this indirect comparison can lead to errors associated with the UMTT validation being further multiplied. The validity of the MAS obtained from these field-based tests is therefore questionable. Accordingly, the aims of the current study were; 1) Study the validity and reliability of field-based measures of MAS; specifically, the 30-15 intermittent fitness test (30-15IFT), a 5-minute time trial (5TT), and the 1.2 km shuttle run test (1.2SRT). 2) Assess the validity of the use of a 0.7 second correction in field tests including changes of direction (30-15IFT and 1.2SRT). Nine participants, all training and competing in intermittent-sprint sports, performed a continuous incremental graded laboratory-based treadmill test to establish vVO_{2max}. Subsequently, all participants completed the three field-tests twice in a random, counterbalanced order for a total of nine testing visits. The MAS attained from the 5TT was similar to the vVO_{2max} (P>0.05). The MAS attained from the 30-15IFT and the 1.2SRT were significantly different to the vVO_{2max} (P<0.05), with the 0.7 second correction leading to a MAS score significantly different to the vVO_{2max} in both the 30-15IFT and the 1.2SRT (P<0.05). In the 1.2SRT the 0.7 second correction significantly improved the validity of the MAS score attained (P<0.05). The 1.2SRT showed no significant test-retest difference (P>0.05), however, the 5TT and the 30-15IFT both showed a significant test-retest difference (P<0.05). These findings emphasise the necessity for practitioners to be aware of the validity of field tests if the results obtained are to be utilised when prescribing training. Ensuring the intended intensity of training sessions is prescribed using valid tests and accounting for the nature of the tests administered is imperative to elicit the desired adaptations.

The effect of a low-volume, high-intensity, 'priming' activity on driving performance in male golfers

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Driving ability, compromising of maximal driving distance (DD), resulting from optimal club head speed (CHS), is regarded as a principle determinant of golf performance. Whilst the optimal preparation strategy to acutely enhance driving ability is currently unclear, immediate improvements in DD and CHS are possible with appropriate physical preparation strategies. One preparation strategy growing in interest is the use of low-volume, high-intensity exercise in the hours prior to athletic performance, a practice termed 'priming'. 'Priming' strategies performed between 2 and 30 hours before competition have demonstrated acute improvements in athletic performance within a variety of sporting disciplines, but this concept has yet to be extended to golf. The purpose of this study was to, therefore, determine the effects of a morning-based 'priming' activity on driving performance in male golfers. With institutional ethics approval, nine male golfers (mean ± standard deviation handicap 4.7 ± 3.0) were assessed for measures of DD, CHS and readiness to perform (RTP), with (EXP) and without (CON) a preceding low-volume, high-intensity, prior-exercise intervention, consisting of ballistic medicine ball exercises, body-weight jumps and whole-body push-pull exercises, performed two-hours prior to testing, in a randomized, crossover design. DD increased following EXP (271.8 ± 7.6 yards), with a mean increase of 7.4 yards, in comparison to the CON (264.4 ± 5.2 yards) trial (95% CI = 2.4 to 12.3 yards, $P < 0.02$). Likewise, CHS increased following EXP (103.8 ± 5.4 mph), with a mean increase of 2.0 mph, when compared to the CON (101.8 ± 5.2 mph) trial (95% CI = 0.3 to 3.7, $P \leq 0.05$). There was no meaningful interaction effect between the trials for any perceptual measure ($P > 0.05$), in particular RTP ($P = 0.38$). These findings support the concept that the morning of competition provides an additional opportunity in the training cycle, whereby, subsequent sporting performance can be acutely enhanced. Specifically, the results from the study indicate that a low volume, high-intensity priming strategy performed two-hours prior to golf can acutely increase DD and CHS, and thus, golf drive performance, in male golfers. A rationale, therefore, exists for preceding competitive golf performance with a bout of prior-exercise, to potentially provide golfers with a competitive edge.

The effects of a six-week plyometric training intervention on general and trampet specific jumping performance in teamgym gymnasts.

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Modern gymnasts are required to perform complex aerial skills which are physically demanding. Coaches and practitioners should be aware that performing these multifaceted skills alone will not develop the physical requirements necessary to execute and develop the skills correctly. Plyometric training is one method which can significantly improve jump height and speed in youth artistic gymnasts (Hall et al [2016]. PLOS ONE, *11*, 1-10). However, the training method has not yet been established in the newer discipline of gymnastics, teamgym. Therefore, the aim of the study was to determine the effects of plyometric training when combined with habitual gymnastics training on measures of general and trampet specific jump performance in youth national level gymnasts. Institutional ethical approval was obtained. Eighteen female teamgym gymnasts (age 12 ± 1 years) participated in the study. The study was a mixed design and participants were assigned to a control or experimental group. The experimental group (n = 10) completed six-weeks of plyometric training (two additional plyometric sessions a week), alongside their habitual training. The control group (n = 8) only completed habitual training. Pre and post tests were conducted for the dependent variables: drop jump (DJ) and countermovement jump (CMJ) height, DJ contact time, reactive strength index, trampet approach velocity and the height of a tuck front somersault. The variables related to jump performance were measured using a force platform (1000Hz, PASCO Scientific, USA) and somersault height was calculated from 2D motion analysis (Quintic Biomechanics V29, Quintic Ltd, UK). The experimental and the control group improved trampet somersault height ($P < 0.05$, $d = 1.154$, $d = 0.489$) respectively. Further analysis showed the experimental group improved more than the control group ($P < 0.05$, $d = 1.489$), with average improvements of 15% (2.33 ± 0.31 m vs. 2.65 ± 0.24 m) and 6% (2.00 ± 0.19 m vs. 2.09 ± 0.22 m), respectively. Furthermore, the experimental group improved CMJ height ($P = 0.05$, $d = 0.783$) by an average of 13% (0.26 ± 0.03 m vs. 0.30 ± 0.049 m); the control group showed no change. There were no significant improvements for DJ height, DJ contact time, reactive strength index and trampet approach velocity for either groups. In conclusion, the addition of two sports specific plyometric training sessions a week improved measures of general and specific jumping performance in youth gymnasts. Plyometric training should therefore be considered as part of their usual training routines.

The acute and delayed impact of lower extremity self-myofascial release durations, within a sporting warm up, on amateur boxers' flexibility and jump performance

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Benefits of warming up include increased muscle temperature, neural activation and joint flexibility. After aerobic activity, either dynamic or static stretching are incorporated, with dynamic preferred for neural activation and static for flexibility (Morrin & Redding [2013] Journal of Dance Medicine and Science, *17*, 34-40). Previous reports suggest self-myofascial release using foam rolling may improve both, however, inconsistently prescribed durations prevent an axiom conclusion (Schroeder & Best [2015]. Current Sports Medicine Reports, *14*, 200-208). Furthermore, post-warm up and competition is typically separated by >15 min inactivity, questioning whether acute foam rolling effects (positive or negative) diminish pre-competition. This study aims to determine whether different foam rolling durations effect flexibility and jump performance, whilst establishing whether effects diminish pre-competition. A single blind, randomised and counterbalanced crossover design was implemented following institutional ethical approval. After familiarisation, 11 recreationally active male amateur boxers undertook three experimental trials consisting of 30, 15 or 0 s foam rolling. Each trial began with 5 min standardised jogging (132 m/s), before 2 foam rolling sets in fixed order of; left then right gastro-soleus, hamstrings, quadriceps and tibialis anterior. Weight bearing lunges (left and right leg), sit and reach, countermovement and squat jumps were completed pre-warm up (baseline), 0 (acute) and 15 min (delayed) post-foam rolling condition. Participants remained inactive post-warm up. A repeated measures ANOVA (3 conditions × 3 times) was used to assess performance changes. When significant main or interaction effect was reported, LSD post hoc analysis was used. Statistical significance was set at $P < 0.05$. Overall, 30, 15 and 0 s foam rolling displayed indifferent right leg weight bearing lunge ($P = 0.64$), sit and reach ($P = 0.94$), countermovement ($P = 0.94$) or squat jump ($P = 0.41$) at all test times. Left leg weight bearing lunge however, improved after 30 s foam rolling compared to 15 (95% CI [0.2 to 1.5] cm) or 0 s (95% CI [0.1 to 2.0] cm), yet elevated baselines cancel this positive effect. Irrespective of condition, sit and reach increased from baseline to acute (95% CI [0.4 to 2.6] cm) and delayed (95% CI [0.7 to 2.6] cm), countermovement jump decreased from baseline to acute (95% CI [−1.5 to −0.6] cm) and delayed (95% CI [−1.8 to −0.8] cm), while squat jump decreased from baseline to acute (95% CI [−0.6 to −1.4] cm), and delayed (95% CI [−1.3 to −1.9] cm). Consequently, warm ups should avoid foam rolling, as flexibility and jump performance unchanged between 30, 15 or 0 s.

One repetition maximum prediction for the barbell back squat, bench press and hexagonal barbell deadlift using the load-velocity relationship

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The load-velocity relationship has been used to accurately predict an individual's one repetition maximum (1RM) for the barbell bench press (Jidovtseff et al [2011] Journal of Strength & Conditioning Research, *25*, 267-270), and barbell back squat (Conceição et al [2015], Journal of Sport Sciences, *34*, 1099-1106). Recent research has however called into question the validity of such methods, on the grounds of methodological limitations; primarily the use of Smith machines and paused repetitions in data collection (Banyard et al [2017] Journal of Strength & Conditioning Research, *31*, 1897-1904). Therefore, the aim of this study was to determine the validity of 1RM prediction using the load-velocity relationship for three compound multi-joint strength exercises, whilst accounting for the aforementioned methodological limitations. Following institutional ethical approval 25 men and 15 women (means ± SD, age: 27.9 ± 6.5 years; stature: 1.78 ± 0.1 m; body mass: 88.07 ± 21.7 kg; training age: 3.5 ± 2 years; bench press 1RM: 104.7 ± 37.8 kg; back squat 1RM: 165.3 ± 54.8 kg; hexagonal barbell deadlift 1RM: 205.4 ± 55.8 kg) underwent the testing protocol. Participants performed a standardised direct 1RM assessment for the barbell bench press, and either the barbell back squat or hexagonal barbell deadlift, during which velocity at 1RM was recorded (V_{1RM}). Following ≥48 hours rest, participants performed maximum volitional velocity repetitions at submaximal intensities (35%, 45%, 55%, 65%, 75% and 85%) to create a load velocity profile, following the recommendations of Jovanović and Flanagan ([2014], Journal of Australian Strength and Conditioning, *22*, 58-69). Participants then repeated this protocol for the remaining lower-body lift, following a further ≥48 hours rest. Mean velocity of all movements was collected using a GymAware linear position transducer sampling at 50hz. Pearson product moment correlation coefficient (R^2) and standard error of estimate (SEE) were used to determine the strength of the relationship, and accuracy of prediction. The values observed for the bench press (R^2 = 0.98, SEE = 5.05%); back squat (R^2 = 0.97, SEE: 10.18%); and deadlift (R^2 = 0.98, SEE: 9.06%) indicate a strong relationship between directly assessed 1RM and predicted 1RM, with varying accuracy of prediction.

The effect of uni-lateral strength training on the running economy of recreational runners

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Evidence supports the use of traditional strength training to aid development of running performance and economy (Balsalobre-Fernández et al. [2016]. Journal of Strength and Conditioning Research, *30,* 2361-8). Uni-lateral strength training may have further benefits for running economy because of the enhanced neuromuscular activation required to maintain balance and posture during movements, however there has been no research on this topic. The aim of this study was to examine the effects of a uni-lateral strength training programme on running economy in recreational runners. We hypothesised that six weeks of uni-lateral strength training alongside usual endurance training would result in superior improvements in running economy in comparison to a control group. Following university ethical approval, nine recreational runners, with minimal strength training experience, (mean ± SD; aged 25 ± 9 years, running at least 15 miles per week) were recruited for the study. All participants provided informed consent. Participants attended the physiology laboratory on three occasions. The first was used to assess eligibility, record anthropometric measurements and complete a 10-repetition maximum (10 RM) back squat test to allow training load to be prescribed in the safest way possible. During the second visit participants performed a maximal graded exercise test. Oxygen consumption (VO_2), blood lactate concentration, heart rate and ratings of perceived exertion were measured throughout the test. Following baseline testing, participants were randomised into either the control group (C; n=5) or the uni-lateral strength training group (UST; n=4). The UST group completed gym-based sessions twice weekly for six weeks. Training included five repetitions of four exercises (lunge, single-leg press, calf press, rear-leg elevated split squat) progressing from three sets in week one to five sets in week six. Following completion of the training, all participants returned to the laboratory to repeat the 10 RM back squat and maximal graded exercise test. An independent samples t-test revealed no statistical significance between groups at stages one to three baseline for running economy (C = 68.1 ± 10.01 $L{\cdot}kg^{-1}min$; UST = 68.75 ± 8.18 $L{\cdot}kg^{-1}min$; $P > 0.05$) or 10RM (C = 65 ± 22.3 kg; UST = 67.5 ± 20.7 kg; $P > 0.05$). Training is ongoing, therefore only baseline data are presented here. Post-training results and study conclusions will be available to present at the conference.

The dose-response relationship between training load and fatigue in youth football players: *to individualise or not to individualise that is the question?*

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The ability to understand how training load (TL) and fatigue interact is commonly termed the "dose-response relationship". Practitioners in association football generally use the distance covered above arbitrary speed thresholds to monitor external TL (i.e. high-speed running distance), however this method might not represent the true exertion of each player. An individualised approach, based on a players' physiological characteristics, might be more representative. If true, an individualised approach would be expected to display a stronger relationship with changes in fatigue. We therefore aimed to establish the relationship between external TL (arbitrary and individualised) and changes in fatigue status. For this experimental research, a counterbalanced randomised crossover design was employed. Following institutional ethics approval, fourteen youth soccer players completed a "moderate", "high" and "very high" training session (based on external TL prescription) over a 3-week period. Arbitrary high-speed running (metres covered > 17 $km \cdot h^{-1}$ [m>17]), and individualised high speed running (metres covered > maximal aerobic speed [m>MAS], estimated from a 1500 metre time-trial) were measured in each training session via global positioning systems. Session ratings of perceived exertion (sRPE) were collected as measures of internal load. Fatigue status was monitored 24 h after each session and included subjective ratings of wellness (Fatigue, Sleep Quality, Soreness), drop jump reactive strength index (DJ-RSI), and the mechanical responses to a sub-maximal shuttle run test (PlayerLoad percent vertical contribution [$\%PL_V$] and Medio–Lateral PlayerLoad [PL_{ML}]). Linear mixed modelling was used to assess the within-athlete relationships between measures of training load and changes in fatigue status, with magnitude-based inferences subsequently applied. The difference between m>17 (1,263 ± 557 m) and m>MAS (1,232 ± 548 m) was most likely trivial (31 m; ±203 m). Within-athlete relationships between m>17, m>MAS and fatigue measures were possibly very large with sRPE (both r = 0.75; ±90% confidence limits 0.15) and Fatigue (m>17: 0.70; ± 0.17, m>MAS: 0.72; ± 0.17), very likely large with Soreness (0.68; ± 0.18, 0.69; ± 0.18), likely large with DJ-RSI (both 0.61; ± 0.21) and PL_{ML} (both 0.61; ± 0.21), possibly large with $\%PL_V$ (0.51; ± 0.24, 0.53; ± 0.24) and unclear with Sleep Quality (0.04; ± 0.29, 0.05; ± 0.29). Absolute and individualised measures of external TL display large relationships with measures of fatigue, suggesting the importance of these measures in understanding the dose-response nature of soccer training. However, correlation magnitudes were almost identical for absolute and individualised methods, suggesting no benefit of individualising external TL when trying to understand the acute fatigue responses of training.

The effect of sleep on high speed running during a weekly micro-cycle in elite female soccer players

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The potential benefits of adequate sleep for increased recovery and performance in elite sport have been widely documented however, the effect of sleep on soccer match performance has been less reported, especially within female soccer. The aim of this study was to investigate the effect of sleep quality and quantity on match day high speed running (HSR) in elite female soccer players. Data were collected over three training weeks, with each week comprising of four training sessions and an official Scottish Women's Premier League match during the 2017 soccer season. Ethical approval was obtained from Manchester Metropolitan University. Each participant (n=4; 21 ± 2.7 years; 169 ± 7.6 cm; 63.1 ± 6.54 kg) provided written informed consent to take part in the study. During the three-week data collection period, subjective wellness questionnaires were administered to each player post-training and match (equating to 4-5 collection points each week), via smartphone application. Questionnaires captured self-reports of sleep quantity (hrs) and sleep quality (5 point Likert scale, 5 = insomnia, 1 = very restful), which were summed for each week and a mean calculated. Furthermore, participants were issued with 10 Hz global positioning system (GPS) equipment on match days to measure HSR distance (m; threshold > 5 $m \cdot s^{-1}$). Mean sleep quantity, quality and HSR during the data collection period were 37.3 ± 4.6 hrs, 10.3 ± 3.3, and 479.6 ± 231.8 m, respectively. Pearson's correlation coefficient analysis revealed no significant relationship between sleep quantity and HSR (r=-0.48, *P*= 0.88) or sleep quality and HSR ($r = -0.216$, $P = 0.50$). There does not appear to be a relationship between sleep time and quality during training weeks and the amount of HSR completed during a subsequent match-day. Considering muscle repair and restoration of immune function occur with the increased growth hormone and testosterone, and reduced cortisol release during sleep, a relationship between sleep time and quality and HSR was expected. While the lack of association observed may be due to the small sample size, the results of this study may still allow practitioners to make individual recommendations to improve sleep quality and quantity with both recovery and match performance benefits. Furthermore, it remains to be seen whether increasing sleep quality and/or quantity during training weeks, beyond that observed here, could contribute to an increase in quantity of match-day HSR.

Heavy resisted sled sprint training: impact on 20 metre sprint performance in academy rugby players

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During competitive rugby, players repeatedly complete multiple sprint efforts, covering distances of 5 to 20 m on average, at any one time. As such, improving sprint speed is a fundamental component of the physical preparation of player performance and acceleration over short distances is regularly tested and monitored at elite level as a key indicator of athletic performance. Resisted sled sprint (RSS) training via the use of a loaded sled is a popular sprint training method allowing athletes to achieve the greatest exercise specificity and generate force in a horizontal direction creating movement patterns identical to those observed during the acceleration phase of competitive play thus maximising the transfer of strength and speed adaptations to competitive performance. Traditionally, RSS are performed at light resistances of approximately 10% body mass (BM), as loads exceeding 10% BM may alter or significantly deteriorate sprint mechanics and sprint performance when used over extended periods of time. Other research suggests that a load equating to 10% BM may be too low a resistance providing inadequate stimulus for adaptation in comparison to un-resisted sprint training or sprint skills based training, although limited experimental research has challenged the 10% BM load assumption. The aim of this study was therefore to explore the impact of a heavy resisted sled sprint training intervention (HRSS) on sprint performance. Sixteen college rugby union players (age: 16 ± 1 years) were randomly allocated to an intervention group (12 weeks HRSS, 40% BM) or a control group (12 weeks un-resisted sprint training) with the aim to improve 20 metre sprint performance. Following the intervention significant improvements in 20 metre sprint time were observed in the intervention group (7.3%, P = 0.01, d = 1.58) and the control group (5.4%, P = 0.005, d = 0.91). No significant differences in 20 m sprint performances were observed between the intervention and control groups. However, the large effect size (d = 1.58) observed within the intervention group indicates a greater and more effective improvement with the use of heavy resisted sleds compared to the control group. The results highlight the benefit of using heavier loads for resisted sled sprinting with competitive team and field athletes, over longer durations due to the positive influence upon sprint performance where sprint kinematics are less important than to those competitive in track events.

The effect of starting velocity on maximal acceleration capacity in elite level youth football players

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Due to advancements in performance monitoring technology (Global Positioning System (GPS) & Accelerometry), practitioners can measure accelerations and decelerations with a view to quantifying their impact on training load in team sports. In practice, the magnitude of these accelerations has typically been categorized into low, moderate, and high thresholds. Research suggests a value of >2.78 $m \cdot s^{-2}$ as a high acceleration threshold, based on data measuring maximal acceleration capacity from a standing start. (Varley and Aughey [2013] International Journal of Sports Medicine, *34*, 34-39). However, there has only been one study to our knowledge that directly examines the effect of starting speed on the capacity to maximally accelerate (Sonderegger et al [2016] PloSone, *11*). Furthermore, the research fails to examine accelerations measured via GPS or Accelerometry in football specific context. Therefore, the aim of this study is to quantify, via GPS and Accelerometry, the impact of different commencement velocities on the maximum voluntary acceleration capacity of individuals during maximum efforts. A secondary aim of the study is to analyse more dynamic situations involving a stretch-shortening cycle, by determining the impact of changing entry speed and deceleration on the acceleration capacity of individuals making maximum voluntary efforts. Fifteen male football players from the Development Squad of a Scottish Premier League club took part in the study. Subjects wore Catapult OptimEyeX4 10-Hz GPS units with in-built tri-axial accelerometer, gyroscope and magnetometer sampling frequencies of 100-Hz. The players were asked to complete three different running tests that would require them to accelerate maximally from either a standing start, from five increasing run-in speeds or after a period of deceleration. The data collected for analysis was; peak acceleration at point of change of pace & peak deceleration at point of deceleration. These were measured by both Doppler GPS method and from the vector of the tri-axial accelerometer data. The results showed that peak accelerations achieved during progressively increasing starting velocities were 2.34 ± 0.35, 1.85 ± 0.31, 1.5 ± 0.26, 1.12 ± 0.18 and 0.92 ± 0.21 $m \cdot s^{-2}$. Accelerations were reduced to 1.42 ± 0.57, 0.83 ± 0.51, 0.61 ± 0.26, 0.47 ± 0.37 and 0.33 ± 0.32 $m \cdot s^{-2}$ when the effort was preceded by a rapid deceleration after similar entry speeds. This study provides useful information as a practitioner within football with regards to monitoring accelerations. The reduction in acceleration capacity with increased entry speed, and the impact of sudden deceleration are important factors to consider when assessing training load and the number of 'high' accelerations a player completes.

The efficacy of cold and contrast water immersion on the indices of recovery following exercise induced muscle damage

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Muscle damage is at times, an inevitable bi-product of exercise. Unaccustomed and eccentric movements can elicit exercise induced muscle damage (EIMD), resulting in a multitude of physiological and performance decrements caused by the primary and secondary components of EIMD (Howatson and van Someren, [2008]. Sports Medicine, *38*, 483-503). With eccentric contractions forming a substantial part of training programmes, and athletes often having insufficient time in between training or competitions (Cochrane, [2004]. Physical Therapy in Sport, *5*, 26-32), an efficient recovery modality is essential. Coldwater immersion (CWI) and Contrast water immersion (CTW) have emerged as popular recovery strategies. However, high heterogeneity of results exists for both methods. Additionally, few studies compare both CWI and CTW in the same study design. The aim of the present study was therefore, to assess the effectiveness of cold water immersion and contrast water immersion as a recovery modality following eccentric muscle damage and analyse any differences between the two. Fourteen recreationally active males (178.7 ± 6.1 cm; 75.8 ± 8.8 kg) volunteered to perform 100 drop jumps. Thereafter, they were randomly allocated into one of three groups: CWI (12 minutes in 10°C; n = 5), CTW (3 cycles of 40°C for 3 minutes and 10°C for 1 minute; n = 5), or control (passive recovery; n = 4). Maximal counter movement jump (CMJ), maximal isometric voluntary contraction (MIVC) of the knee-extensors, muscle soreness on a 200 mm visual analogue scale (VAS) during a full squat, thigh circumference, peak power output (PPO) and average power during a 6 s sprint on a cycle ergometer were the dependant variables. These were measured pre-trial, post-trial and at 24, 48 and 72 h post-trial. The muscle damaging exercise was successful in eliciting muscle damage as evidenced by the significant time effects for VAS, CMJ and MIVC ($P < 0.05$). Cold water immersion better reduced thigh circumference than contrast water immersion ($P = 0.021$) and control ($P = 0.042$), but no other significant differences were found. These results suggest that cold water immersion may reduce swelling of the lower limbs following eccentric exercise in comparison to passive recovery, but like contrast water immersion, has no beneficial effect on muscle soreness or function. These data are in agreement with a growing body of literature disputing the validity of immersion as an efficacious recovery strategy (Goodall and Howatson, [2008]. Journal of Sports Science and Medicine, *7*, 235-241).

Intracellular signalling responses following loaded contractions in murine skeletal muscle induced by programmed exercise: Hypertrophy or hyperplasia?

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Chronic resistance training brings about adaptive responses in skeletal muscle to meet future bouts of resistance. These are typically hypertrophic (increased fibre size) but can be hyperplastic (increased fibre number) following supraphysiological stimuli in rodent models. Hypertrophic adaptation is facilitated by the mTOR/p70s6k signal transduction pathway, increasing ribosomal biogenesis and subsequently protein synthesis. Using a novel rodent model with sub-cutaneous electrical stimulation of plantar/dorsi-flexors, objectives were to establish the effects of short-term (7 days) electrical stimulation on hypertrophy/hyperplasia. To elicit plantarflexion under load, simulating resistance training, miniature, programmable stimulators with electrodes running subcutaneously to the site near the common peroneal (to stimulate the tibialis anterior (TA) and extensor digitorum longus (EDL) and tibial (gastrocnemius stimulation) nerves were surgically implanted into mice (n=3). Resisted contractions were stimulated daily (100 Hz for 2 s-ON, 2 s-OFF, for 5 sets of 10 repetitions, with 2 minutes rest between sets) for one week. Unstimulated legs were used as internal controls. Upon completion of the study mice were euthanized, the TA and EDL muscles from both legs extracted, cleaned of connective tissue and weighed prior to freezing in isopentane, pre-cooled in liquid nitrogen. The proximal, mid-belly and distal end of the muscle were separated, aligned and mounted in OCT onto cork discs before sectioning; 1) 5 μm sections for cross-sectional histology analysis and 2) 25, 20 μm sections treated with dispase to prepare a single-cell suspension for assessment of intracellular signalling via flow cytometry. Raw data were plotted as a percentage difference between the stimulated and unstimulated leg. Results demonstrated that electrical stimulation of just 7 days caused a significant increase in the total weight of the stimulated vs. control TA and an increase in the stimulated vs. control EDL, 7.6 ± 2.5 mg (+16.9%; $P < 0.001$) and 1 ± 1 mg (+11.1%; $P = 0.143$), respectively. Fibre size, number and mitochondrial content will be assessed via histological analysis and intracellular signalling (phospho-p70s6K, phospho-mTOR, phospho-ERK, phospho-Akt and phospho-P38MAPK) will be analysed by FLOW cytometry. We hypothesise that with a significant increase in the mass of the stimulated TA and EDL, we will observe increased activation of the signalling proteins above, which will underpin a hypertrophic response.

Greater neuromuscular fatigue following work-matched interval compared to continuous eccentric cycling

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Eccentric cycling consists of a bike (usually recumbent) that drives the pedals towards the user using an electric motor. Users apply force to oppose the direction of pedal rotation which results in the muscles of the lower limb, specifically the quadriceps, lengthening whilst under tension and thus, acting eccentrically. A well-documented consequence of eccentric exercise is delayed onset muscle soreness and a reduction in the force generating capacity of the muscle (i.e., muscle fatigue, Gandevia [2001], Physiological Reviews, 81, 1725-1789). Continuous low- to moderate-intensity eccentric cycling can reduce muscle function and increase muscle soreness for up to four days (Penailillo et al., [2013]. Medicine and Science in Sports & Exercise, *45*, 1773-1781). However, it is unknown how workload distribution, specifically the use of higher-intensity intervals interspersed with lower-intensity work, affects subsequent muscle fatigue and soreness. The aim of this study was to determine the effect of session structure (i.e., intervals or continuous workload) on muscle fatigue and soreness after a single bout of eccentric cycling. Sixteen recreationally active males, pair-matched for concentric cycling maximum aerobic power (MAP), were assigned to a continuous (30 min; CONT) or interval (10 × 2 min; 1 min passive recovery; INT) eccentric cycling protocol. Eccentric cycling intensity was 80% and 120% of concentric MAP respectively. Perceived leg soreness (0–20 cm visual analogue scale), blood [creatine kinase], and knee extensor twitch responses to electrical stimulation of the femoral nerve were obtained pre, immediately post, and 24, 48, and 72 h post-exercise. Femoral nerve stimulation was delivered during and 2 s following, an isometric knee-extensor maximal voluntary contraction (MVC) to determine potentiated twitch force ($Q_{tw.pot}$), maximal rate of force development (MRFD), and voluntary activation (VA). Eccentric cycling induced an immediate decrease in VA (INT −10%, CONT −6%), MVC (INT −19%, CONT −13%), $Q_{tw.pot}$ (INT −31%, CONT −18%), and MRFD (INT −32%, CONT −16%; all $P < 0.05$). This decrease in $Q_{tw.pot}$ was greater, and longer in duration (48 vs. 24 h) post-INT compared to post-CONT ($P < 0.05$). All other neuromuscular measures had returned to baseline at 48 h. Furthermore, INT induced greater muscle soreness compared to CONT at 48 h (8.4 ± 4.5 vs. 3.9 ± 2.0) but not 24 h (5.3 ± 2.4 vs. 4.7 ± 1.9), or 72 h (4.2 4.0 vs. 1.3 ± 1.3). No changes in [creatine kinase] were observed after either protocol. Distributing eccentric cycling workload in an interval versus continuous manner elicits greater levels of peripheral fatigue and muscle soreness, and increases recovery time.

The potentiating effects of flywheel eccentric overload on sprint acceleration and deceleration performance

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The ability to rapidly accelerate and decelerate is a critical component of team-sport performance. Enhancing the performance of explosive activities through the use of a prior conditioning activity (CA), known as post-activation potentiation (PAP) is of significant interest to practitioners (Seitz & Haff [2016]. Sports Medicine, *46*, 231-240). Unlike traditional constant load resistance exercises, flywheel eccentric overload (EO) provides unlimited resistance throughout the entire eccentric and concentric phases, heightening muscle activation and mechanical stress, and therefore may provide a unique PAP response to high-intensity exercise performance (Norrbrand et al [2008]. European Journal of Applied Physiology, *102*, 271-281). Despite this, only one study to date has investigated the PAP response of EO on activity demanding rapid acceleration and deceleration, demonstrating superior change of direction performance (de Hoyo et al [2015]. International Journal of Sports Medicine, *36*, 308-314). Therefore, the aims of this study were to examine the acute effects of a bout of EO on sprint acceleration and deceleration performance. Using randomised crossover design, eleven male team-sport athletes (24.9 ± 2.1 years) performed 3 trials of a maximal linear acceleration-deceleration ability (ADA) task following a standardised dynamic warm-up control (D-WU) or D-WU with 3 sets of 6 repetitions of flywheel EO rear foot elevated split squats (RFESS). Prior to data collection all participants completed a 2- week familiarisation period that included 3 sessions of the flywheel EO RFESS exercise in which a 20-30% EO was established. Sprint acceleration (10 and 20 m split time; peak velocity) and deceleration (distance to stop – DTS; time to stop – TTS) performance variables were obtained using a radar gun. Following EO a *possible* moderate (ES = 0.60) to *very likely* small (ES = 0.40) improvement in deceleration performance variables DTS and TTS respectively was found compared to D-WU. Only 10 m split time had a *possible* small improvement following EO. All other performance variables associated with acceleration had trivial changes (ES = 0.10 – 0.20). In conclusion, the results indicate a bout of flywheel EO prior to a rapid ADA task led to enhanced deceleration performance and could therefore be implemented as part of a warm-up routine prior to training and competition to specifically target enhancement of deceleration related performance qualities.

The effects of a flow resistive loading device mask worn during high intensity interval training, the effects upon 5 km running performance

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Fatiguing respiratory muscles are a limiting factor to exercise performance. Inspiratory Muscle Training (IMT) has been shown to increase performance via changes in muscle architecture (diaphragm thickness and strength), leading to changes in exercise performance. IMT coexists alongside traditional training strategies and novel devices that limit air flow and are worn during exercise may lead to improvements in performance, however, the benefits of this approach remain unknown. To determine the effects of a flow limiting face mask worn during a six-week high intensity interval training (HIIT) programme and the effects upon 5 km running performance. Thirteen physically active participants performed a 5 km time trial (TT) before being assigned to either a high intensity interval training group (HIIT n=4), HIIT whilst wearing a flow resisted training mask (MASK, n=5) or HIIT and conducting IMT concurrently (n=5). HIIT sessions were performed on a treadmill with the speed was equivalent to 95% of the individuals speed at $\dot{V}O_2$ max. Each interval was 2 minutes in length and interspersed with 2 min of active rest at self-selected walking pace. Training load progressed weekly with 6 reps in the first week and 10 reps in week 5 before tapering in week 6 (6 reps). Performance on the 5 km time trial in IMT showed a trend for improvement (baseline 26.3 ± 2.4 min vs. post-IMT 24.5 ± 3.2 min, Δ7%) but was unchanged following IMT (*P>0.05).* This was consistent with MASK (baseline 26.3 ± 4.7 min vs. post 25.7 ± 3.9 min, Δ3%, *P<0.05*) and with HIIT (baseline 30.0 ± 1.4 min vs. post 29.1 ± 1.3, Δ3%, *P*>0.05). Maximum Inspiratory Pressure (MIP) at baseline and pre-intervention in IMT was (94 ± 12 cmH2o), which was similar for MASK (126 ± 18 cmH2o) and HIIT (121 ± 42 cmH2o, *P>0.05*). Post intervention MIP increased in IMT by 29% (110 ± 19 cmH2o, *P<0.05*) but was unchanged in both MASK (130 ± 13 cmH2o, *P>0.05*) and HIIT (109 ± 22 cmH2o, *P>0*.05). Performance on the 5 km running time trial was unchanged in all conditions; however, IMT showed a trend for improvement (Δ7%). The addition of a flow resistive mask that is worn during training does not appear to provide additional improvements on performance when compared with HIIT training alone.

The gut microbiome rapidly alters the abundance of key bacteria in response to a bout of acute strenuous exercise

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The human gut microbiome (GM) has links with various disease states and has control over many of the body's processes including metabolism and immunity. For endurance athletes, a GM that promotes efficient energy use (short chain fatty acid [SCFA] production) of food sources would be of clear benefit. Healthy dietary and exercise habits can stimulate favourable changes in the GM however; the mechanisms that facilitate them are not fully understood. Commonly studied species *Prevotella* and *Bacteroides*, have been related to complex carbohydrate and 'western' style diets respectively (Arumugam et al. [2011]. Nature, *473*, 174-180). Therefore, while their presence appears to be related to diet, it is unclear how both the relative abundance might change in response to exercise and how this relative abundance impacts SCFA production and utilization. To provide further information on this potential link this study assessed changes in the GM in response to a bout of acute strenuous exercise. The composition of the GM of nine elite enduro mountain bikers was analysed using DNA extracted from pre and post-race faecal samples. Each athlete also supplied a complete food diary. The work was approved by the Edinburgh Napier University Ethics Committee and conducted in line with the declaration of Helsinki. Each participant showed unique GM profiles both pre and post-race. Multivariate analysis (PCA) of β diversity metrics across all athletes showed the presence of two distinct clusters comprising similar GMs with the exception of one sample that was not assigned to any of the groups. This unique GM community may have been related to the diet of this athlete. Bacteria known to be linked to energy (SCFA) generation showed a variety of changes pre and post-race depending on the athlete. For example, in some athletes, the relative abundance of *Prevotella* increased by up to 24% after the race while showing a decrease of up to 28% in others. Similar changes were observed in *Bacteroides* and other key SCFA producing bacteria. Increases in these energy producing species' during the race may allow some athletes to meet their energy demands and this may provide these athletes with a race advantage. Overall, this study shows that the GM of individual athletes is variable and that the response of their GM to extreme exercise is variable. Further understanding of these changes may allow athletes to manage their GM to enable better energy generation during extreme endurance events.

Does the fourteen-week Military basic training process have effects on a recruits' mental toughness

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Mental Toughness (MT) is used to identify performers who possess psychological skills, enabling performance under pressure irrespective of prevailing circumstances. Soldiers and athlete's face performance-related psychological challenges, where combinations of cognitive, perceptual and motor skills are needed to obtain a tactical advantage over opponents, under stressful circumstances. A need to establish if the basic training process facilitates MT development has been identified as there is little previous research. (Arthur et al [2015]. Military Psychology, *27*, 232). The adversity faced throughout training can be associated with MT characteristics, encompassing Challenge, Commitment, Control and Confidence. This study examined the effects that fourteen-week Military training has on a recruits MT, it was hypothesised that basic training would have positive effects on overall MT. The study adopted a two-stage naturalistic observational research design with a longitudinal, mixed methods approach. The sample consisted of British nationals (*n*=48) starting British Military phase one basic training, age 17-33 years (19.8 ± 3.8 years). First, the Mental Toughness Questionnaire (MTQ-48; Clough Earle and Sewell, [2002]. *Solutions in Sport Psychology*, 32-43) was completed at week one and fourteen to assess any change in MT over the training process. Secondly, quantitative data obtained from the MTQ-48 was used to develop a semi-structured question set for a follow-up focus-group. The qualitative sample consisted of 4 male British army soldiers with 2 or more years' service and had been exposed to the same training program (age, 24 ± 5 years). A paired *t*-test statistically analysed initial (Pre) and secondary (Post) data for MT and the six-subscales (Challenge, Commitment, Confidence interpersonal, Abilities, Control Emotions, Life). Independent samples *t*-tests established differences of initial MT of recruits who drop out and recruits who completed the program. A thematic analysis of focus-group transcript data allowed an understanding of the phenomenological lived experiences, supporting quantitative data. The findings presented a significant increase in overall MT ($P = 0.012$), supporting the hypothesis, demonstrating that the training process enhanced MT. Triangulation of data gave further clarity highlighting how the process developed confidence ($P < 0.01$), whilst lived experiences expressed how they developed into more confident individuals, and developed confidence within others around them during the training process. Secondary findings presented no significant difference ($P = 0.306$) in initial MT, between recruits' who withdrew from training (n=15) and completed (n=33) training. Findings presented that training does facilitate the development of MT.

Exploring 'belongingness' as an exercise determinate in undergraduate students' gym attendance

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A limited body of research exists regarding the notion of belongingness and its impact on exercise behaviour within the gym environment. Belongingness is a primal human need, defined as a "sense of personal involvement in a social system, so that persons feel themselves to be indispensable and integral part of the system" (Anant, [1967] Acta Psychologica*, 26,* 391-396). In recent studies, a sense of belongingness has been shown to create positive psychological outcomes with health adaptive behaviours increasing within social supportive groups (Dowd, [2014] Journal of Sport and Exercise Psychology*, 36*, 21-27). Additional research is necessary to ensure a deeper understanding of the potential impact of a lack of belongingness as an exercise determinate. The aim of this study was to investigate the effect of belongingness towards gym attendance on young adults, aged 18 to 25 years old, in higher education. Sixty (TBC) participants completed the 'General Belongingness Scale' as an online questionnaire, adapted for gym communities by Whiteman-Sandland, Hawkins, and Clayton ([2016] Journal of Health Psychology*, in press*) using 'LimeSurvey'. Six participants consented to participate in an individual semi-structured interview of approximately 20 minutes, designed to gain in-depth understanding of experiences of belongingness or lack of. Questionnaire data was analysed via SPSS to determine the relationship between gym attendance and general belongingness, alongside additional participant demographic information. Qualitative data was analysed via Interpretive Phenomenological Analysis to create key themes which represent the participants' experiences. The results will provide both quantitative and qualitative insight into the impact of belongingness on exercise behaviour. It is anticipated the quantitative data will generate insight into the degree of belongingness participants experience in a gym. The qualitative data will supplement the quantitative data by providing additional insight into participant's initial responses. The presentation will present the key findings from the research and consider the applied implications of the research.

Sedentary behaviour, physical activity, stress, and depression in undergraduate university students

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Sedentary behaviour and physical activity are associated with risk factors for type II diabetes, cardiovascular disease, premature death and all-cause mortality (Wilmot et al. [2012]. Diabetologia*, 55*, 2895-2905). High levels of sedentary behaviour and low levels of physical activity are also associated with mental health conditions including stress and depression in adults (Department of Health, 2011). Worryingly, the prevalence of depression in university students in America is high, between 13-15% (Einsenberg et al. [2007] Journal of Orthopsychiatry*, 77*, 534-542). Furthermore, students are less active at University compared to secondary education, with the proportion of individuals achieving the physical activity guidelines declining from 55% to 35-40%, respectively (Bray & Born [2004]. Journal of American College Health, *52*, 181-188). While physical and mental health are clearly important to maintain and improve in young adulthood, little is known about the link between sedentary behaviour, physical activity, stress and depression in university students. Therefore, the aim of the current research was to investigate the relationship between habitual sedentary behaviour, physical activity, stress and depression in undergraduate university students. Liverpool John Moores University Research Ethics Committee granted ethical approval. First year Sport and Exercise Science students (*n* = 223) completed the Depression Anxiety Stress Scales (DASS-21) self-report questionnaire to assess stress and depression. Anthropometric measures of stature and body mass were also taken. Of these, 50 randomly selected participants wore a GT9X ActiGraph accelerometer on the non-dominant wrist for 7 days to assess habitual sedentary behaviour and physical activity. Accelerometer data were processed in ActiLife software and customised Microsoft Excel macros were used to determine time spent in light, moderate and vigorous intensity physical activity, and sedentary behaviour. In SPSS, correlations statistically analysed the associations between sedentary behaviour, light-, moderate-, vigorous-, moderate-to-vigorous intensity physical activity, and, stress and depression. Stress and depression levels was classified as normal for 58.3% and 59.2% of the sample, respectively. A small percentage of the sample: 5.4% and 5.8% were classified as severely or extremely stressed and depressed, respectively. Compared to males, females had a higher stress score but lower depression score, although differences were not significant. The results show that 95% of accelerometer wearers met the government guidelines for physical activity. There were no significant correlations between sedentary behaviour, any physical activity intensity, and stress and depression. The findings will help inform university strategies for health and well-being, especially targeting females as they had higher stress scores.

What are the associations between extroversion and enjoyment in group vs. non-group physical activity?

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Physical inactivity is associated with a variety of health issues, and the prescription of physical activity is common to alleviate some of these. One problem facing practitioners is that of adherence to a physical activity program. It has been shown that enjoyment is a factor in physical activity adherence. It has also been shown that the personality trait of extroversion is associated with enjoyment. There is also anecdotal evidence suggesting that physical activity as part of a group can yield more enjoyment than in non-groups. It is the purpose of this study, therefore, to explore the associations between enjoyment and levels of extroversion in group and non-group based physical activity interventions. Institutional ethical approval was sought after and granted. Seventeen subjects were recruited and randomised into two groups: 'group' (n= 8) and 'non-group' (n= 9). The 'group' group were asked to walk for 30-minutes for 5 consecutive days as part of a pair, and subjects in the 'non-group' group were asked to do the same intervention alone. All subjects completed two surveys, one pre-intervention measuring extroversion using the Goldberg Transparent Bi-Polar Inventory, wellness levels using the Warwick-Edinburgh Mental Well-being Scale, age, sex and body mass index (BMI). The post-intervention survey measured wellness and enjoyment of the intervention using the Physical Activity Enjoyment Scale (PACES). A multiple regression showed no statistically significant relationship between extroversion and enjoyment, a statistically significant relationship between enjoyment and intervention group (P = 0.038), and a significant relationship between pre-intervention wellbeing scores and enjoyment scores (P = 0.003). Extroversion is not a predictor for enjoyment in this sample, however wellbeing and being part a group are predictors of enjoyment in this sample. Practitioners should consider prescribing physical activity as part of a group to yield higher enjoyment (and therefore, adherence). Due to the small sample size, further study is needed to confirm or refute this.

The effects of overnight fasting on repeated sprint ability, cognitive function and mood state

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Combat sports are physically demanding sports due to their intermittent nature of short bouts of high and low intensity exercise (Andreato [2017]. Sport Med open, *3*, 9). Additionally, combat sports can be physiologically demanding due to the pre-competition weight-loss strategies athletes frequently follow to achieve their chosen weight-category (Langan-Evans [2011]. Strength and Conditioning Journal, *33*, 25-39). Although limited research has shown that fasting can have adverse effects on mood, cognition and high-intensity performance (Petterson [2013]. International of Athletic Training, *48*, 99-108), there is a lack of research on the effects of fasting on mood, cognitive function and performance in intermittent sports. This study aims to investigate whether a 12-hour fast affects sprint ability, cognitive function and mood state in 10 recreationally active males (mean ± SD; age 21.8 ± 2.44 years; stature, 178.1 ± 5.9 cm; body mass 74.3 ± 12.6 kg). Participants were randomly allocated to a fasted (F) or non-fasted (NF, 1.2 g/kg^{-1} CHO) condition and visited the lab on two separate occasions. A repeated sprint test consisting of 3 Wingate tests with 2-minute passive recovery was conducted on both days under the two different conditions. Pre, during and post measurements included heart rate, blood lactate (BLa), glucose, peak power output (PPO), fatigue index (FI), rating of perceived exertion (RPE) and rating of fatigue (RoF). Pre and post testing, participants completed the Brunel Mood Scale (BRUMS), the Stroop Shift test and the *3*-back test. No significant differences were found in BLa, glucose, PPO, FI, RPE, and RoF in the F and NF condition ($P > 0.05$). Although there was no statistical significance in FI, the relative change in FI from pre to post-exercise increased 4-fold in the F condition (7.44 ± 18.58%) compared to NF (3.49 ± 17.71%). A significant decrease was observed in the percentage of correct answers via the Stroop shift test post testing in NF compared to F ($P < 0.05$), with no other differences found in mood and cognitive function between the two conditions. It appears that 12-hours of fasting does not have a detrimental effect on exercise performance in intermittent exercise. Additionally, mood and cognition did not seem to be affected after intermittent exercise. However, although insignificant, small reductions observed in FI may be important in competitive situations. Further studies with a greater sample size and a longer fasting period need to be conducted in intermittent type exercise, to further investigate potential adverse effects on performance.

The effects of custom-made compression garments on recovery and performance parameters after high intensity running

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Returning to optimal performance can be achieved through balancing training stress and recovery (Kellmann [2010] Scandinavian Journal of Medicine and Science in Sports, *20*, 95-102). Insufficient recovery can leave individuals feeling muscle pain and discomfort (DOMS), lasting for up to 5-7 days after exercise (Valle et al [2013] Muscles Ligaments Tendons Journal, *3*, 295–302). In recent years, interest in compression garments (CG) has grown as a non-invasive recovery modality. CG create an external pressure gradient, reducing space for swelling thus reducing muscle damage (Jimenez et al [2016] Physiology and Behaviour, *153*, 133-148). CG have also been found to improve performance through improved blood flow to the muscles (Hill et al [2013] British Journal of Sports Medicine, *48*, 1340-6). Previous research has focused on 'off-the-shelf' CG, with limited research of made-to-measure CG, tailored to fit the individual athlete. Accordingly, the present study aimed to investigate the effects of made-to-measure CG on performance and recovery indicators, during and after high intensity running. Eleven recreationally trained runners performed two time to exhaustion treadmill trials (TTE) at 110% of their identified critical speed. One trial was performed in running shorts and the other in compression garments. Trials were presented in a counter-balanced order. CG were a full-length lower limb design, custom made to each participant (Kurio Compression, Nottinghamshire, UK). Performance CG were worn during the trial and recovery CG were worn for 12 hours, immediately after the completion of the CG trial. A variation in applied pressure distinguished between the garments. TTE, pre and post blood [lactate] and running economy were recorded. Participants recorded their perceived level of DOMS through a visual analogue scale (VAS), pre, post, 12 hr and 24 hr after running trials, thus assessing recovery. TTE was significantly Improved (P = 0.01; d = 0.39) when wearing CG (687 ± 254 vs. 599 ± 189 s), along with a reduced perception of DOMS after 12 hr (14.4 ± 12.9 vs. 22.7 ± 15.2 mm; P = 0.01; d = 0.59) and 24 hr (5.8 ± 6.0 vs. 13.27 ± 11.9 mm; P = 0.01; d = 0.79). No significant differences between conditions, in response to the running trial, were found in blood [lactate] or heart rate, however, a small effect (38.89 ± 11.6 vs. 42.6 ± 10.2 ml·kg·min^{-1}; d = 0.34) for improved running economy was reported during the CG trial. This data confirms CG improved high intensity running performance and recovery, however, mechanisms remain somewhat unclear. It should be noted that improvements might be a result of individual's self-belief or a potential placebo effect.

The effect of cold water immersion on exercise recovery in healthy active males: a systematic review

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Cold water immersion (CWI), hot water immersion and contrast cold and hot water immersion strategies have been used to accelerate the post-exercise recovery process. CWI is one of the most widely used cooling recovery strategy within the sports industry. However, despite the recent increase in research quality surrounding CWI, outcomes remain inconsistent and unclear. Therefore, the aim of this study was to systematically review the ergogenic practice of post-exercise cooling strategies to enhance recovery from exercise. A focussed research question was defined, 'Do post-cooling intervention strategies improve recovery after exercise". Acute and chronic recovery was defined using an objective metabolic marker of blood lactate (BL) and a subjective measure of delayed onset muscle soreness (DOMS). The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) good practice guidelines for conducting systematic reviews were followed. Four electronic and scientific databases (Discovery, PubMed, Research gate & Goggle Scholar) were used to source and access relevant scientific articles from the past ten years. Only articles published in the English language were included. Fifty-eight journal articles were initially identified with a final ten articles meeting the strict inclusion criteria. Six of the ten studies (60%) showed a positive effect of using CWI for recovery purposes. Other studies demonstrated that massage, contrast water therapy and active rest elicited similar results. Limitations of the study included inconstant immersion times and protocols and also a wide range of exercises to evoke physiological stress. There may be a risk of language bias as only English articles were considered and publication bias may have reduced the accessibility of information not formally published. Future research in this area should look to replicate or standardise the intervention, exercise and participant protocols to reduce limitation variables.

The role whole-body post activation potentiation has on a 100 m front crawl swimming performance

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In the last 5 years of the British University and College Sports short course 100 m freestyle final, the average time between first and second position has been 0.67 s. This very small difference means that marginal gains are required to be successful against other athletes at this level of competition. Post-activation potentiation (PAP) has been used with an aim of improving swimming performance, however, studies have only induced PAP to lower limb muscle groups in an attempt to improve the start of very short sprint performance (Sarramian et al., [2015], Journal of Strength and Conditioning Research, *29*, 1003-1009). Accordingly, this study investigated if a whole-body PAP stimulus, performed prior to a maximal 100 m front crawl swim, would influence performance. Following ethical approval, ten (4 females) University level swimmers (mean ± SD age, 20.75 ± 1.11 years; stature, 177.07 ± 9.86 cm; body mass, 73.18 ± 12.27 kg) participated in this study, with all participants receiving regular strength and conditioning training. In a randomised order, all participants took part in a PAP and control trial. The whole-body PAP stimulus consisted of body weight squat jumps and medicine ball slams. Countermovement jump (CMJ) height was collected pre and 8 minutes post PAP stimulus or 10 minutes post the period of sitting (control). Swimming time (s) at 50 and 100 m was recording with touch pads (Daktronics timing system, SD, USA) and the number of strokes completed over 100 m, and for each individual 25 m length, was verified by video recordings. The whole-body PAP protocol successfully induced an improvement in CMJ height compared to control (1.74 ± 2.39 vs. 0.25 ± 1.69 cm, $P = 0.046$). Mean swimming time over 100 m improved in the PAP condition compared to control (60.82 ± 4.95 vs. 61.79 ± 4.60 s, $P = 0.004$). Time in the first 50 m was not different (28.97 ± 2.05 vs. 29.39 ± 2.11 s, $P = 0.370$) and there was no difference in stroke rate throughout the 100 m ($P = 0.91$). A whole-body PAP stimulus improved 100 m front crawl performance however, when understanding the individual effects of PAP, CMJ height was increased with the same effect not being observed in completed strokes. This could suggest only the legs were potentiated and the medicine ball slams were not an effective method of eliciting PAP in the upper body.

Effects of 300 mg caffeinated gum on sprint performance after a simulated first half in university-standard male soccer players

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Despite the prevalence of caffeine use in team sport and the well documented ergogenic properties (Chia et al. [2017]. Journal of Sports Medicine, *47,* 174-182), there is a paucity of research on caffeine administration using gum. Repeat sprint ability is crucial in soccer and declines in sprint performance are evident during the initial 15 minutes of the second half in soccer (Weston et al. [2011]. International Journal of Sports Physiology and Performance, 6, 2453-2471). Caffeine in gum form is rapidly absorbed through the buccal mucosa cavity and takes five minutes for 85% of the dose to enter the blood stream (Kammimori et al. [2002]. International Journal of Pharmaceutics, *234*, 159-167). A soccer half-time period lasts 15 minutes, therefore chewing caffeinated gum during this period for five minutes would have immediate effects post half-time. Therefore, the purpose of this study was to investigate the efficacy of caffeinated gum on second half repeated sprint performance in soccer players. The study examined sprint performance at two periods which are; 1) immediately at the beginning the second half, and 2) 15 minutes into the second half. With institutional ethics approval, using a double-blind, repeated measures crossover design, 11 University-standard soccer players performed two experimental trials involving 45 minutes of soccer specific activity followed by a 15 minute rest period where either caffeine (300 mg caffeinated gum) or placebo (identical gum with 0 mg of caffeine) was administered. This was followed by participants completing two repeated sprint tests (RST1 & RST2) consisting of 6 × 20 m sprints, each separated by a 15 minute period of soccer specific activity. Resting and post-exercise blood [lactate] were measured along with heart rate (HR) throughout the protocol and rating of perceived exertion (RPE) after each sprint test. Furthermore, total time and sprint percentage decrement (S_{dec}; %) were measured to assess sprint performance. Total time and S_{dec} were not different between trials in RST1 (0.728, P = 0.34; ES = 0.17, 0.17 respectively), although caffeine significantly reduced total time and S_{dec} during RST2 (0.041, P = 0.014; ES = 0.84, 1.06, respectively). Furthermore, RPE values were lower in RST1 and RST2 (P < 0.01; ES = 0.59, 0.84, respectively). The data suggests that moderate doses of caffeinated gum can ameliorate feelings of fatigue during repeated sprinting in soccer players and attenuate sprint decay during later stages of the second half. Such findings may prove useful towards coaches wanting to implement an effective nutritional half-time strategy to players to reduce match-induced fatigue.

A comparison between jump training and plyometric training on sprint performance in elite sprinters

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The elite sprinter's mantra is to continuously improve maximum speed. Extensive research into the development of sprint performance via a myriad of training approaches exists (Villarreal et al., [2013]. Journal of Science and Medicine in Sport, *16*, 146-150). Two such approaches: jump training and plyometrics are often regarded as analogous. Plyometric exercises incorporate powerful muscular contractions which respond to swift forceful loading or muscle stretching whereas jump training's response to dynamic load and muscle stretching is significantly longer. There is a sparse number of studies comparing these two different modes of training on sprint performance. This study aims to differentiate between the effects of jump and plyometric training on performance in a 30 m sprint and to determine which method generates the greatest short-term advantage to the sprinter. Fourteen trained national level sprinters (mean ± SD: age: 22.57 ± 3.48 yrs.) were divided into two equal groups, of which one completed jump training (JT) and the other completed plyometric training (PT) twice weekly, over six weeks. Pre-(0 weeks), mid-(3 weeks) and post-testing (6 weeks) involved a standardised warm-up prior to performing i) counter-movement jumps to assess vertical jump performance and contact force and ii) 30 m treadmill sprints to assess 30 m maximum sprint speed. The JT group performed squat jumps without counter movement and box jumps at various heights (3 sets of 5 reps) depending on ability. Plyometric training consisted of three sets of five depth jumps and five hurdle hops from a box. Recovery (1 minute between reps, and 3 minutes between sets) was applied. Both groups observed an improvement in all assessed parameters however there was no statistical significance between the groups except for sprint contact time during the 30 m treadmill sprints ($P < 0.05$). Sprint time and sprint contact time observed a larger improvement for the PT group than JT from pre- to post testing (Sprint time: −24.4% and −16.6%, Sprint contact time decreased: −16.66% and −0.99%, respectively). The JT group reported a greater improvement in jump height than the PT group from pre- to post- testing (PT 17.1% increase (d = 0.48) JT 39.9% increase (d = 0.85)). The results show that short-term intervention of JT and PT generally yielded positive athletic performance improvements for both groups in six weeks. Implementation of either PT or JT into athletes' regime is therefore deemed worthwhile to obtain short term improvements in sprint performance.

Investigating one repetition maximum back squat and vertical jump height of female university volleyball players

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Squatting movement pattern is predominantly adopted in back court defensive play and provides the explosive motion of vertical jumps (VJ). Vertical jump performance combats blocking, hitting and serving (Ziv, & Lidor [2010] Scandinavian Journal of Medicine & Science in Sports, *20*, 556-567), therefore having a large VJ height could be advantageous. The primary aim of this study was to compare volleyball athlete and generally active population VJ characteristics and 1 repetition maximum squat (1RMS). A secondary aim was to identify whether squat performance could differentiate VJ performance. Fourteen female participants formed two groups, volleyball players group (n = 8) and generally active group (n = 6). Participants completed two testing sessions, including familiarisation, which included countermovement vertical jump with arm swing on a force plate in one session. Five jumps were recorded and averaged for each participant gaining representation of average performance due to VJ performance varying in a game. 1RMS strength was also assessed, starting with a weight pre-determined during familiarisation. 1RMS was normalised to participant mass. Jumping force-time data and 1RMS data were analysed using SPSS. No significant difference was found for 1RMS (t_{12} = 0.632, p = 0.539, d = −0.341). There were significant differences between the groups countermovement jump phase duration (t_{12} = 3.912, p = 0.002, d = −2.114) and relative mean force (t_{12} = -2.600, p = 0.023, d = 1.404). While no significant correlation was found between jump height and 1RMS in either group, there was a stronger correlation in the volleyball group (r_p= 0.548, p = 0.160) compared to the generally active group (r_p= 0.363, p = 0.479). When both groups where combined a significant correlation was found between phase duration and relative mean force (r_p= −0.943, p < 0.01). No significant correlation was found between 1RMS and VJ height. This may be due to the experience level of the players and lack of weighted squat training. Volleyball players had a smaller relative jump mean force compared to the general population. However, no difference was found in jump height therefore volleyball players VJ may be more efficient and require less energy. This is beneficial in a game where players repeatedly jump over an extended period of time. The phase duration for volleyball players was longer this may be due to training, taking longer to complete the jump provides more decision time to determine where to place a block/spike and to generate necessary impulse.

Influence of the menstrual cycle on load-velocity profiles in trained female university athletes

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The menstrual cycle is a key biological rhythm in the female body, the relationship between oestrogen and progesterone is considered to impact strength however evidence is inconclusive and therefore further research is needed. The contemporary nature of this topic suggests that during phases in a menstrual cycle where oestrogen is high and progesterone is low, maximal strength is enhanced (Pallavi [2017]. Journal of Clinical and Diagnostic Research, 11). The aim of this study is to test maximal strength across a menstrual cycle in university female athletes and establish if hormonal changes have an impact on load-velocity profile. Twelve resistance trained female university athletes will be recruited. The study will be a repeated measures design. A pilot study will conducted to ensure testing procedures adhere to the purpose of the study. Participants will complete a LEAF-Q (Melin [2006]. British Journal of Sports Medicine, 48, 540-545) to give an indication of menstrual status. Individual food and caffeine intake will be replicated prior to each testing session to minimise its impact on performance. Back squat 1RM will be tested in athletes within a familiarisation session; 30%, 50%, 70% and 90% loads will then be calculated for each individual. Participants will be tested once a week, on the same day for four weeks across one whole cycle in which they will perform four repetitions at each load. Three minutes rest will be given in-between each load. Saliva samples will be taken at each testing session and analysed to determine menstrual status using ELISA for Progesterone and Oestrogen. Using ELISA, it will be evident what phase of the menstrual cycle each testing session took place in. Squats will be performed on a force plate (Kistler, Germany) so maximum force can be recorded concurrently with a linear position transducer (Gymaware, Australia) to record peak velocity under each load. Back squat 1RM will be recorded again following 4 weeks of testing in the same menstrual phase as baseline testing to see if any changes in strength are present as a result of training. It is anticipated that the results will inform training and competition periodisation in female athletes.

The possible effect of high intensity interval training on physiological markers and obesity, as well as understanding the possible roles of single nucleotide polymorphisms

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There has been an increase in global obesity levels, matched with a decrease in participation levels. Obesity contributes to increased body weight, leading to physiological (cardiovascular and respiratory) defects. Genetics, such as single nucleotide polymorphisms (SNPs), can also increase the likelihood of developing obesity. Continuous exercise and dietary changes are common forms of treatments (Fock and Khoo 2013, Journal of Gastroenterology and Hepatology, *28*, 59-63). However, practitioners are beginning to suggest the use of high intensity interval training (HIIT), as is possesses a number of benefits, such as a reduced session time. The aims of the study were to assess how a 6-week HIIT programme can affect obesity characteristics as well as a number of physiological values. Secondly, to investigate the effect of a SNP within the FTO (Fat-Mass and Obesity) gene on an individual's body fat percentage and how this responds to HIIT. Thirty-two healthy subjects were evenly divided into exercise and control groups. Physiological characteristics linked with obesity were examined before and after intervention, for both groups. The intervention involved 3 sessions a week, 3 × 1-minute bouts of high intensity (110-120 rpm) with 3 × 2-minute low intensity bouts (40-50 rpm), at an individualised resistance. Mismatched PCR and restriction fragment length polymorphism was used to analyse the exercise group for the FTO gene SNP (RS9939609) post-intervention. These were categorised into Homozygous Lower Obesity Risk (T: T) (n = 1), Heterozygous Medium Obesity Risk (T: A) (n = 14) and Homozygous Higher Obesity Risk (A: A) (n = 1). There was no significant difference for body fat percentage (P= 0.33), BMI (*P* = 0.67), cholesterol (*P* = 0.79), pulse pressure (*P* = 0.69) and waist: hip ratio (*P* = 0.86) between the pre and post intervention results for the exercise group. There was no significant difference in body fat percentage between the pre and post intervention for T: A. The sample size for both T: T and A: A was insufficient for statistical analysis, however, results suggested that HIIT could possibly reduce body fat in the elevated risk A: A type (24% decrease). To conclude, the 6-week training programme did not have an effect on the measured obesity characteristics. Although the results, along with improvements of the experimental design, can drive further research to statistically test whether a HIIT programme can reduced the likelihood of obesity development for individuals who are at a higher risk.

The effects of intermittent lower-limb occlusion on recovery in rugby union players: a comparison study between university and regional academy players

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Competitive rugby games cause muscle damage and neuromuscular fatigue (Gabbett, King & Jenkins, [2008] Sports Medicine, *38*, 119-138). This study sought to investigate the effects of intermittent lower-limb occlusion on well-being, gym-based performance outcomes and Creatine Kinase (CK) levels two days post-match in university and regional academy players.Following institutional ethical approval, twelve male participants took part in a randomised counterbalanced crossover study. Five participants from the Edinburgh Rugby Academy (mean ± SD; age, 18.6 ± 0.8 years, body mass, 93 ± 9.23 kg, stature, 188.4 ± 6.83 cm) and seven participants from the Edinburgh Napier University Rugby Union Team (age, 19.7 ± 1.03 years, body mass 79.57 ± 10.68 kg, stature, 180 ± 6.37 cm). All participants completed a familiarisation session and two testing cycles. A testing cycle consisted of playing a competitive rugby union game followed by filling out a well-being questionnaire and completing a lower limb occlusion recovery intervention. Two days post-game, as part of the same cycle, participants filled out another well-being questionnaire and completed a number of gym-based exercises (back squat [BS], bench press, squat jump [SJ], countermovement jump [CMJ] and drop jump). Performance outcomes were measured using GymAware (Kinetic Performance, Australia) and the OptoJump (Microgate, Italy) systems. The occlusion recovery intervention comprised of two randomised protocols. Protocol 1 (control group): Participants fastened the occlusion cuff (Occlusion Cuff Elite®, UK) firmly to the proximal end of their thigh and applied 15mmHG pressure for three minutes before switching legs. This was repeated bilaterally (12 minutes total). Protocol 2 (experimental group) was the same as protocol 1 but with a pressure of 220 mmHG. Blood sampling was performed in a sub-set of participants (8/12) to determine the influence of post-match intervention on Creatine Kinase (CK). CK was quantified in plasma samples taken at baseline and two days post-match using semi-automated spectrophotometry. All variables were compared between sample groups, but due to lack of significant differences the data were additionally analysed as one group. Preliminary analysis shows that occlusion did not significantly improve performance outcomes. However, positive trends were seen in the intervention group for CMJ height (P=0.089, ηp^2=0.262) and relative peak power (P=0.057, ηp^2=0.317). Small improvements were seen in 10/14 measured variables following occlusion. The four variables not showing improvement were BS (mean velocity, peak force, peak velocity) and SJ (jump height). Well-being significantly improved (P=0.01) following occlusion in the university level participants. In summary, larger studies are required to test the effectiveness of intermittent lower limb occlusion as a recovery method in rugby union players.

Repeatedly training in a sauna suit induces similar magnitudes of physiological and perceptual adaptations to chamber-based heat acclimation protocol

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Upcoming major sporting events have been scheduled for hot/humid climates (e.g. FIFA World Cup 2022, Olympic Games 2020), where elevated heat stress will impair intermittent sprinting performance compared to temperate conditions (Hayes et al [2013] Journal of Sports Sciences, *31*, 565-572; Taylor [2014] Comprehensive Physiology, *4*, 325-365). Heat Acclimation (HA) undertaken in a heat chamber is traditionally prescribed to induce heat adaptation, however, cost, disruption to training and logistical constraints may preclude the use of this strategy prior to competition. This study aimed to determine whether training whilst wearing a full-body sauna suit can confer similar heat adaptations to a laboratory based HA protocol. Following ethical approval, eight males completed short term heat acclimation (STHA) (five 90-minute training sessions in either 40°C and 40% relative humidity (RH)) [*n* = 4, body mass: 78.98 ± 6.04 kg; body surface area: 1.97 ± 0.08 m^2; $\dot{V}O_{2peak}$: 3.14 ± 0.65 $L \cdot min^{-1}$] wearing normal clothing or (five 90-minute sessions in 20°C and 40% RH [*n* = 4, body mass: 78.68 ± 10.90 kg; body surface area: 2.01 ± 0.15 m^2; $\dot{V}O_{2peak}$: 3.64 ± 0.11 $L \cdot min^{-1}$] wearing a full body sauna suit ($STHA_{SS}$). During the interventions, $STHA_{SS}$ matched STHA for peak core temperature (STHA: 38.82°C; $STHA_{SS}$: 38.85°C, P = 0.69) and displayed a larger peak heart rate (HR: STHA: 125 $b \cdot min^{-1}$; $STHA_{SS}$: 167 $b \cdot min^{-1}$, P < 0.01) and whole body sweat rate (WBSR) than STHA (STHA: +1.11 $L \cdot hr^{-1}$; $STHA_{SS}$: +1.27 $L \cdot hr^{-1}$, P < 0.05). Meaningful adaptations post-intervention included; reductions in resting (STHA: −8 $b \cdot min^{-1}$; $STHA_{SS}$: −7 $b \cdot min^{-1}$, P = 0.91) and exercising HR (STHA: −10 $b \cdot min^{-1}$; $STHA_{SS}$: −7 $b \cdot min^{-1}$, P = 0.63), increased WBSR (STHA: +0.04 $L.hr^{-1}$; $STHA_{SS}$: +0.78 $L \cdot hr^{-1}$, P = 0.07) and local sweat rate (STHA: +0.10 $mg \cdot min^{-1} \cdot cm^{-2}$; $STHA_{SS}$: +0.07 $mg \cdot min^{-1} \cdot cm^{-2}$, P = 0.62) and conserved sweat sodium concentration (STHA: −4 $mMol \cdot L^{-1}$; $STHA_{SS}$: −11 $mMol \cdot L^{-1}$, P = 0.51). Meaningful perceptual adaptations were also found for reductions in rating of perceived exertion (STHA: −1; $STHA_{SS}$: −1), thermal sensation ($STHA_{SS}$: −1) and thermal comfort (STHA: −1; $STHA_{SS}$: −1). $STHA_{SS}$ in temperate conditions displayed a similar physiological strain during 5 sessions of cycling to STHA within an environmental chamber in hot conditions. $STHA_{SS}$ improved cardiovascular, perceptual and sudomotor markers of heat adaptation to the same extent as STHA and may therefore be considered an appropriate alternative to chamber based regimes.

Assessing the physiological cost and intrinsic motivation of multiplayer versus single player active videogames in young healthy males

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It is well known that obesity remains a problem among children and adolescents within the UK, with almost one third of 2 to 15 year olds being overweight (Health and Social Care Information Centre, 2015). Within the UK, video games are played for almost 13 hours per week (Pratchett [2005], *BBC Audience Research*, New Media, London). Exergaming (exercise and gaming) can therefore be used to increase the physical activity levels of individuals, used in combination with other sources of activity (O'Donovan & Hussey [2012] Physiotherapy, *98*, 205-210). The aims of this study were twofold: (1) to compare the physiological costs of active videogames (AVGs) and sedentary videogames (SVGs) in a multiplayer mode, in comparison to single player, and (2) to assess intrinsic motivation of participants during each game mode. Institutional ethical approval was granted. A convenience sample of nineteen young males participated in the single player mode of the study (age, 23 ± 3 years; stature, 178 ± 6 cm; body mass, 79 ± 15 kg), whilst eighteen completed multiplayer (age, 24 ± 5 years; stature, 180 ± 7 cm; body mass, 81 ± 13 kg). Participants completed a maximum oxygen uptake ($\dot{V}O_{2max}$) test and one gaming session, if only completing single player, including AVGs (Reflex Ridge, River Rush and Boxing for the Microsoft Kinect) and SVGs (FIFA 14 and Call of Duty for the Microsoft Xbox). Those who also completed multiplayer gaming attended one further session, playing the same games. Heart rate (HR) and oxygen uptake ($\dot{V}O_2$) were recorded continuously during all videogames. Ratings of perceived exertion (RPE) were taken every 3 minutes during AVGs and SVGs. Energy expenditure (EE), expressed as metabolic equivalents (METs), were calculated. One MET was defined as the volume of oxygen consumed at rest in a seated position and is equal to 3.5 mL of O_2/kg of body mass/minute. The exercise intensity for each game was expressed as a percentage of $\dot{V}O_{2max}$ and percentage of age-predicted maximum HR (HR_{max}). On completion of each game mode, the flow state scale (FSS) was administered for both AVGs and SVGs (single player and multiplayer) in order to assess intrinsic motivation. During AVGs, single player gaming produced significantly greater exercise intensity (RPE, HRmax, $\dot{V}O_{2max}$) and EE ($P < 0.01$) in comparison to multiplayer gaming. The FSS displayed greater scores for multiplayer gaming through all sub-categories in multiplayer gaming, many of which significant, in comparison to single player. Our results indicate multiplayer gaming induces greater levels of intrinsic motivation, despite no improvement in physiological responses.

A gender comparison of torso strikes in male and female competitive amateur boxing

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In contact sports such as boxing, rugby, and football, upper body impacts are a common occurrence. The greater presence of breast tissue in females could increase the risk of injury to the breast whilst competing. It is recommended that female contestants wear a sports bra together with a singlet or top that covers the back and is designed to preserve modesty, furthermore, breast protectors are recommended. However, the effect of impact on the breast in female contact sports has received limited research. A paper investigating the effect of participating in boxing on Italian female's breast health 2002 to 2007 found boxing to be a safe sport with no specific disease, particularly in the breasts. (Massimiliano et al. [2011], British Journal of Sports Medicine, *45*, 563-570). However, no published study on the frequency of breast impact during competitive boxing matches has been undertaken. The aim of this study is to identify whether female boxers experience a greater frequency of breast impacts when compared with male boxers. The hypothesis of the study was that female boxers will target the breast area to seek a competitive advantage. To investigate this, a sample size of twenty participants (ten female, ten male) who have been boxing for one or more year(s) were utilised. Ten (five of each group) of the participants were filmed whilst competing. Footage was recorded using two IPads on tripods in opposing corners of the ring, using a sampling rate of 60 Hz. For the other ten participants boxing match footage was collected from public domain websites such as Youtube. The footage collected for both groups was coded for torso impacts using Nac Sport performance analysis platform. Coding included recording frequency and location of each torso impact and whether it was a purposeful strike or a deflection or miss. The footage was watched at half speed to ensure no impacts were missed. The results for this study are currently being analysed. The study has the potential to establish that female boxers target the breast area of their opponents. Targeting could be utilised to achieve a professional advantage. If this is identified, more research in the area on the effects of impacts to the breast should be undertaken and protective breast garments should be further developed.

Mechanical stress in the knee during a low-handicap golf drive

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The modern day golf swing requires great power to produce and perform a successful drive (Keogh & Hume [2012] Sports Biomechanics, *11*, 288-309). However, the power required for this action has detrimental effects on the lower limb, particularly the tibiofemoral joint. During a drive, the tibiofemoral joint experiences increased internal compartmental stress causing increased compressive forces with the potential to reach up to three times the body weight (Shenoy et al [2013]., Orthopaedics and Trauma, *27*, 264-371). Therefore, the aim of this study was to compare the moments experienced during the golf swing, more specifically during the down-swing phase, in both the front (M_KL) and back (M_KR) leg, to establish whether there is an increase in a golfer's injury potential. Four male, right handed golfers volunteered to participate in this study (mean ± standard deviation: 27.5 ± 15.7 years, 1.79 ± 0.06 m, 73.8 ± 1.2 kg and 5.1 ± 2.2 handicap). Three dimensional kinematic and kinetic data of 35 successful golf drives were recorded by Vicon Nexus 2.0 (200 Hz) and two Kistler force plates (1000 Hz) respectively. Knee joint moments and club head angular velocity were analysed in mediolateral, longitudinal and anteroposterior movement planes. Centre of pressure was also analysed in the longitudinal movement plane. Peak joint moments during the down-swing phase were M_KL: 1.32 ± 0.42 Nm/kg M_KR: −0.84 ± 0.34 Nm/kg (flexion and extension), M_KL: 0.56 ± 0.24 Nm/kg M_KR: 0.93 ± 0.37 Nm/kg (internal and external rotation), M_KL: 0.17 ± 0.06 Nm/kg M_KR: 0.04 ± 0.06 Nm/kg (abduction and adduction). Peak club head angular velocity occurred during the down-swing phase just prior to ball contact. Changes in centre of pressure occurred highlighted a shift in shear forces and the compressive loads at the initiation of the down-swing phase (LS: 1.16m and LF: 1.19m, RS: 0.56m and RF: 0.63m). Significant differences (P<0.05) in flexion and extension moments were observed between the front and back knee in all four of the participants. The findings of this study suggest that large knee moments during all three movement planes, particularly during flexion and extension, are caused by increased compressive and shear forces during the down-swing phase of the golf swing linked to a decrease in ACL function and stability. Analysis of moments developed in the front and back knee respectively would be particularly useful for analysing a golfer's performance and the relationship that performance has on their injury potential.

Optimising strength development in boxers: determination of peak impulse and rate of force development during a 'trap-bar deadlift'

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Effective punching depends on rapid rates of force development (RFD), momentum of the punching arm, and a second-pulse in muscle activation on impact (Ruddock [2016]. Strength and Conditioning Journal. *38*, 81 - 90). The Impulse-Momentum (f·t = m·v) relationship states that impulse (f·t) is required to change momentum (m·v). Therefore, effective punching depends upon the generation of large impulses. Impulsiveness is developed through a combination of strength training to develop force-production and technical training. Boxers, however, present several contra indicators to heavy strength-training including ankle, knee, hip and shoulder movement dysfunctions that limit the use of traditional exercises such as squats and deadlifts. The 'trap-bar deadlift' is an exercise used to develop biomechanical determinants of punching with minimal technical demands and when combined with barbell speed assessments can be used to describe, prescribe and explain strength and conditioning programmes. However, no research has demonstrated the optimal loads and barbell velocities in the trap-bar deadlift to maximise RFD and impulse. The aim of this study is to observe the optimal load and mean-velocity at which peak impulse and peak RFD occurs. With institutional ethics approval, 10 highly-trained boxers will be recruited for the study. During visit 1, participants will perform 3 repetitions at 80, 100, 120, 140, and 160% of body mass, and the speed of each repetition will be assessed using a linear position transducer (GymAware, Kinetic Performance, Australia). Bi-variate correlation will be used to predict the load corresponding to 0.37 $m \cdot s^{-1}$, which is equivalent to the speed of a true 1 RM effort, (Pallarés [2014]. Journal of Sports Sciences, *32*, 1165-1175). On visit 2, participants will perform 3 repetitions at 30 to 90% 1RM with maximum exertion on a force plate in 10% increments (9281ca, Kistler Instruments, Austria), whilst assessing velocity for each repetition. Peak RFD, and peak impulse will be calculated from ground-reaction forces. Differences between dependent variables for each load will be assessed using a One-Way ANOVA, with statistical significance set at $P < 0.05$. Outcome measures will be evaluated using standardised mean differences (Cohen's *d*) and 90% confidence intervals. Quadratic regression will be used to identify the %1RM and corresponding velocity that elicits peak RFD and peak impulse. The results will provide strength and conditioning coaches with information to prescribe loads and velocities to optimise RFD and impulse during the trap-bar deadlift and therefore develop biomechanical determinants of punching. without the need for force-plate based assessments.

The effect of ankle taping and bracing on stability and ground reaction forces in a dynamic cutting task

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There is a high incidence of inversion sprains across sports which involve injury to the lateral ligaments of the ankle, most commonly the anterior talofibular ligament. Inversion sprains occur at foot strike during landing or change of direction due to explosive inversion and plantar flexion. Once sprained, ankles undergo greater levels of instability, and preventative methods are of interest. Netball cutting manoeuvres involve rapid change in direction after landing, these demanding movements generate high and repetitive ground reaction forces (GRFs). Greater GRFs increase the likelihood of ankle sprain occurrence. Centre of pressure displacement (CoP) can be utilised as an outcome measure for stability. Ankle taping and bracing are utilised to reduce sprain occurrence, yet conflicting evidence regarding effectiveness exists. Therefore, the aims of this investigation were; 1) to examine the effect of ankle taping and bracing on GRFs during a netball cutting manoeuvre and 2) to explore the effect of taping and bracing on CoP displacement. Ten participants, competing at BUCS level in netball volunteered to take part. After ethical approval, participants completed five trials in each condition; the control (netball shoe), taped (closed basketweave technique), and braced (semi-ridged). Participants repeated a dynamic cutting manoeuvre past a static defensive opponent at speeds between 3.6 and 4.4 m/s. GRF data were processed (% body weight) using (Bioware software). Statistical analysis was carried out using SPSS V.24. A Shapiro-wilks test was used to test for normality and repeated measures analysis of variance were used to test for differences. Taping the ankle brought about a greater reduction in vertical GRFs (−7.69%) and loading rates (−10.17%) than bracing. Both taping (−11.00%, −22.76%) and bracing (−3.24%, −12.61%) brought about reductions in GRFs and loading rates (respectively) compared to the control. Group differences between conditions were not significant ($P > 0.05$), with a small effect size ($\eta^2_{partial} < 0.05$) for all variables. The results suggest taping and bracing has no significant effect on GRFs during a dynamic cutting manoeuvre. In addition, it seems there is no apparent effect on stability of the ankle. The rapid and reactive nature of netball is potential explanation for the high number of ankle sprains sustained. The protocol may have not generated enough stress on the ankle and so did not require additional support, giving potential explanation as to why no differences were observed. Future research should focus on reactive cutting manoeuvres.

Exploring the Interaction Effects of Physical Activity and Personality on Subjective Wellbeing of University Students in Hong Kong and the United Kingdom

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Subjective wellbeing (SWB) has been accepted as a well-established predictor of academic success at university level (Howell, 2009, The Journal of Positive Psychology, *4*, 1-13). However, university has also been considered a time where students face various psychological challenges, and previous research has shown that university students tend to have poorer SWB than the general population (Cummins, 2003, Social Indicators Research, *64*, 225-256). Hence, it would be useful to further investigate the antecedents of university students' SWB. While physical activity (Chuang et al., 2017, American Journal of Health Behavior*, 41*, 446-453) and each of the Big Five personality traits (Steel et al., 2008, Psychological Bulletin, *134*, 138-161) have all been consistently linked SWB, no published research has examined whether individuals with a particular personality would be more or less likely to experience physical activity's influence on their SWB. This study aimed to assess the interaction effects of physical activity and personality on SWB, and whether they would vary between university students in Hong Kong (HK) and university students in the United Kingdom (UK). The Godin-Shephard Leisure-Time Physical Activity Questionnaire (GSLTPAQ) was used to measure physical activity; the Big Five Inventory (BFI) was used to assess personality; the Satisfaction with Life Scale (SWLS) and the Positive and Negative Affect Schedule (PANAS) were used to measure SWB. Altogether 387 (188 from universities in HK and 199 from universities in the UK; 157 male and 230 female) students completed this study. Their mean age was 21.15 ± 3.68 years old. Results showed that the relationship between physical activity and SWB was significantly moderated by agreeableness (P = 0.023) and marginally moderated by conscientiousness (P = 0.052) - the relationship was significantly stronger among more agreeable participants and marginally stronger among more conscientious participants. Extraversion, openness to experience, and neuroticism did not moderate the physical activity-SWB relationship. Consistent with previous research, agreeableness, conscientiousness, extraversion, openness to experience, and physical activity were positively related to SWB, and neuroticism was negatively related to SWB (all $P < 0.001$). Multi-group analysis showed that none of the interaction effects varied between the HK participants and the UK participants; however, the extraversion-SWB path was significantly stronger in the UK sample compared to the HK sample (P = 0.003). Potential explanations for the results above, implications of the findings for sports and exercise psychology, and directions for future research were discussed.

A pilot study to assess the effect of autonomous and controlled training plan provision on effort during physical activity

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Physical inactivity is a risk factor for a range of conditions associated with an increased mortality rate (Lee [2012] Lancet, *380*, 219-229). Therefore, creating strategies that encourage physical activity (PA) is key to reducing the burden of inactivity on society. One method to improve behaviour maintenance is self-control (Sniehotta [2005] Psychology & Health, *20*, 143-160). Ego depletion theory states that the depletion of self-control reduces physical activity participation and self-determination theory builds on this, declaring that controlled regulation causes a reduction of self-control capacity. This study aimed to determine the effect autonomy-supportive or controlled exercise plans have PA effort. A secondary aim was to confirm that a reduction in effort was due to a loss of self-control and not mental fatigue. Forty-eight participants were recruited (33 females). Participants were randomized into three conditions (controlled, autonomous and control groups). Each participants' effort was tested with a wall sit at baseline (T_0). At a subsequent session, participants completed their respective intervention condition (the creation of an autonomous exercise plan, the provision of a controlled exercise plan or no exercise plan being provided). Upon completion of the intervention participants then completed their second wall sit (T_1). Main effects were assessed using a mixed design (within-between) ANOVA. Mixed design (within-between) ANCOVAs were utilised to control for various potential mediators (physical activity behaviour). Due to being underpowered, analysis confirmed that more participants would have produced a significant difference in wall sit duration, with those within the autonomous regulation group holding the wall sit for a greater period (+ 18 s). Additionally, this result was confirmed to not be influenced by any covariates. Finally, the lowering of effort was established as likely being due to self-control depletion, as an increase in mental fatigue was not found. The study design did not offer any explanation for the underlying mechanisms of the improved effort. One set of potential mechanisms are the various models of self-control depletion (strength model, affect alarm model and shifting priorities model). However, as the ego depletion effect is debated, other mechanisms must be considered. These include the level of self-determined motivation, the satisfaction of psychological needs, and the motivational climate. This study has opened the door to a new consideration within PA interventions by highlighting the importance of personal choice within training plan provision. Future studies should now aim to define key concepts to provide practitioners and stakeholders aiming to increase PA participation and maintenance with new knowledge that will facilitate the creation of more effective and efficient interventions.

Promoting health and physical activity in older age: retirement as a transition point

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Retirement represents a major life transition point, a positive retirement experience is crucial for maintaining physical and psychological health in later life. Adaptation to retirement is a heterogeneous process, and so the retirement experience may vary not only across individuals but also within individuals over time (Wang, Henkens, & Van Solinge, [2011]. American Psychologist, *66,* 204). There is the evidence that retirees tend to have poorer physical health, greater depression and loneliness, lower life satisfaction and well-being in comparison with workers (Wang, [2007]. Journal of Applied Psychology, *92,* 455). However, positive effects of retirement on health and well-being have also been reported (e.g. Kim & Moen [2002]. Journal of Gerontology: Psychological Sciences, *57,* P212-P222). Despite the attempts to investigate the retirement process and perspectives extensively, the research on factors causing different retirement adjustment patterns is limited (Wang & Shi [2014]. Annual Review of Psychology, *65*, 228). It is posited that well-being and retirement experience might be affected by satisfaction/frustration of the basic psychological needs for autonomy, relatedness, and competence, as well as identity changes, retirement planning, and the attitudes towards retirement and ageing (Stephan, Fouquereau, & Fernandez [2008]. International Journal of Aging and Human Development, *66,* 329-345). As such, the proposed study aims to develop a more comprehensive understanding of the retirement experience. A longitudinal quantitative study will track the variables hypothesised to inform retirement experience over a five-year period. Individuals who plan to retire within next six months and recently retired individuals (within three months) will be recruited through diverse sampling approaches (e.g., social media, communication with local organisations, word of mouth). Participants will be required to complete questionnaires assessing well-being, needs satisfaction and frustration, identity, personality, loneliness/isolation, ageing stereotypes, coping strategies, subjective health, quality of life, and socioeconomic characteristics. Data will be collected at baseline, then monthly during the first year of study, followed by annual follow-ups. It is expected that more adaptive retirement will be associated with higher need satisfaction, stronger identity, high social support, effective coping strategies (e.g. planning), and positive ageing stereotypes; whereas need frustration, identity loss, limited social support and coping strategies, and negative ageing stereotypes will be related with a maladaptive retirement. The results of the study are expected to enhance our understanding of the retirement process and inform a pragmatic, theoretically ground intervention aimed to promote a more adaptive retirement (e.g., psychological and physiological) through the use of physical activity.

The effects of music on enjoyment, affect response, RPE and exercise intentions during sprint interval training in sedentary young adults

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Sedentary behaviour is fast becoming a public health pandemic, with 20 million UK adults not adhering to physical activity guidelines. This behaviour is linked to cardio metabolic diseases and obesity; heavily contributing to all-cause mortality. (Chau et al. [2013]. British Journal of Sports Medicine, *49*, 737-742). Sports and exercise scientist play a key role in providing evidence-based research to help create strategies in enhancing exercise participation and therefore reduce all-cause mortality related to sedentary behaviour. Anaerobic exercise protocols such as sprint interval training (SIT) have been found to produce the same physiological adaptations as traditional aerobic training, but in less time. The high intensity nature may induce negative perceptions of SIT. Literature has suggested music may play a key role in enhancing positive perceptions towards exercise (Karageorghis & Priest, [2012] International Review of Sport and Exercise Psychology, *4*, 67-84). Ethical approval for the study was granted by Sheffield Hallam University. The aim of the study was to investigate the impact of varied music tempo on enjoyment, pleasure and ratings of perceived exertion (RPE) during the immediately following a SIT session in young sedentary males (Age = 18-24 years; N=8). Participants completed 3 sessions of SIT on a cycle ergometer: one session listening to fast tempo music (140–155 BPM); medium tempo music (110-125 BPM) and a non-music control condition. The trials were randomised between participants. SIT consisted of 4 'all-out' intensity bouts with 4 min recovery between bouts. RPE was recorded during the last 5s of each exercise bout. Feeling scale (pleasure-displeasure) responses were collected at bassline, immediately after each exercise bout and immediately following the SIT protocol. Enjoyment (physical activity enjoyment scale) was recorded flowing each session. A repeated measures ANOVA was used to detect differences. Results indicated enjoyment was significantly higher in the fast music tempo vs. non-music tempo ($P < 0.05$) post exercise. RPE was significantly lower in medium tempo ($P < 0.001$) and higher tempo bout ($P < 0.05$) vs. non-music bout. Emotional balance was significantly higher in fast tempo vs. no music tempo ($P < 0.05$). This research demonstrates fast tempo was optimal at enhancing emotional balance, enjoyment and reducing RPE compared to medium and non-music condition. These results suggest fast music tempo should be recommended along SIT to potentially increase exercise adherence in sedentary males.

An ecological approach to exploring physical activity interventions aimed at young UK-based females: a narrative systematic review

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Given the well-documented benefits of physical activity (PA), high levels of sedentarism among young females have encouraged targeted interventions for PA behavior-change within this population. However, the effectiveness of such interventions has not been rigorously analysed and previous reviews of their ability to target specific barriers and sub-groups of society have produced inconsistent findings. Ecological models have been shown instrumental for categorising factors that influence health behaviours on multiple levels (intrapersonal, interpersonal, organisational and environmental, and, policy and legislative). Therefore, this narrative systematic review aims to collate, summarise and synthesise evidence pertaining to the characteristics of PA interventions aimed at young females (aged 14-25 years old) in the UK, explore the measures used to evaluate intervention impact within this population, and make recommendations for future PA interventions and research using an ecological perspective. Studies published in English were identified through electronic databases: Sport discus, Medline®, Psycarticles®, Scopus®, and Web of science™. The main selection criteria were UK-based PA interventions aimed at healthy females aged 14-25 years. Two reviewers independently screened the studies for inclusion and data was extracted based upon agreed criteria and considering the ecological model of health behavior. From the 21 articles included in the analysis, 17 interventions took place in educational institutions (universities n=7, colleges n=2, schools n=8). The average ± SD length of interventions was 19.4 ± 22.4 weeks with a median length of 10 weeks. Participant age-range was 11 to 25 years and the average number of participants within each study was 188 ± 373), with a median of 54 and range of 10 to 892. PA options were limited (n=7) across interventions and within interventions participants were not given a choice of activity. Four studies utilised qualitative methods and two studies conducted follow-up measurements. With reference to the ecological model, it was identified that 20 of the 21 studies investigated intrapersonal factors, seven studies explored interpersonal level factors, four studies considered organisational and environmental level factors, and only one study investigated policy and legislative level factors. To conclude, interventions aimed at this population vary in terms of their size, length and the measures of effectiveness employed. Intervention setting and PA offer is limited and the dynamic interplay of factors that influence participation is not commonly addressed. Future PA interventions should consider the multi-level influences of health behaviour and employ a variety of methodologies to evaluate their effectiveness.

Occupational Socialisation Theory: Identification of the barriers and facilitators that underpin physical education teachers' perspectives of the TGfU approach

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Teaching Games for Understanding (TGfU; Bunker & Thorpe [1982]. Bulletin of Physical Education, *18*, 5-8) aims to provide an alternative approach to teaching invasion games that differs from traditional methods. The aim of this study was to identify the factors that underpin the utilisation of the TGfU approach in teaching practice, using Occupational Socialisation Theory (Lawson [1983]. Journal of Teaching in Physical Education, *2*, 3-16). Information was collected under the three phases of Occupational Socialisation (Acculturation, Professional Socialisation and Organisational Socialisation) depicting teachers' childhood, university and on the job experiences. The teachers' perceived barriers towards implementing TGfU in schools were also discussed. Thematic analysis with a qualitative approach was carried out with 13 PE teachers from across 15 state schools in Yorkshire. The teachers were aged between 25-56 years old and had between 4-32 years experience working in schools. The main finding of this study was that teachers' job experiences had the greatest influence on their current teaching practice. The departments' and schools' goals, the wider impact on the department specifically the pupils and their current knowledge of teaching methods were the main reasons given by the teachers as to why they teach the way they do. Secondary to the study's main finding was that whilst the teachers' childhood experiences underpinned their choice of career, in the main their university experience had very little effect on their current teaching practices. The main barriers to the teachers implementing TGfU were lack of understanding, lack of knowledge, lack of support, reluctance to change and lack of time to plan TGfU lessons. The teachers' opinions on overcoming these barriers include: coaching awards, advertising on social media and teacher centred websites, improved subject resources and the need to be educated through on the job training to allow for greater networking opportunities. The findings of this study suggest that focusing on teachers on the job experience is the most effective way of improving the chances of implementing the TGfU approach in current teaching practice. This study promotes on the job training as a means of re-educating teaches who, because of their childhood and university experiences, have little to no experience of the TGfU approach. Targeting this phase of Occupational Socialisation is promoted as a means of helping teachers overcome the barriers to implementing TGfU in their current teaching practice.

Dance-based exercise may be more effective for improving mental health in older adults than conventional exercise

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Group-based exercise presents a promising intervention for positively influencing cognitive function and emotional wellbeing due to a combination of social and physical components (Ballesteros et al. [2015]. Neuroscience and Biobehavioral Reviews, *55*, 453-477). In particular, danced-based activities that require the integration of multiple brain regions to perform rhythmic motor coordination, memory recall and social interaction can improve cognitive function to a greater extent than interventions which require lower level of coordinative tasks. However, the evidence supporting dance-based exercise for improving mental health in older adults is limited to long-term, cross-sectional studies, with little comparison to other types of exercise. Therefore, this study aimed to compare the short-term effects of dance-based exercise (cheerleading training) versus conventional exercise (indoor cycling) on cognitive function and emotional wellbeing in community-dwelling older adults. After institutional ethics approval, 19 volunteers participated in an older adult exercise program (once per week; 10 weeks) delivered by SilverFit® Charity in a local leisure centre. Participants were allocated to either cheerleading training (9 female; 61.7 ± 3.9 years old) or indoor cycling (8 female, 2 male; 65.5 ± 6.5 years old). At pre- and post-intervention, participants attended the university lab and completed a computer-based Stroop task to evaluate cognitive function (selective attention and processing speed), along with self-report scales to evaluate emotional wellbeing (perceived stress, positive and negative affect, and relatedness to others in physical activity). Data were analysed using a 2 × 2 mixed ANOVA for group (cheerleading vs. indoor cycling) and time (pre- vs. post-intervention). Following the completion of the exercise intervention, Stroop Incongruent accuracy rate improved ($P = 0.04$, $\eta^2p = .25$), however, no differences were observed between groups. Congruent reaction time significantly improved following cheerleading training ($P = 0.01$, $\eta^2p = .26$) but not indoor cycling. Both types of exercise led to improved ratings of positive-affect ($P = 0.01$, $\eta^2p = .32$). Ratings of negative-affect ($P = 0.06$, $\eta^2p = .20$), perceived stress ($P = 0.06$, $\eta^2p = .19$) and relatedness to others in physical activity, also tended to improve ($P = 0.08$, $r = 0.34$). However, no differences were observed between the two groups for any of the evaluated indices of perceived emotional wellbeing. The findings of this study demonstrate that the positive effects of short-term participation in group-based exercise on emotional state and stability, and perceived stress in older adults were not dependent on the type of exercise performed. However, dance-based exercise may be superior over conventional exercise for improving cognitive function.

Perceptions of recovery from mental illness in sport settings

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Athletes may be more vulnerable to the development of mental illness than the general population (Rice et al., [2016], Sports Medicine, *46*, 1333-1353). According to the dominant medical model, recovery from mental illness represents a complete alleviation of symptoms and a return to typical functioning (Mountain & Shah, [2008] Advances in Psychiatric Treatment*, 14*, 241-244). However, symptoms of mental illness are stubborn and an idealistic notion of complete relief from symptoms can often lead to feelings of frustration (Davidson & Roe, [2007] Journal of Mental Health, *16*, 459-470). In contrast, the social model of recovery emphasises recovery as a process, through which an individual can live a satisfying life alongside the presence of symptoms (Leamy *et al.*, [2011] The British Journal of Psychiatry, *199*, 445-452). There is currently a dearth of research examining perceptions of recovery in sports settings. This is problematic because there is limited knowledge of how to best support athletes in recovery from mental illness. Therefore, the current study's research question was; how do athletes with an experience of mental illness conceptualise recovery? To answer this, eight participants with personal experience of mental illness who were involved with competitive sport at the time of the research (women's football, rugby union, netball, weightlifting and powerlifting) participated in individual semi-structured interviews about their perceptions of recovery from mental illness. Interviews were voice recorder and transcribed verbatim and then analysed using inductive thematic analysis (Braun, Clarke & Weate, [2016], *Routledge Handbook of Qualitative Research in Sport and Exercise,* 191-205). Two core themes were generated through the analysis; 1) there is no such thing as a full recovery, and 2) recovery is an active process. The first theme concerned athletes' perceptions of recovery from mental illness as an ongoing journey characterized by successful management of symptoms and regained control over certain aspects of life. The second theme related to the athletes' construction of recovery as an active process, requiring choice, development of identity and social inclusion. The findings from this study offer preliminary insight into perceptions of recovery in sport settings and the impact on athletes' experiences of mental illness. The findings may be used to help individuals involved with an athletes' welfare better understand how to facilitate recovery. Additionally, these findings can be used to inform interventions aimed at recovery from mental illness in sport settings.

How are Rugby League players supported in their transition from professional Rugby into retirement?

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There is growing interest in the mental health and well-being of professional athletes due to series of high profile accounts of athlete depression following retirement. A number of professional athletes have openly criticised their governing bodies for their lack of support when transitioning from professional sport to retirement. In response, players' unions and a small body of existing research have looked at player welfare support in rugby league, however, less research has been conducted on retirement and support mechanisms in professional rugby league. The purpose of this study was to investigate potential mechanisms in place for professional rugby league players. The aims of the study were: 1) to establish how Rugby Football League (RFL) players are supported with their transition from professional rugby into retirement; and 2) establish what support mechanics were in place. Nine male professional rugby players (26.66 ± 5.87 years) were recruited from local professional rugby league clubs. The accumulated time playing rugby professionally ranged from 1 year to 13 years. Five interviews were randomly selected to be transcribed. The five players selected for transcription were currently playing professional rugby. Face to face semi-structured interviews were conducted with participants, using an audio recorder. Open ended questions were used to allow participants to talk openly and freely about their experiences (e.g. describe any help or support you are receiving from the RFL to help with your transition into retirement). Follow up probes and basic counselling skills (e.g. paraphrasing, mirroring and reflecting) were used to clarify participant responses and to make the participant feel at ease. The questions focused on the following themes: player emotions; planning ahead; support/mechanisms in place from the club and the RFL; self-help (e.g. courses attended / qualifications); and familial support. The interviews were transcribed verbatim. Data were analysed using thematic analysis; and the initial stage involved reading through each transcript once and establishing any emerging themes; a process called descriptive coding. Results pending.

The impact of heading a football on prospective memory

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Previous research has shown how concussion has a detrimental effect on cognition. (Nordström, Nordström, and Ekstrand, [2014]. Journal of Sports Medicine, *48*, 1447-1450). More recent research has investigated how sub-concussive impacts from heading a football can have a negative impact on cognitive processes such as memory (Di Virgilio et al. [2016]. EBioMedicine, *13*, 66-71). To date, no previous research has explored the impact of heading a football on prospective memory. Prospective memory has been defined as the ability to remember future activities such as medication on time, hence underlining how important this aspect of memory can be to everyday functioning (Brandimonte, Einstein and McDaniel. [2014]. Psychology Press). Therefore, the aim of this study was to investigate whether the sub-concussive impact from heading a football has an effect on prospective memory. Participants across the groups were recruited through refined sampling due to the nature of the study, requiring specific criteria. The inclusion criteria consisted of anyone that was aged 18-25, male and played exclusively football or basketball for Northumbria University. After removal of participants who had previously suffered from concussion, a total of 27 participants took part in this study, 18 football players and 9 basketball players as a control group. Participants were assessed through an objective measure (Prospective Remembering Video Procedure, PRVP) as well as a self-report measure of prospective memory (Prospective and Retrospective Memory Questionnaire, PRMQ). Prior to commencement, the research protocol was approved by the School of Health and Life Sciences Ethics Committee at Northumbria University. ANCOVAs were run to control for substance abuse on correct location-action combinations on the PRVP and the PRMQ. The non-significant covariates were then removed and a series of 1 way ANOVAs and ANCOVAs incorporating the significant covariates were run comparing the two groups on the correct location- action combinations on the PRVP as well as the PRMQ. Data analysis revealed that there was no significant difference between the football players and basketball players on the PRVP and PRMQ scores. As a result, this suggests that heading a football does not have a detrimental effect on prospective memory. This study has presented novel research concerning potential consequences from heading a football and provides foundations for future research. Further research is needed to ascertain any deficits from heading a football as well as the impact of heading a football on youth players who are more at risk from injury due to heading a ball (Spiotta et al. [2011]. Neurosurgery, *70*, 1-11).

The effect of beetroot juice supplementation on symptoms of acute mountain sickness and the inflammatory response to acute normobaric hypoxia

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In recent years there has been an increase in popularity of travel to altitude for sport and recreational purposes, which is associated with a significant prevalence of acute mountain sickness (AMS). Although not completely understood, hypoxemia may facilitate the development of AMS and there is some evidence to suggest this syndrome is a progressive inflammatory process. Beetroot juice (BJ) contains several bioactive compounds (i.e. nitrate, betalains, (poly) phenols, carotenoids and ascorbic acid) that could elicit vasoactive and anti-inflammatory properties (Clifford *et al.,* [2016]. Nutrients, *7*, 2801-2822). Thus, it was hypothesised that BJ might attenuate hypoxemia, inflammation, and reduce symptoms of AMS. Ten healthy males completed two 6.5 h normobaric hypoxic exposures (4,300 m, ~F_iO_2: 0.117). On each occasion, participants walked for an hour at 50% of their hypoxic VO_{2max} at a 10% gradient whilst carrying a 10 kg backpack, 2.5 h after entering the chamber, to simulate altitude hiking. Using a randomised, double-blind crossover design, participants were supplemented at two time points with; either concentrated BJ (BEET-IT, James White Drinks Ltd; ~18 mmol of nitrate), or an isocaloric placebo (PL; with negligible nitrate and phytochemical content), 1.5 hours prior to hypoxic exposure (140 ml) and following exercise (70 ml). Lake Louise scores (LLS), peripheral oxygen saturation (SpO_2), heart rate (HR), fractional expired nitric oxide (FeNO) and plasma Interleukin 6 (IL-6) were measured at baseline (normoxia), pre-exercise, post-exercise and at the end of the 6.5 h exposure. In the BJ group, FeNO was significantly higher compared with PL (mean difference 11.7 ± 5.0 ppb), suggesting greater nitric oxide bioavailability during hypoxic exposure ($P < 0.05$, $\eta^2 = 0.374$). At baseline no participants had AMS. However, in the BJ group more participants reported AMS compared with PL (7 vs. 4; LLS ≥ 3, with headache) following exercise (LLS: 3.6 ± 2.4 vs. 2.4 ± 1.3). These symptoms subsided by the end of exposure with one exception in both groups. There was no significant difference between treatments on SpO_2, HR or IL-6. There was a significant decrease in SpO_2 during hypoxic exposure with the nadir immediately post-exercise (74 ± 6%; $P = 0.003$, $\eta^2 = 0.981$). Post-exercise there was also a significant increase in HR (Δ76 ± 6 bpm; $P = 0.007$, $\eta^2 = 0.95$) and IL-6 (Δ1.6 ± 0.6 pg·ml^{-1}; $P < 0.05$, $\eta^2 = 0.594$). Contrary to the hypothesis, acute supplementation with BJ did not attenuate the decrease in SpO_2, nor ameliorate inflammation or symptoms of AMS. This was despite a significant increase in nitric oxide bioavailability, compared with the PL.

The impact of dietary nitrate supplementation on 2000 m rowing performance in well-trained, male, competitive rowers

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Six days of dietary nitrate supplementation (500 ml·d^{-1}) has been shown to enhance rowing ergometer performance in junior, male rowers. More recently, concentrated dietary nitrate beverages, of smaller quantity, have emerged to the market. The aim of this study was to explore the impact of dietary nitrate ingestion on 2000 m indoor rowing performance in well-trained, competitive, young adult, male rowers following a 4-day concentrated beetroot juice supplementation intervention (140 ml·d^{-1}). A within-subjects double-blind, randomised, placebo-controlled cross-over study design was adopted. The study received institutional ethical approval. Six well-trained, male competitive rowers were voluntarily recruited (age, 22±2 years; stature, 1.83±0.09 m; body mass, 75.8±11.7 kg). Each completed three 2000 m rowing trials: Baseline (no supplementation), experimental (beetroot juice [BR] supplementation, James White Ltd, 140 ml·d^{-1} over 4 days) and a control (BR placebo, James White Ltd, 140 ml·d^{-1} over 4 days). Trial order was randomised and a wash-out period of 7 days between trials was included. Participants were asked to abstain from heavy exercise for 24 h before trials to ensure they were in a fully rested state, and asked to avoid alcohol, caffeine or any other stimulant or non-prescribed nutritional supplement for 24-48 h. Participants were instructed to ingest the BR and the BR placebo beverages in the morning and evening for the three days prior to each rowing trial, and on the day of testing consumed the BR and the BR placebo beverages 2 h prior to the rowing trial. On test days participant resting systolic and diastolic blood pressures (SBP and DBP) and heart rate (HR) were monitored in the laboratory between the point of BR or BR placebo ingestion and the start of the rowing trial. Following a self-selected warm-up, participants completed the 2000 m rowing trials at a fixed stroke rate (22-28 strokes·min^{-1}; drag factor 135-139). HR, Blood lactate and respiratory parameters (breath-by-breath gas analysis) were recorded every 500 m. Overall performance time, and 500 m split performance times were noted. Main findings showed an improved 2000 m rowing performance following BR supplementation compared to baseline (425±25 vs. 431±22 s, Δ0.9%, d=−0.25) and compared to BR placebo (429±26 s Δ0.9%, d=0.16). Performance improvements were also noted compared to baseline in the control (BR placebo) group (Δ0.5%, d=0.08). To conclude, BR supplementation over 4 days elicits small enhancements in 2000 m rowing performance in young, well-trained, male competitive rowers.

Effect of acute cocoa flavanol supplementation on dynamic strength recovery from exercise induced muscle damage in a female cohort

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Acute muscular recovery is paramount in fixture-congested team sports such as soccer and rugby. Inherent athletic movements (e.g. sprinting, kicking) involve eccentric contraction that when performed excessively or unaccustomedly, may potentiate exercise induced muscle damage [EIMD] (Proske & Morgan, 2001, The Journal of Physiology, *537*, 333-345). Typically, this results in pain, swelling, and impaired muscle strength, affecting recovery. This may be attributed to inflated oxidative stress and supplementation with flavanol antioxidants may attenuate this via mediation in myocellular redox homeostasis (Powers & Jackson, 2008, Physiological Reviews, *88*, 1243-1276). Epicatechins, a flavanol subtype, have demonstrated cardiovascular perfusion promoting properties through elevation of nitric oxide. Collectively, this synergy may enhance muscle recovery. Therefore, this study investigated the effect of cocoa flavanol [CF] powder, rich in antioxidants, on strength recovery from EIMD in females - an understudied cohort that typically experiences an extended relative recovery period. This was a single-blinded, counterbalanced, parallel, dietary-monitored, randomised controlled trial conducted on ten participants (24.3 ± 6.2 years, 1.68 ± 0.10 m, 66.8 ± 12.4 kg) during the luteal menstrual phase (cycle day 16-28). Following institutional ethics approval, participants performed 100-drop jumps (5 × 20 repetitions) from a 40 cm platform. Upon completion, participants were randomly allocated to consume one of two beverages. These contained 60 g MaltoDextrin, 20 g whey protein concentrate, and 400ml water; the treatment beverage contained an additional 10 g of Chococru powder (830 mg CF). Measurement of maximal reciprocal concentric and eccentric knee-extension peak torque (5 repetitions), was taken at pre (baseline), 48 and 72 hours post-drop jumps on a Cybex^{TM} Norm isokinetic dynamometer (Model 770, Cybex Norm$^{®}$, Humac, CA, USA) seated, at $60^{\circ}s^{-1}$. Data were analysed via two-way repeated measures Analysis of Variance; Alpha level was $P<0.05$. No significant difference was observed between treatment groups over collective time points for concentric ($P = 0.373$, $\omega^2 = 0.00071$) and eccentric ($P = 0.769$, $\omega^2 = -0.00834$) peak torque. The results indicate no acute strength recovery benefit of cocoa flavanols, supporting previous related research (Peschek, Pritchett, Bergman, & Pritchett, 2014, Nutrients, *6*, 50-62). While acute supplementation does appear to attenuate oxidative stress in skeletal muscle (Decroix et al., 2018, Sports Medicine, *in press*), this does not appear to translate to enhanced muscular recovery based on the observed findings. Therefore, acute CF use does not appear effective for strength recovery in fixture-congested sport. More extensive research with a larger sample size is needed to corroborate these findings.

Effect of co-ingestion of beta-alanine and sodium bicarbonate on high intensity exercise performance

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The ability to produce relatively high quantities of force for longer periods of time (<60 s) is a vital component in some sports. An inevitable consequence of this, is the loss of contractile properties due to exercise-induced acidosis. Thus, *β*-alanine (BA) and sodium bicarbonate ($NaHCO_3$) may provide performance enhancing benefits by increasing the concentrations of physiochemical buffers such as muscle carnosine and blood bicarbonate to counteract the increased flux of hydrogen ions (H^+). To date, numerous studies have reported contradicting findings whether there is an additive effect by using two buffers over one. This study aimed to identify the effect of one and a combination of two, intracellular and extracellular, H^+ buffers on blood variables and high intensity exercise performance. Twelve active participants visited the laboratory 5-times. On each visit, participants performed a 3-minute maximal effort cycling time-trial. A pre-and-post exercise blood sample was taken to measure pH, blood bicarbonate and lactate. Visit one was a familiarization, visit two was for baseline (BL) measures followed by *β*-alanine supplementation (28 d, 6.0 $g \cdot d^{-1}$) intake. After 28 days of supplementation, participants returned for 3 more visits: 2nd familiarization, *β*-alanine trial and *β*-alanine + acute $NaHCO_3$ (0.3 g/kg^{-1} of body mass). Participants completed the rest of the trials in the next 2 following weeks. During this time, they ingested only half of the usual dose. Results indicated no significant differences in average power output when the treatment trials were compared to baseline (00:00 – 03:00 min; $NaHCO_3$ 328.3 ± 48.4 W vs. BL 325.6 ± 65.8 W; P = 0.18, BA 301.1 ± 50.1 W vs. BL 325.6 ± 65.8 W; P = 0.31). However, there was a significant difference in BA + $NaHCO_3$ trial in the second and third 60 s split average power output when compared to BA (01:00 – 02:00 min; BA + $NaHCO_3$ 243.5 ± 39.7 W vs. BA 214 ± 44.2 W; P = 0.04; 02:00 – 03:00 min; BA + $NaHCO_3$ 228 ± 37.0 W vs BA 204.3 ± 39.6 W; P = 0.04*),* but not the baseline trial (01:00 – 02:00 min; BA + $NaHCO_3$ 243.5 ± 39.7 W vs. BL 244.6 ± 59.3 W P = 0.23; 02:00 – 03:00min; BA + $NaHCO_3$ 228 ± 37.0 W vs. BL 229.76 ± 56.8 W; P = 0.24). The present study demonstrated that the combination of two treatments elicited improvements in maintenance of power during the trial, whilst BA had no effect on performance.

The effects of cocoa flavanol supplementation on eccentric exercise induced muscle damage in recreationally active females

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Eccentric contractions have been shown to generate exercise induced muscle damage (EIMD) and are commonly associated with team sports. Losses in muscle function are attributable to damage caused by EIMD, analysed by the countermovement jump (CMJ). Implications of these deleterious effects on muscle function are its negative impact on subsequent performance. Findings suggest that females suffer prolonged recovery periods following EIMD compared to males (Ronglan, Raastad and Børgesen [2006]. Scandinavian Journal of Medicine & Science in Sports, *16*, 267-273). Subsequently, attempts at attenuating these reductions in muscle function have involved nutritional ergogenic aids. Recent study has investigated cocoa flavanol effects on recovery with contradictory results (González-Garrido et al. [2017]. Journal of Sports Medicine and Physical Fitness, *57*, 441-447). Thereby, the aim of this study was to investigate the effect of acute cocoa flavanol consumption on recovery from eccentric exercise in females. Prior to any experimental procedures the study received ethical approval from the University of Huddersfield ethics committee. Ten recreationally active females (mean ± SD; age 24 ± 6 years, body mass 66.8 ± 12.5 kg and stature 168 ± 7 cm) were allocated to one of two treatment groups by block randomisation; cocoa flavanol beverage (CFB) or placebo (PLA). Both treatments contained 400 ml of water, 60 g Maltodextrin, 20 g whey protein, differentiated by CFB content 10 g flavanols. Participants consumed CFB or PLA immediately post muscle-damaging exercise protocol which consisted of 100 (5 × 20) drop jumps from a height of 0.4 m; an inter-jump rest period of 10 s and inter-set passive rest period of 2 mins was provided. CMJ height was recorded pre, 48 hrs and 72 hrs post the damaging protocol (Kistler Integrated Amp Plate, 9281CA SN<616902, Hampshire, UK). Participants were tested during the luteal phase of their menstrual cycles to control potential hormonal influence on muscle function. The data were analysed using a repeated measure ANOVA with the alpha set at 0.05. No difference was detected between groups CFB vs. PLA (P = 0.91; ω^2 *=-0.015)* for CMJ height. These findings suggest that acute consumption of cocoa flavanols do not attenuate the loss in muscle function with regards to CMJ height following a bout of eccentric exercise. This study provides a novel insight into female response to EIMD following consumption of cocoa flavanols. Recommended future research should investigate the chronic ingestion of cocoa flavanol in females and its effects on muscle recovery.

High-intensity interval walking in combination with acute green tea extract supplementation reduces postprandial glucose in sedentary participants

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Exercise and green tea supplementation have been shown to have the potential to improve postprandial blood glucose concentrations, but past interventions have not often investigated attainable and time effective exercise protocols. The purpose of this study was to investigate the effects of interval walking exercise and acute green tea extract supplementation on the glycaemic response to an oral glucose tolerance test (OGTT). Twelve sedentary participants (9 male, 3 female, age: 22 ± 1 y; mass: 81.2 ± 16.3 kg; stature: 175.7 ± 9.6 cm; body mass index (BMI; in kg/m^2): 26.2 ± 4.3) underwent a 2-hour OGTT immediately following i) no intervention, ii) placebo and exercise, iIi) green tea extract supplementation (4 doses: 320 mg catechins, 200 mg EGCG, per dose) and exercise, in a random order. The walking exercise consisted of 6 × 1min of brisk walking (7.92 ± 0.56 km/h^{-1}) separated by 1-min of slower walking (4.8 km/h^{-1}). Differences between groups were identified using magnitude based inferences. Participants attended a semi structured interview to discuss their experiences of the interventions. The combined intervention resulted in a ~9% most likely beneficial effect on blood glucose area under the curve response to the OGTT (702.18 ± 76.90 mmol/L^{-1}·120 min^{-1}) compared to no intervention (775.30 ± 86.76 mmol/L^{-1}.120 min^{-1}), and a very likely beneficial effect compared to the exercise intervention alone (772.04 ± 81.53 mmol/L^{-1}·120 min^{-1}). Additionally, thematic analysis suggests that the combined intervention may be a successful at achieving long-term rates of adherence. These data suggest that a combined intervention can reduce postprandial glucose concentrations in sedentary individuals. Suggesting that GTE may alter skeletal muscle glucose uptake and/or absorption in humans. Qualitative interview responses identified that the interventions may be achievable and translatable for sedentary people.

The impact of creatine supplementation on muscular strength after resistance training in older adults: a systematic review

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The aim of this study was to systematically review the effects of creatine supplementation on short-term muscular strength gains in older adults. Good practice guidelines for conducting a systematic review were followed (Centre for Reviews and Dissemination, Guidance for undertaking reviews. University of York, [2009]). A search strategy was conducted in accordance to the defined relevant research question via electronic databases. The electronic databases PubMed, Discover and Google-Scholar were used to source scientific articles published between 2007 and 2017. Only articles reporting outcomes from randomised, controlled trials involving interventions less than six months in duration, including healthy, older male or female human adults and written in the English language were deemed eligible for inclusion. Key search terms included "older adults" (defined as those aged over 50 years), "resistance training" "creatine" "supplementation" and "muscular strength". Four studies, involving 54 healthy females, approximate mean age 63 years were found. Six studies involving 128 healthy males, aged 50 to 72 years were also included. Only one study involving females, and no studies involving males reported a change in muscle strength as determined from upper (chest press) or lower (leg press) limb assessments, after a creatine supplementation intervention. Outcomes between studies were inconsistent however a number of confounds were evident including: timing of creatine administration, dosage (e.g., 5 $g \cdot d^{-1}$, 20 $g \cdot d^{-1}$, 0.1 $g \cdot kg^{-1} \cdot d^{-1}$) and duration of intervention trials (10 to 24 weeks). To conclude, due to the lack of sufficient scientific evidence exploring the impact of creatine supplementation on short-term muscular strength gains it is not possible to confirm if creatine supplementation is effective for promoting muscular strength gains in healthy older adults. Further research is needed to examine the dosage and timing of creatine administration over a prolonged (> six months) period of time.

Can acute ingestion of Citrulline Malate alter substrate utilisation during a cardiorespiratory exercise test with healthy participants?

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Ingestion of Citrulline Malate (CM) has been shown to improve exercise with beneficial effects reported during strength-based assessments and time trial performance (Suzuki et al. [2016]. *Journal of The International Society of Sports Nutritio*n, *13*). CM has been reported to increase plasma arginine availability and subsequent nitric oxide (NO) production, leading to increased blood flow. Citrulline in particular accelerates the ureagenesis cycle resulting in the removal of ammonium while Malate is essential for oxidative metabolism which regulates skeletal muscle functions including glucose and fatty acid oxidation. Despite this, the metabolic influence of CM has received little attention in the literature. Much of the current literature has primarily focused on performance outcomes during high intensity exhaustive exercise. As such, the purpose of this study was to investigate the effects of CM on substrate utilisation during a low-moderate cardiorespiratory exercise test. This study used a randomised controlled cross-over design and adopted double-blind procedures. Following institutional ethical approval, nine healthy, and active participants (4 males, 5 females) were recruited for the study with only eight completing both trials. Over a period of 38 days, participants completed one familiarisation and two experimental trials, each of which was separated by at least three days. In the experimental trials, participants consumed either CM (3×1000mg) or PLA (3×100% lactose) 60 minutes prior to completing a modified Bruce treadmill protocol, with increases in speed and gradient every 3 minutes until 85% of maximum heart rate (HR) was achieved. HR and breath-by-breath values for oxygen uptake, respiratory exchange ratio and ventilation were obtained at rest and during the final 30s of each 3-minute stage. RPE (Borg 6-20) was also recorded at the end of each stage. Respiratory data was subsequently entered into stoichiometric equations to calculate fatty acid oxidation (FAO; $g \cdot min^{-1}$) and carbohydrate oxidation (CHO; $g \cdot min^{-1}$). Data was analysed using a paired samples t-test and a factorial repeated-measures analysis of variance (ANOVA) with Bonferroni post-hoc tests implemented and effects sizes (Cohen's *d*) calculated. There was no significant difference reported for the time (min) to complete the exercise test ($P > 0.05$). No statistical differences were found between conditions for all other data (all $P > 0.05$) at any stage during the test with the main effects showing similar results ($P > 0.05$). Although no significant difference was shown, the current study provides an insight into the metabolic effects of CM during bouts of low-to-moderate intensity exercise. In addition, it contributes to the growing literature regarding CM and could be useful in the sports nutrition and weight loss industries.

The effect of a cocoa flavanol enriched recovery beverage on perceived soreness following eccentric exercise induced muscle damage on females

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In team sports, such as rugby and soccer, players report experiencing high levels of perceived soreness, predominantly due to exercise induced muscle damage (EIMD) Commonly athletes experience a discomfort known as delayed onset muscle soreness (DOMS) post-exercise. Typically, DOMS occurs in the first 24 h, peaking between 48-72 h afterwards. Recovery is important as performance could be impeded if a player shows signs of soreness during the next fixture. The aim of this study was to investigate the effect of cocoa flavanols (CF), due to their known anti-inflammatory and antioxidant effects, on perceived soreness following a validated muscle damaging protocol. A female cohort was used due to the considerable lack of literature regarding aspects of muscle recovery in females. The participants were tested during the luteal phase (days 16-28 of their menstrual cycle) due to the known effects on perceived soreness. Ten recreationally active female participants (mean ± SD, age 24.3 ± 6.2 years, height 168 ± 7 cm, weight 66 ± 12 kg) were recruited, following institutional ethics approval. The participants were block randomised into single-blind, parallel groups, placebo or CF. Perceived soreness was recorded with a visual analogue scale (VAS) and lower extremity functional scale (LEFS) pre, 48 h and 72 h post EIMD. To cause EIMD a drop jumps protocol was utilised, consisting of 5 × 20 repetitions from 0.4 m, with 10 s between jumps and 120 s between sets (Miyama & Nosaka, [2004] Journal of Strength and Conditioning Research, *18*, 206-211). After completion of the protocol the participants ingested an assigned beverage. Both drinks included 20 g chocolate whey protein, 60 g maltodextrin and 400 ml water, CF drink included an additional 830 mg flavanols. A 24 h food diaries were used to check for dietary differences between participants on the day of the protocol, prohibiting high polyphenolic foods. Statistical analysis was performed using a repeated measures two-way analysis of variance and ω^2 for effect size. No significant difference was found for VAS or LEFS, ($P = 0.338$, $\omega^2 = 0.00224$ and $P = 0.964$, $\omega^2 = -0.03296$ respectively). These data contradict McBrier, et al. ([2010] Journal of Strength and Conditioning Research, *24,* 2203-2210) who found that a cocoa beverage had a significant effect on perceived soreness over 24 h and 48 h after EIMD. Further research should look to confirm these findings and investigate chronic consumption on recovery.

Application of interval exercise training in patients with COPD as part of Pulmonary Rehabilitation in the North East of England

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This is an interim analysis of data gathered from chronic obstructive pulmonary disease (COPD) patients attending pulmonary rehabilitation (PR) sessions at North Tyneside General Hospital prior to entering a study that evaluated the influence of bi-level ventilatory support on exercise tolerance (Clinicaltrials.gov: NCT03068026). Analysis is focused on the feasibility of the application of interval training in the PR setting. Following ethical approval, and after providing informed consent, 16 patients with COPD (6 male), FEV_1: 50 ± 27% predicted, underwent a 6-week interval exercise training programme involving two weekly sessions lasting 1-hour in duration. The program consisted of 30 min interval exercise on a bicycle ergometer (alternating 30 s of exercise of maximal tolerable workloads with 30 s resting periods) and 30 min circuit strength training of several large muscle groups. Average adherence to the programme was 70 ± 18%. Training workload throughout the programme increased by nearly 1-fold (from 25 ± 8 to 44 ± 15 W). These loads were associated with moderate sensations of Borg scale breathlessness (2.9 ± 1.8) and leg discomfort (2.9 ± 1.2), mild to moderate arterial oxygen desaturation (SPO_2: 92 ± 4%) and low cardiovascular load (heart rate: 104 ± 17 beats/min). Adherence to training was acceptable with significant progression of training load and physiological responses typically seen in COPD during interval training. Therefore, application of interval exercise training is feasible within the outpatient setting of PR in the North East of England.

Exergaming to improve postural control in community-dwelling older adults – a feasibility trial with a tailored exergame

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Exergaming (exercise-gaming) has shown to be an effective method for training balance for older adult fallers (>60 years). Exergaming studies have tended to use commercial "off the shelf" equipment, due to its availability and cost effectiveness. However, methodological heterogeneity exists in outcome measures, movements trained and equipment employed, all with varying limitations to the individual or quality of the intervention (Tahmosybayat, Baker, Godfrey, Caplan, & Barry [2017]. Maturitas, *98*, 35-45). A balance evaluation method exists (Mini-BESTest), supported and designed based on a postural control theoretical framework, yet has received little attention in exergaming interventions. Furthermore, a novel exergame (Mira Rehab™) designed for older adults are based on guidelines for training balance and consider needs pertaining to game speed and progression, screen complexity and general interest among other factors. Therefore, the aims of the present study were to implement a novel exergame designed for use with older adults in a six week exergaming intervention to: 1) quantify postural control outcomes (reactive, anticipatory, sensory integration and gait) using a novel measure, 2) quantify outcomes of balance confidence, fear of falling, fatigue, depression, mental state and general health to give perspective on quality of life, and 3) to implement a novel method of assessing physical activity outcomes using a tri-axle accelerometer over seven days. Older adults (>60 years) that had fallen once or twice, were able to ambulate freely, with no prior balance training (<3 months), had no neurological, musculoskeletal or medical condition that affected their activities of daily living were of interest were allocated to an exergaming group, standard practice group or no exercise control group. Training consisted of 60 minutes per week for 6 weeks. Pre-and post-intervention preliminary data (mean ± SD) are presented pertaining to primary, secondary and tertiary outcomes. Briefly, both exergaming and standard practice intervention groups showed an increase in overall Mini-BESTest scores (2.9 ± 1.9 and 2.6 ± 0.3 points, respectively), although not reaching the minimal detectable change score for mixed populations with imbalances (>4). These data are the first to demonstrate an increase in postural control outcomes in an exergaming intervention using a novel balance evaluation scale supported by a theoretical framework and an exergame tailored to the older individual with imbalances. This study will inform the protocol for a pilot randomised control trial.

The effects of 8 weeks of inspiratory muscle training on the balance of healthy older people: a randomised, double-blind, placebo controlled trial

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The diaphragm works as a postural muscle both indirectly, by increasing intra-abdominal pressure to support the spine, and directly, by continuous co-contraction to assist the mechanical stabilisation of the trunk. The crural part of the diaphragm appears to predominate during trunk stabilisation, especially for isometric upper and lower limb contractions (Kolar, et al., [2010], Journal of Applied Physiology, *109*, 1064-1071). However, with ageing, the function of the diaphragm and other inspiratory muscles declines, which may impair their direct contribution to postural control and balance. The primary aim of this study was to test whether inspiratory muscle training (IMT) influences balance in older adults. The secondary aim was to measure the effects of IMT on trunk muscle function. Fifty-nine healthy older people (20 male, 39 female; 65–89 years; 26 ± 3 kg/m^2) were assigned randomly in a double-blinded fashion to undertake 8 weeks of IMT or sham-IMT. The IMT group performed 30 breaths twice daily at ~55% of maximal inspiratory pressure. The sham-IMT consisted of 60 breaths once daily at ~9 cmH_2O, a protocol known to elicit negligible changes in inspiratory muscle function (Romer, McConnell. & Jones, [2002], Medicine & Science in Sports & Exercise, *34*, 785-792). Assessments of pulmonary and respiratory muscle function, static and dynamic balance, functional mobility, and trunk muscle endurance were performed pre- and post-IMT. Significance of variation was calculated with Paired-Samples T-test or Wilcoxon-Test. Absolute variations are reported along with P-values and Cohen`s d. The IMT group exhibited a significantly improvement in: maximal inspiratory pressure (34.9 vs.13.1 cmH_20, IMT vs. sham-IMT; $P < 0.01$; d=1.4); peak inspiratory flow rate (0.9 vs. 0.3 $L/_S$, IMT vs. sham-IMT; $P < 0.01$; d=1.2); Mini-BEST (3.7 vs. 0.5, IMT vs sham-IMT; $P < 0.01$; d=1.3); Motor-Timed-Up-and-go (−1.1 vs. −0.1 s, IMT vs. sham-IMT; $P < 0.05$; d=0.5); Biering-Sørensen test (40.7 vs. 9 s, IMT vs. sham-IMT; $P < 0.01$; d=0.7); sit-up test (27.3 vs. 7.5 s, IMT vs. sham-IMT; $P < 0.01$; d=0.3). There were no changes in pulmonary function in either group. These data suggest that inspiratory muscle training improves balance proficiency. In addition, IMT improves inspiratory muscle strength, peak inspiratory flow rate, functional mobility and trunk muscle endurance. These findings support the hypothesis that inspiratory muscles, contribute to the mechanical stabilisation of the trunk, and to an improvement in balance proficiency. Further research on the potential role of IMT in reducing the risk of falling in older people is warranted.

The efficiency of kinesio taping in the treatment and prevention of low back pain, neck pain, and shoulder stabilisation: a systematic review

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The aim of this study was to investigate the impact and effectiveness of kinesio tape (KT) for the management of low back pain, neck/cervical pain and shoulder stability for range of motion in comparison to a control group or other interventions which have been used in therapeutic treatment. A systematic review research approach was adopted and followed current best practice guidelines (Centre for Reviews and Dissemination, York, 2008; Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), 2015; Cochrane Handbook for Systematic Reviews of Interventions, 2017). Two electronic databases (PubMed and Discover) were used for the initial article searches. Key terms included: "kinesio tape*", "shoulder", "neck", "cervical", "low back", "pain", "treatment", "prevention". Key inclusion criteria were: (i) the article reported data for low back pain, neck pain and shoulder stability and range of motion (ROM), (ii) participants were male or female adults, and excluded athletes (iii) participants received a current or historical clinical diagnosis of injury (iv) articles were published in English. Twelve articles were included in the final review: 3 relevant articles for the shoulder joint, 5 articles for lower back pain and 4 articles for neck/cervical pain. The shoulder joint articles presented a sample size of 111 subjects (50 males and 61 females). The low back pain articles included a sample size of 225 subjects (65 males,60 females, 100 participants with sex unspecified) and 263 participants (85 males, 85 females, 97 unspecified) were included in the neck/cervical pain articles. KT may be beneficial on the treatment of certain soft tissues, although outcomes were not consistent across joints and injuries. At the shoulder, significant improvements were observed for stability, ROM and proprioceptotion when an inclinometer was used, but not with a dynamometer. For low back pain significant improvements were evident for trunk stabilisation, pain reduction and postural control. Finally, three studies reported reduced pain and disability, increased muscular strength and increased cervical ROM with KT application, however two further studies reported no differences between KT and sham intervention outcomes. Despite significant outcomes supporting the effectiveness of KT in some studies, overall the effectiveness of KT must be viewed with a degree of scepticism due to the lack of robust and rigorous research designs, e.g., randomised controlled trials; poorly defined outcome measures e.g., "pain"; diverse participant and injury characteristics and limited evidence to support the theoretical conceptual basis of KT. Further research with well-defined interventions, protocols and consideration for appropriate control groups are vital to deliver reliable and valid results to support the future practical therapeutic application of KT.

Identifying fall risks in older adults: the effect of cognitive fatigue on balance

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Each year, approximately a third of adults >65 years fall (Lusardi et al, [2017], Journal of Geriatric Physical Therapy, *40*, 1-36). Performing a concurrent cognitive dual-task can impair balance, therefore it is hypothesised that cognitive fatigue (CF) may impair balance in a similar way (Grobe et al, [2017], Preventive Medicine Reports, *6*, 88-93). CF occurs due to prolonged mentally demanding tasks and can negatively affect attention, alertness and concentration. Therefore, the current study aimed to investigate whether CF affects balance. Following ethical approval by the Human Sciences Research Ethics Committee, 10 healthy older adults (74±6 years, 168±8 cm, 72±18 kg) and 10 healthy younger adults (21±1 years, 172±10 cm, 74±19 kg) attended the lab twice, leading to a counterbalanced design. A series of balance tasks (single/dual-task static, single/dual-task dynamic) were completed pre and post 25 minutes of an incongruent paper-based Stroop task (CF condition) or leisurely reading (control condition). Static balance was assessed using centre of pressure (COP) path length whilst standing for 30 seconds with eyes open and feet together on a Bertec force plate. Dynamic balance was assessed using a timed up and go test. In dual-task trials participants concurrently counted backwards in threes starting from a randomly selected number between 300-900. Results show that COP path length was significantly greater in dual-task compared to single-task trials (30.99±2.16cm vs 27.22±1.75 cm; $F_{(1,18)}$=7.878, *P*=0.012). A significant interaction between group*time*condition ($F_{(1,18)}$=5.353, *P*=0.033) showed significant differences between age groups during post CF trials (*P*=0.022); older adults had larger COP path lengths (35.16±3.02cm) than younger adults (24.43cm±3.02cm). In older adults a significant reduction (*P*<0.001) was identified between pre (32.48±2.92cm) and post control trials (26.70±2.45cm). This effect also occurred in younger adults (*P*=0.006; 27.73±2.92cm vs 23.88±2.45cm). However, path length was significantly greater post CF compared to the control condition in only older adults (*P*<0.001; 35.17±3.02cm vs 26.70±2.45cm). The timed up and go test identified a significant task*group interaction ($F_{(1,18)}$=6.500, *P*=0.020). Only older adults performed significantly worse in dual-tasks in comparison to single tasks (12.57±0.59s vs 10.46±0.53s, *P*<0.001). Furthermore, there was a significant difference between old (10.46±0.53s) and young (7.72±0.53s) during single task (*P*=0.002) and dual tasks (*P*=0.001; 12.57±0.59s vs 8.35±0.59s). In conclusion, static balance improved following the control condition potentially due to repeated testing, but CF eliminated this improvement. CF impaired static balance ability in older adults, but was unaffected in younger adults. Therefore, findings suggest CF can impair balance in older adults.

Acute effects of exercise on subjective fatigue in individuals with Parkinson's disease

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Parkinson's disease (PD) affects 1 in every 500 people, predominately aged 50 years and over. Besides the use of medicine, such as Levodopa, to treat PD, research has found that exercise has a positive impact on both motor and non-motor symptoms. Fatigue is a common non-motor symptom and causes decreased physical functioning and problems with emotional regulation (Herlofson & Kluger [2017]. Journal of the Neurological Sciences, *374*, 38-41). Current research has demonstrated that long-term moderate-to-high intensity exercise can mask and improve symptoms of fatigue, reduce stress, and improve perceptions of quality of life in PD (Johnson & Almeida [2007]. Geriatrics and Aging, *10*, 318-321). Acute bouts of low-to-moderate intensity exercise can enhance feelings of energy and decrease fatigue in both a healthy and clinical population (Lauzé et al [2017]. Journal of Parkinson's Disease, *6*, 685-698). This exploratory study, aims to investigate the acute effects of moderate-to-high intensity exercise on subjective fatigue and related emotional changes within PD. Preliminary data has been collected on eight elderly (64.9 ± 9.6 years) participants (4 male, 4 female), all with PD (5.5 ± 2.7 years since diagnosis) and currently attending an exercise class (14.1 ± 5.7 months attendance). With institutional Tier 1 ethical approval, the participants completed the Exercise-Induced Feeling Inventory (EFI) and the Ratings of Fatigue Scale (RFS) on two separate occasions, acting as their own control. Questionnaires were completed directly before and after a 1-hour moderate-to-high intensity class, and across a similar timespan on a separate day for the control. The class combines aerobic training with balance and strength exercises, to specifically combat the hallmark symptoms of PD whilst aiming to improving quality of life and provide a social space for those with PD. A Wilcoxon signed-rank test showed that the median of the post-exercise positive engagement subscale score of the EFI, *Mdn = 2.3 (IQR = .23)*, was significantly higher than the pre-exercise score, *Mdn = 3.0 (IQR = .93)*, when compared to the control condition *(Z = −2.045, P = 0.041).* There were no other significant differences in the EFI subscales or RFS. This study is one of the first to demonstrate that an acute bout of moderate-to-high intensity exercise may impact subjective fatigue-related feelings of positive engagement immediately after exercise. This insight into the fatiguing effect of exercise on subjective feelings allows clinicians and exercise professionals to better educate individuals on the short-term effects of exercise in PD, to help improve adherence and enjoyment of programmes.

Influence of the VitaBreath on exercise tolerance in patients with COPD

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Non-Invasive Ventilation (NIV) improves exercise capacity in patients with chronic obstructive pulmonary disease (COPD) by reducing the intensity of breathlessness. However, there are several practical limitations associated with the use of NIV during exercise. The VitaBreath device (Philips) provides bi-level support; use during rest periods may reduce dynamic hyperinflation and work of breathing. The aim of this study was to compare the effects of using the VitaBreath device on exercise tolerance, dynamic hyperinflation (DH), symptoms of breathlessness and leg discomfort to the pursed-lip breathing (PLB) technique. Following ethical approval, patients initially performed an incremental cycling test to the limit of tolerance (Wpeak). They were then randomly allocated to a constant-load exercise (CLE) protocol (CLE: 6 min work at 60% Wpeak alternated, with 2 min rest; n=9), or an interval exercise protocol (IE: 2 min work at 80% Wpeak, alternated with 2 min rest; n=9), both sustained to the limit of tolerance. Patients breathed through the VitaBreath device during the first minute of each 2 min rest periods in both exercise protocols. Compared to PLB, use of Vitabreath increased exercise endurance time (IE: by 4.4 ± 5.4 min; $P = 0.04$ and CLE: by 4.2 ± 6.1 min; $P = 0.07$). At the limit of tolerance, use of VitaBreath was associated with significant reductions in DH (IE: by 167 ± 187 ml; $P = 0.028$), Borg scale breathlessness (IE: by 1.2 ± 1.5; $P = 0.047$ and CLE: 0.9 ± 0.6; $P = 0.002$), and leg discomfort (IE: by 0.6 ± 0.5; $P = 0.013$ and CLE: 0.8 ± 1; $P = 0.043$). This interim analysis suggests that compared to PLB, use of VitaBreath is associated with improved exercise tolerance and reduced exertional symptoms both during IE and CLE protocols.

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Characterising fatigue and the influence of psychological stress in people with Multiple Sclerosis

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Fatigue is one of the most debilitating symptoms in people with multiple sclerosis (MS), it can have a significant impact on an individual's quality of life and everyday functioning. Secondary comorbidities to fatigue include depression. Anxiety and depression commonly coexist; with anxiety often preceding depression, yet anxiety is often overlooked. Better understanding of fatigue and its relationship with depression and anxiety could help characterise underlying mechanisms. The aim of this study was to examine the relationship between fatigue with depression and anxiety in patients who experience high and low levels of MS fatigue versus an age-gender matched control group. Thirty patients diagnosed with multiple sclerosis were included in the study (15 fatigued, 15 less-fatigued) along with 15 healthy controls. Fatigue was characterised by the Fatigue Severity Scale (FSS; ≥5 as fatigued and <5 as less-fatigued). Hospital Anxiety and Depression (HADS) is unidimensional measure of psychosocial stress comprising of anxiety and depression dimensions (scores ≥ 8 as anxious or depressed). Pearson's Correlation Coefficients were used to determine concurrence between scales and One-Way Anova with Post Hoc analyses used for comparability between groups. FSS showed significant differences between all three groups (P<0.001), with no differences shown between less-fatigued and healthy controls (P=0.627). Significant differences in mean HADS scores were shown between all three groups (P<0.001). Fatigued MS patients were more anxious (≥ 8) than their less-fatigued counterparts (P=0.004) and the healthy controls (P=0.002), with no differences shown between less-fatigued patients and healthy controls (P=0.922). Fatigued MS patients were more depressed than healthy controls but not with less-fatigued patients (P=0.072). No differences were shown between less-fatigued patients and healthy controls (P=0.783). Fatigue significantly correlated with anxiety (r=0.64; P=0.010) and depression (r=0.54; P=0.036) in fatigued MS patients. However, no association was shown between fatigue with depression and anxiety in less-fatigued and healthy controls. No significant differences were shown for influences of clinical parameters such as, age and disability status. Anxiety and depression are highly prevalent in patients with MS experiencing high levels of fatigue. More investigation is warranted into the underlying mechanisms and the coexistence of depression and anxiety in MS patients with fatigue to help alleviate this debilitating symptom.

The effect of a 10-week postural stability exercise intervention on balance in elderly female care home residents

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In the UK, older people constitute a large and increasing percentage of the population and 32-42% of over 70's fall each year, particularly care home residents (Todd, and Skelton [2004] *WHO Regional Office for Europe*). Balance is one of the major risk factors for falling. Exercise interventions that challenge balance have been shown to have the greatest effect in reducing falls in community-dwelling older people (Sherrington et al [2016] British Journal of Sports Medicine, *in press*). However, few exercise interventions have been conducted in a residential care home setting. Therefore, the aim of this study was to investigate the effect of a 10-week postural stability exercise intervention on balance in care home residents. Six female residents (92 ± 3 yrs) took part in this study following ethical approval. Participants were screened using an adapted Falls Management Exercise (FaME) procedure (Skelton et al [2005] Age and Ageing*, 34*, 636-639). Community-dwelling questions were removed and balance was focused on by including the Berg Balance Scale (BBS). Participants completed a 4-week control period followed by a 10-week exercise programme led by Postural Stability Instructors. This programme comprised twice weekly group-based classes of one hour, encompassing balance, strength and cardiovascular exercises. The BBS and Confidence in Balance (ConfBal) questionnaire were conducted before and after the control period, at the midpoint and at the end of the programme. A qualitative In-Depth Interview (IDI) was carried out with the care home manager post intervention. The authors considered interviewing the participants however there were ethical constraints and issues surrounding their variable mental cognition. Two participants didn't complete the study; fall-related injury (Week 7), non-adherence after Week 11. A Friedman's ANOVA was carried out on the remaining 4 participants data. There was no significant difference in the BBS over the 4 testing points (median and IQR: baseline=37; 13.75, pre=37; 11.50, mid=35; 12.75, post=38; 5.25), ($F_{r(3)}$=3.265, *P*=0.353) or ConfBal score (median and IQR: baseline=15; 9.00, pre=16; 8.25, mid=18; 11.75, post=14; 9.25), ($F_{r(3)}$=5.727, *P*=0.120) over time. Two participants achieved clinically meaningful improvements in BBS, one participant's score declined and one stayed constant. The parameters that defined clinical meaningfulness in this study were in accordance with previously determined banding (Donoghue and Stokes [2009] Journal of Rehabilitation Medicine, *41*, 343-346). Despite the limited sample size potentially influencing the results, these data provide novel, preliminary information about the effect of exercise on balance in frail, elderly individuals. The interview revealed many perceived benefits in qualitative measures including quality of life, confidence and appetite. Objective measures of these perceived benefits may provide a future avenue of research.

A retrospective analysis of pelvic overuse injuries in British Army standard entry recruits between 2011 and 2016

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Remaining injury free is of the highest importance during Initial Army Training. Injury influences career success and maintenance of operational effectiveness in the field army. Women are typically two times more likely to get injured during military training compared to men (Geary et al. [2002] Occupational Medicine, *52*, 85-90). At specific sites, such as the pelvis, women can be up to eight times more likely suffer injury (Gemmell [2002] Journal of the Royal Army Medical Corps, *148*, 6-10). The aim of this study was to conduct a retrospective analysis of pelvic overuse injury rates between male and females at Army Training Centre Pirbright (ATC(P)) to establish if injury prevention strategies are required. A retrospective analysis was undertaken using injury data from all recruit appointments with a physiotherapist from ATC(P). The dataset contained 14,328 reported injuries sustained by standard entry recruits ranging in age from 18 to 32. Data were collected between 1 April 2011 and 31 March 2016. Pelvic overuse injury was defined and diagnosed as tenderness over the inferior pubic ramis, pain on resisted hip flexion and adduction and exclusion of simple muscle strain. Hip fractures were excluded as they could result from acute trauma during training. All data were reviewed in line with the Caldicott Principles. Pelvic injury rates and relative risk ratios were calculated for both sexes and cause of injury and week of incidence reported. A total of 140 pelvic overuse injuries were recorded (F = 75, M = 65), with a relative risk of 6:1 (female: male). The average rate of pelvic overuse injury in women was 6.44 per 1000 recruits (95% Confidence interval (CI): 6.34-6.55) compared to 1.08 per 1000 recruits (95% CI: 1.05-1.12). In women the highest incidence of pelvic injuries were observed in weeks 4 (12%), 5 (12%) and 11 (17.3%) and in men, weeks 2 (13.9%), 3 (15.4%), and 12 (13.9%). Endurance running was the most commonly cited cause of pelvic injury in both female and male recruits (F: 43%, M: 45%). Pelvic overuse injury resulted in 14% of all medical discharges in women and 0.73% in men. Female recruits are exposed to greater risk of suffering pelvic overuse injuries and being medically discharged compared to males during initial Army training. Mitigation strategies have been implemented, including; single sex platoon training, guidance on marching stride length, nutritional and footwear interventions. However, the current data indicate that additional injury prevention strategies should be investigated.

Incidence of breast pain, breast health knowledge and use of breast support in British Army recruits

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The incidence of breast pain in female British Army recruits has yet to be established. In a recent study 32% of the UK physically active female population identified with having at least one form of breast pain (Brown et al. [2014]. Journal of Sports Sciences, *32*, 801-809). A current research focus of the Army Recruiting and Training Division is to improve the retention of female recruits during Initial Training. This study aimed to quantify the current use of breast support, incidence of breast pain and breast health knowledge in a female recruit population. Female British Army standard entry recruits (*n* = 314, age 22 ± 4 yrs, stature 1.65 ± 0.06 m, mass 65.9 ± 8.9 kg) volunteered to participate. During week two of training participants completed a questionnaire, comprising of 48 questions, relating to the incidence of breast pain, sports bra usage, bra fit issues and breast health knowledge. Data were analysed descriptively to quantify occurrence of breast pain and a chi squared ($\chi 2$) analysis was utilised to assess the relationship between cup size and breast pain. Bra size was ranked and the mode and range described. The study was approved by the Ministry of Defence Ethics Committee. Thirty-five percent of recruits reported experiencing breast pain during training, although no association was found between cup size and breast pain ($\chi 2$ = 2.727, *P* = 0.605). The lack of significance may be due to the high proportion of smaller-breasted women within the sample (modal bra size 34 B). Observed counts of breast pain for the cup size category ≥DD (44.4%) exceeded expected counts (36.2%). Average reported pain for smaller breast categories (AA–D) was 33.3%; 43% of participants reported 'wearing a sports bra 7 days per week during training', followed by 30% of participants who wore a sports bra '5-6 days per week'. A self-reported 'average' rating of breast health knowledge was reported by 50% of participants and 31% reported 'below average' knowledge; 88% of participants had never been professionally fitted for a sports bra. These data confirm that a notable number of participants, wearing self-purchased sports bras, experience breast pain and bra fit issues during training. A pilot study to issue all female recruits with high-quality sports bras, on entry to training, has been approved and should be supplemented with an educational program on breast health and bra fit, to ensure appropriate breast support and correctly fitted sports bras are worn.

Kinetics and kinematics of the barbell hip thrust

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The barbell hip thrust has recently become popular in the area of strength and conditioning. The hip thrust involves the athlete sitting on the floor with a box or bench posterior to them. The barbell should sit in the pelvic region and be held in a closed pronated grip. The feet should be flat on the floor and located so that the knee joint is at 90^{o} of flexion with the tibia perpendicular to the ground at full hip extension, and shoulder width apart. Through an explosive contraction of the hip extensors, the athlete displaces the barbell vertically with a forceful extension of the hip joint. The athlete controls the lift throughout the raising and lowering phases. Whilst previous studies have used electromyography analyses, to date there is a lack of kinetic and kinematic analysis of the barbell hip thrust. Therefore, the aim of this study was to quantify the lower limb joint kinetics and kinematics of the barbell hip thrust. Seven male athletes (sprinters: n=4; weightlifters: n=3) with a minimum of six months training experience of the barbell hip thrust and a minimum of six months free from injury, performed 3×3 repetitions of the barbell hip thrust at 70% of 1RM. Data were collected using a 15-camera Vicon Vantage motion-capture system (250 Hz) alongside two floor mounted Kistler force plates and a custom made instrumented bench (1000 Hz). Kinematic and inverse dynamic analysis were performed. Results (mean ± SD) are reported for single repetitions for hip, knee and ankle joint angle, angular velocity, moment, power and work. Weightlifters produced greater peak hip joint moments (sprinters= 2.94 ± 0.42 Nm/kg; weightlifters= 3.39 ± 0.49 Nm/kg) and average hip joint moments (sprinters= 1.69 ± 0.46 Nm/kg; weightlifters= 2.02 ± 0.29 Nm/kg), and greater work at the hip in the raising phase of the lift (sprinters= 0.09 ± 0.02 J/kg; weightlifters= 0.11 ± 0.02 J/kg). Sprinters produced greater power at the knee joint (sprinters= 1.37± 0.62 W/kg; weightlifters= 0.88 ± 0.28 W/kg). This study was unique as it was the first to quantify the joint kinetics and kinematics of the barbell hip thrust, as well as identifying joint kinetic and kinematic differences that exist between athletic populations. Joint kinetic-time curves also identified the loading characteristics of discrete phases of the repetition. The results of this study along with the existing literature (Contreras et al., [2016]. Journal of Applied Biomechanics, *32*, 254-260) suggest that as previously proposed, the barbell hip thrust is an effective way of loading the hip extensor musculature.

Comparison of different footwear on 2-D kinematics during the barbell back squat in young healthy adults

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The barbell-back-squat (BBS) is a popular exercise that serves to build strength. Wearing different types of footwear has been shown to influence BBS kinematics. Weightlifting shoes (WLS) have rigid soles and a raised heel which evidence suggests is key in reducing anterior trunk lean thereby, minimising injury and promoting correct squat technique (Legg et al. [2017] Journal of Sports Sciences, *35*, 508-515). CrossFit™ training has seen the development of a hybrid shoe (HBS), thought to act as a compromise to WLS. Unlike WLS, HBS have durable soles with no heel lift and it is presently unclear how they compare with WLS in terms of lower limb and trunk kinematics. The aim of this study was to compare lower limb and trunk kinematics during a BBS between HBS, WLS and barefoot conditions. With institutional ethical approval, 20 participants actively participating in CrossFit™ performed 5 BBS per footwear condition at 60% of their self-reported 1 repetition-maximum. A rest period of 2-5min was offered between sets. Absolute angles of anterior trunk lean, the thigh, and the foot from the lowest squat depth were obtained using video footage then analysed using MaxTRAQ software. The camera was positioned to the left of the participants. Markers were placed on the left side of the participants at the tip of the barbell, greater-trochanter, lateral-epicondyle, lateral-malleolus, and fifth-metatarsal to form rigid body segments of the trunk, thigh, and foot. Centre of pressure (CoP) data were collected using an AMTI force plate (1000 Hz) and used to indicate medio-lateral and anterior-posterior stability. Effect sizes were calculated using Cohen's *d* method and examined for differences between conditions to determine their influence on squat technique. Repeated-measures ANOVA revealed a significant main effect for footwear on trunk lean ($P<0.001$). WLS showed less anterior trunk lean than HBS ($ES=0.4$) and BF condition ($ES=0.5$). There were no significant effects of footwear on peak thigh flexion ($P=0.112$). There were significant effects of footwear on foot angle ($P<0.001$). WLS showed greater foot angle than HBS ($ES=1.1$) and BF condition ($ES=1.1$). There were no significant effects of footwear on CoP in the anterior-posterior direction ($P=0.341$) or the medio-lateral direction ($P=0.416$). These data demonstrate that HBS are less effective than WLS at reducing trunk lean, and do not promote deeper squat depth. HBS may therefore not be a suitable compromise for WLS in terms of achieving equivalent squatting technique.

2D Kinematic analysis of cycling time trial performance

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The ability to maintain optimal upper and lower body kinematics is an important component of cycling time trial (TT) performance. During short duration maximal TT, the onset of fatigue can occur within 5 minutes (Dingwell et al. [2008]. IEEE Transactions on Biomedical Engineering, *55*, 2666-2674), leading to altered kinematics. Specifically, fatigue-induced changes in trunk lean and hip range of motion have been reported, which can increase aerodynamic drag and the risk of repetitive strain injuries (Dingwell et al. [2008]; Sayers et al. [2012]. Journal of Science and Medicine in Sport, *15*, 169-174). Accordingly, the aim of the study was to evaluate upper and lower body kinematics at 5-minute intervals during a maximal intensity 20-minute TT. Following ethical approval, eight experienced male cyclists (age: 21.4 ± 3.1 years, stature: 177.0 ± 5.4 cm, body mass: 66.3 ± 5.8 kg) provided informed consent and performed a 20-minute TT at a maximum perceived workload. Reflective marker placement allowed for two-dimensional kinematic data of the trunk, hip, knee and ankle to be collected, as well as heart rate, power output, pedalling cadence and rate of perceived exertion (RPE) at 5-minute intervals during the TT. Average counter movement jump (CMJ) height was measured pre and post the TT to assess lower-limb fatigue Maximum intensity was achieved during the TT (Maximum heart rate: 192.31 ± 6.00 bpm, average power output: 263.33 ± 37.77 W, average cadence: 96.07 ± 4.55 rpm, final RPE: 19.38 ± 1.31) at a constant workload (average 5-minute interval workload: 1306.87 ± 150.45 J). No significant difference was found between pre and post measures of counter movement jump height ($t = 1.59$, $p = 0.156$). No significant difference was found in ROM between any of the 5-minute intervals at the hip ($F = 0.135$, $P = 0.938$), knee ($F = 0.027$, $P = 0.994$), or ankle ($F = 0.260$, $P = 0.854$). Trunk lean showed no significant differences throughout the TT ($F = 0.145$, $P = 0.932$). Two-dimensional kinematics of the trunk, hip, knee and ankle do not change throughout the course of a 20-minute cycling TT at maximum perceived workload.

Effects of leg strength asymmetry and asymmetric loading on trunk angles during stair ascent

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Stair walking has previously been highlighted as a demanding task and one of the most hazardous activities in everyday life (Larsen et al. [2008]. Journal of Electromyography and Kinesiology, *18,* 568-580). Although issues with stair negotiation typically develop with age, due to stair negotiation involving a considerable percentage of maximum strength capacity, the locomotion of stair walking is equally as relevant to younger adults. Analysing biomechanical aspects involved in stair ascent can add to the understanding of the diverse and complicated processes involved in human locomotion. It is currently known that the trunk generally provides a stable platform for lower limb movements, however, it is remains unknown as to what extent trunk movements affect stair negotiation. Therefore, the aim of the study was to investigate whether leg strength asymmetry influences trunk angles with the addition of asymmetric loading during stair ascent. With institutional ethics approval, eight participants (4 males and 4 females, mean ± SD age: 21 ± 1.6 years; stature: 1.7 ± 0.1 m; body mass: 71 ± 14 kg; BMI: 24.4 ± 3.2 kg/m^2) all free from injury, voluntarily participated in maximum voluntary contractions (MVC's) of the quadriceps to assess leg strength asymmetry, and in stair negotiation trials. Twenty-four trials of stair ascent were recorded per participant over three different conditions; unloaded, asymmetrically loaded (carrying 10% bodyweight) and symmetrically loaded (carrying 5% bodyweight in each hand). Participants ascended at their own preferred cadence with self-selected rest periods where necessary. The order of conditions and leading leg was randomised. Vicon Nexus and the plug-in gait full body model was used to identify trunk angles during stair negotiation on a 3-step staircase. Effects of leg strength asymmetry and loading conditions were analysed via a two-way repeated measures ANOVA. Data is expected to show that trunk angles will be greater under the asymmetrically loaded condition, especially when ascent is led with the weaker leg, which has been determined from MVC data collected prior to testing. This is expected due to the body compensating for the additional load on one side. It is expected that the trunk angles will be greater in the medial-lateral direction with some posterior lean which increases the risk of balance being lost and falls occurring in negotiation.

Empirically investigating practitioner impact and influence: Insights and reflections from interdisciplinary sport coaching research

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Sports coaching has been widely recognised as an inherently complex and multifaceted relational affair (e.g., Potrac *et al.*, [2000]. Quest, *52*, 186-199), meaning different athletes are highly likely to perceive and respond to coaching practice in a multitude of ways. Social reification and meaning making on the athletes' behalf have been positioned as important components, operating to facilitate such individual responses (Stelter [2007]. International Coaching Psychology Review*, 2*, 191-201). Critically, such interpretations provide us with a platform to investigate the deeper explanatory causal powers, objects and structures interacting to influence athlete outcomes. Despite these assertions, research has often represented coaching practice as if it is received and interpreted by athletes in a homogeneous manner. Traditionally the impact of coaching practice on athlete outcomes has been empirically investigated within the confines of the psychological discipline through a positivistic lens, adopting single method research designs and consulting a singular perspective (i.e., the athlete). Consequently, our understanding of more sophisticated and intricate relationships between coaching practice and athlete outcomes is limited. The central aim of the current study is to highlight the usefulness of a critical realist philosophy and methodology to explore the heterogeneous experiences of coaching practice, and mechanisms operating to influence the effectiveness of practice. With institutional ethics approval, data were collected as part of a longitudinal ethnography with a performance-level cricket squad. A bricolage of methods, namely semi-structured interviews, observation, stimulated recall interviews, and field notes were utilised to address the research questions. Abductive and retroductive analysis was employed, in light of the embedded, relational and emergent (ERE) model and sport coaching ontology (North [2017]. *Sport Coaching Research and Practice: Ontology, Interdisciplinarity and Critical Realism.* New York: Routledge), which formed the theoretical framework guiding the whole research process. Findings and analysis through sociological, psychological, pedagogical and performance layers begin to shed light on the individualised nature of the impact of coaching practice on athlete outcomes, and the underpinning *causal mechanisms* operating to influence the effectiveness of such interactions. Implications of our findings point to the need for practitioners to be reflective, and to critically question typical representations and accepted conventions about 'good' coaching practice. There is a distinct need to focus on *what works for whom, how, when and why*, which may have transferences for practitioners within other disciplines, aiming to influence athlete outcomes.

Repeated sprints with self-selected intervals in elite youth footballers

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Recent studies have applied self-selected recovery periods during repeated sprints in an attempt to account for individual differences in the capacity to recover between sprints (Gibson *et al.,* [2017]. Paediatric Exercise Science, *29*, 186-193). The issue of individual differences in the recovery between sprints is particularly pertinent in young athletes, where physiological responses to repeated sprints can be influenced by stage of maturation. Consequently, using the same inter-interval recovery periods for those at different stages of maturation may overestimate or underestimate recovery requirements. However, given the cognitive demands associated with self-selecting recovery intervals, it is unclear whether this approach is suitable for athletes at different stages of maturation. The aim of the present study was to assess the effect of maturation status on performance during repeated sprints utilising self-selected recovery compared with standardised recovery intervals in youth football players. Twenty-eight male youth football players (*n*=14 pre-peak-height velocity (PHV) and *n*=14 post-PHV) took part in the study (Pre-PHV group: age, 12 ± 0.4 years, stature, 154.1 ± 6.9 cm, mass, 41.4 kg, Post-PHV group: age 14 ± 0.5 years, stature, 170.8 ± 6.4 cm, mass, 58.9 kg). Each player was asked to perform 10 × 30 m sprints under two conditions; one with a 30-s standardised recovery period and another where the individual self-selected each recovery period. Outcome variables including total and fastest sprint time, percentage sprint decrement, total recovery duration and mean and peak HR were calculated and compared both within and between groups. Cohen's *d* effect sizes (ES), ± confidence limits, relative change expressed as the transformed (natural logarithm) and magnitude based inferences were calculated for all outcome measures. The decline in sprint performance was *likely* lower in the pre-PHV compared with the post-PHV group during the standardised recovery trial (37%; ES 0.41 ± 0.51), and *likely* lower in the post-PHV group during the self-selected recovery trial (50%; ES 0.45 ± 0.54). Total recovery duration was *likely* shorter in the pre-PHV compared with the post-PHV group during the self-selected recovery trial (26.1%; ES 0.47 ± 0.45). The results of the present study display that despite the pre-PHV group exhibiting a lower decrement in sprint speed compared with the post-PHV group when standardised recovery intervals were used, this trend was reversed when self-selected recovery intervals were used. These data suggest that pre-PHV players are less able to select appropriate recovery intervals to maintain sprint performance when compared to players who are of advanced physical maturation.

The manipulation of pacing strategies in well-trained male cyclists

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Exercise regulation is still not fully comprehended, as many studies have focused on classic physiology and limitations to performance rather than looking at how participants functionally and perceptually regulate exercise intensity through pacing strategies. This study focused on the physiological and perceptual differences during a 10 km self-paced and even-paced trial to exhaustion, with the aim of gaining more understanding of how exercise intensity is regulated and investigating the optimal pacing strategy for 10 km time-trials (TT). Following ethical approval, nine well-trained male participants (mean ± SD, age 30 ± 11 years; stature 1.82 ± 0.07 m; body mass 77.7 ± 11.0 kg), currently cycling more than 10 km three times a week, took part in the study. Participants performed two 10 km TT and a time to exhaustion trial (TTE). A self-paced familiarisation TT was performed in the first session, this was followed by a self-paced maximum effort TT in the second visit. Each participant then cycled at their average TT power output for the TTE. In all self-paced trials, participants were instructed to complete the distance as fast as possible; heart rate (HR) and rate of perceived exertion (RPE) were recorded every kilometre and blood [lactate] was measured pre-exercise, halfway through, and post-exercise. In the TTE, the same variables were examined, and mean responses were determined. Participants' RPE was significantly higher (P = 0.04, 95% CI, −1.20 to −0.11) when cycling in the TTE compared to the self-paced TT. However, self-paced and even-paced trials showed no effect on HR (P = 0.39, 95% CI, −3.76 to 1.40 bpm) or blood [lactate] concentrations (P = 0.97, 95% CI, −0.97 to 1.00 mmol/l). Despite this, participants were able to demonstrate that an even-pacing strategy resulted in a decreased metabolic challenge, which enabled the athletes to perform for longer at the same mean power (224 ± 35 W) compared to self-paced exercise (21.8 ± 5.1 vs. 17.7 ± 1.2 min; P < 0.05, 95% CI, 1.8 to 6.3 min). This is likely because the power output was set and maintained in the even-paced trial, whereas the parabolic pacing strategy allowed the participants to work below maximum steady in the self-paced trial. Participants perceived the even-paced trial as more perceptually challenging than the self-paced trial, likely due to pacing fluctuations. The results from the present study, along with previous research, suggest that an even-pacing strategy is optimal in time trial endurance events.

The effects of muscle damage caused by plyometric training on balance performance in female gymnasts

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Female gymnasts often train using plyometric exercise, in an attempt to enhance key physical qualities for performance (Agostini et al. [2017]. Motricidade*, 13*, 71-80). However, a consequence of such training is exercise-induced muscle damage (EIMD), particularly when the exercise is unaccustomed. EIMD is characterized by losses in force generating ability, muscle soreness and reduced range of motion. EIMD can also impair balance performance (Twist et al. [2008]. Journal of Sport Sciences, *26*, 1073-1080). Therefore, the aim of the present study was to investigate the effects of plyometric exercise on symptoms of muscle damage and balance performance in female gymnasts. With ethics approval, nine female gymnasts (mean ± SD age, 19 ± 1 years; stature 162.3 ± 6.5 cm; body mass 56.8 ± 7.1 kg) with no structured plyometric training history participated in the study. Using a fully repeated measures design measures of stability index, range of motion (ROM), countermovement jump height and perceived muscle soreness were measured at baseline and immediately, 24 and 48 hours after plyometric exercise comprising 100 foot contacts. Data were analysed using separate repeated measures ANOVA and *post hoc* tests using paired samples *t*-tests with a Bonferroni correction (i.e. $P<0.016$). Stability Index was reduced after plyometric exercise ($F=5.2$, $P<0.05$), with less movement occurring on the platform compared to baseline at all time points ($P<0.016$). The stability index in the anterior-posterior plane was lower after plyometric exercise ($F=4.3$, $P<0.05$), with *post hoc* revealing changes at all time points compared to baseline ($P<0.016$). Perceived muscle soreness increased after plyometric exercise ($F= 38.7$, $P<0.05$), with values higher than baseline at all time points ($P<0.016$). Countermovement jump height was reduced after plyometric exercise ($F=5.5$, $P<0.05$), with *post hoc* revealing lower values at 24 and 48 hours when compared to baseline ($P<0.016$). Dorsiflexion ROM deteriorated ($F=1.8$, $P<0.05$), with values raised at 24 hours after plyometric exercise ($P<0.016$). These findings indicate that plyometric exercise in trained female gymnasts causes symptoms of EIMD for up to 48 hours after. A lower stability index indicates that balance performance is not compromised in this group and is potentially attributed to increased muscle stiffness and increased sensitivity of the proprioceptive system. Moreover, a reduced countermovement jump height in the days after is likely to have implications for the athlete's training. Gymnastics coaches should be cognisant of these changes to functional capacity when employing plyometric training with their athletes.

A cross-sectional study investigating the effect of oral contraceptive use on motor control of the knee-extensors in healthy, young females

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In humans, neuromuscular function has wide-reaching implications for athletic performance, health and well-being, with the knee-extensors having particular importance for locomotion in all populations. Neuromuscular control of movement can be modulated by hormonal status. The female menstrual cycle and hormonal contraceptive usage causes changes in endogenous and exogenous hormone concentrations. However, the implications of chronic contraceptive use on neuromuscular function are unknown. Accordingly, the aim of the present study was to investigate neuromuscular function in two groups of females (oral contraceptive users [OCP], and eumenorrheic females [EF]) during times at which endogenous sex hormones were at their nadir, but OCPs were taking the pill. This allowed the effect of endogenous hormones to be minimised, and the effect of the oral contraceptive pill on neuromuscular properties to be discerned. Healthy females (n=28 [15 OCP and 13 EF], mean ± SD age: 24 ± 3 years) visited the laboratory on two occasions - familiarisation and experimental session. Eumenorrheic females completed their session on day 2 of the menstrual cycle, whereas females on the monophasic combined oral contraceptive pill were tested during the final two weeks of the consumption phase. Transcranial magnetic stimulation (TMS) and motor nerve stimulation (MNS) were used to assess neuromuscular function of the knee-extensors. Maximum strength (MVC) was not different between OCP and EF (503 ± 90 vs. 455 ± 75 N, *P*=0.697). Potentiated resting twitch ($Q_{tw,pot}$) was also similar in EF and OCP (168 ± 27 vs. 153 ± 20 N, *P*=0.103). Voluntary activation assessed with MNS (VA_{MNS}) was not different between EF and OCP (93.6 ± 3.0 vs. 93.9 ± 3.0%, *P*=0.771), neither was voluntary activation assessed with TMS (VA_{TMS}; 94.3 ± 3.3 vs. 93.7 ± 2.6%, *P*=0.580). Corticospinal excitability (MEP/M_{MAX}; 22.4 ± 12.0 vs. 17.4 ± 6.2%, *P* = 0.194) and short interval cortical inhibition (SICI; 78.7 ± 15.0 vs 79.1 ± 8.8%, *P*=0.945) assessed during a 10% contraction were also not different. Cortical silent period (CSP) duration measured during a 50% contraction was longer in OCP vs. EF (187 ± 44 vs. 155 ± 39 ms, *P*=0.046). These data demonstrate that OCP usage does not affect the majority of neuromuscular measures, however, it might augment cortical inhibition (longer CSP). The chronic downregulation of endogenous, neuroactive sex hormones in OCP users might be implicated in modulating neuronal function. As the present study was cross-sectional, future research should investigate the relationship between OCP usage and neuromuscular function in a direct, crossover study design.

Cellular migration following *in-vitro* mechanical wound injury for identifying differences in gender

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The capacity to measure skeletal muscle regeneration, through cellular processes associated with skeletal muscle stem cells [also known as satellite cells (SC)], following exercise-induced muscle damage (EIMD) is limited (Owens, [2015]. American Journal of Physiology-Endocrinology and Metabolism, *309*, 1019-1031). Further, it is unknown whether gender differences relating to muscle recovery following EIMD exist (Sayers & Clarkson [2001]. European Journal of Applield Physiology, *84*, 122-126). Recently, (Lee, [2011]. In Vitro Cell Development Biology Animal, *47*, 438-444) reported changes in muscle SC proliferation following culture in gender-specific bovine serum. Accordingly, the objectives of the present study were to compare and contrast responses between adult human male and female primary SCs following *in vitro* wound injury. The hypothesis to be challenged was that human tissue mechanical wound injury would have significant response to identifying migration rate between genders of individual cell lines. Muscle SCs isolated from 8 male and 4 female recreationally active participants (22.4 ± 3.9 years) were grown to confluence (>80%) prior to mechanical wounding, washed and transferred to fresh culture medium for further analyses. Images were captured immediately after the wounding protocol (artificial damage with 5 ml pipette tip to the muscle sample) at 24, and 48 h later. Wound closure was analysed in Image-J software with the cell counter plug-in. All cells infiltrated the wounds, regardless of gender with no significant interaction (P = 0.358) in cellular migration between male and female SCs. Although the number of cells migrating into the centre of the wounds was higher at 48 h in biopsies derived from males vs. females (mean ± SD: 93.7 ± 12.2 vs. 85.1 ± 14.6 infiltrated cells/wound), significance was not attained. These data illustrate for the first time that skeletal muscle SCs derived from healthy, young males and females are both efficient at wound closure *in vitro*, with no significant differences apparent in cell migration rates within the first 48 h following mechanical wound injury. Data can be extended by following the wounded cells for a further 7 days *in vitro*, to determine whether there are gender-specific differences in fusion capacity following wound closure.

The heightened cardiovascular risk in young females with athletic amenorrhea: a systematic review

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The female athlete triad is commonly known to be composed of three elements; low energy availability, amenorrhea and decreased bone mineral density with or without osteoporosis. It has been suggested these elements, though separate, are interrelated. More recent research suggests endothelial dysfunction as a fourth element in athletic females with ovulatory dysfunction, which may predispose a premenopausal athlete to accelerated cardiovascular risk. Those with athletic amenorrhea demonstrate similar hormonal profiles to menopausal women, in which the cardio-protection of oestrogen is gradually reduced over time. Thus, suggesting females with athletic amenorrhea may, in fact, be at risk of cardiovascular disease. The aim of the current study was to systematically review the current evidence, which explored the associations between disrupted menstrual cycles and risk of cardiovascular disease in athletic women. One electronic database, PubMed, was searched and searches were performed between February and May 2017. After a screening process, a total of seven research papers were included in the review, with publication dates ranging from the years 2003 to 2016. A total of 285 female participants were included in the review. Emphasis was placed upon those with secondary athletic amenorrhea (cessation in menstruation of six months, or more), however female athletes classified as eumenorrheic (regular monthly menstrual cycle, 25-35 days between cycles) and oligomenorrhic (light or infrequent menstrual periods, >35 days between consecutive cycles) were included for comparison. The studies reviewed included those directly relating to vascular function and dysfunction, measured using flow-mediated dilation techniques. Indirect factors, such as altered hormone and cholesterol levels, were also discussed in terms of their relation to cardiovascular risk and consequent atherosclerosis. In five articles, flow mediated dilation (FMD) measurements of the brachial artery were conducted. In four of these articles, FMD was reported to be 6.3%, 5.3%, 5% and 3.5% (all $P < 0.05$) lower in females with athletic amenorrhea, compared to eumenorrheic athletes. One study measured calf blood flow using venous occlusion strain-gauge plethysmography. Those with athletic amenorrhea had reduced resting and peak blood flow at the calf ($P < 0.05$). In one study, grehlin secretion was 39% higher, leptin secretion was 34% lower, and total pulsatile secretion of luteinizing hormone was 40% lower (all $P < 0.05$) in those with amenorrhea. Furthermore, one study demonstrated elevated cholesterol levels in athletes with amenorrhea. Based on the evidence presented in this review, it may be suggested that young female athletes with amenorrhea, may be predisposed to an increased risk of atherosclerosis, however further empirical research is essential.

Heat affects rate of torque development in electrically stimulated but not maximal voluntary contractions

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The effect temperature has on rate of torque development (RTD, ability to produce high torque over a short time period), has produced contrasting findings between studies using voluntary or electrically stimulated contractions. Electrically stimulated contractions RTD increased with heat and decreased with cold, but voluntary contractions RTD was not affected by temperature. Proposed theories for this discrepancy involve muscle fibre type and motor unit recruitment pattern changes (Ranatunga et al. [1987]. The Journal of Physiology, *390,* 383-395). The present study aimed to examine the effect of temperature on electrically stimulated and voluntary contractions RTD by comparing them directly during an isometric knee extension. With institutional ethical approval, twelve, physically active males performed two isometric maximum voluntary contractions (MVC) of the knee extensors in an isokinetic dynamometer, with the hip, knee and ankle joint angle at 90°. The MVCs were performed after the lower limbs were submerged for 20 minutes in hot (40°C) or cold (10°C) water. A control MVC was performed in ambient room temperature (17 ± 0.7°C). Electrical twitches (doublets) were delivered through percutaneous muscle stimulation, during the plateau of the MVC (superimposed doublet) and post-MVC at rest (resting doublet). MVC torque was recorded, RTD (from the onset of contraction until peak torque) of the MVC and resting doublet, and muscle activation capacity were calculated using the interpolated twitch technique (1–(superimposed doublet torque/resting doublet torque) × 100). A repeated-measures ANOVA was used to examine for differences between all three conditions for all variables with significance set at 0.05. There was no significant change between conditions in MVC torque, muscle activation capacity and voluntary contraction RTD ($P > 0.05$). RTD in the stimulated contractions was found to be significantly higher ($P = 0.031$) in the hot (1097 ± 227 $N \cdot s^{-1}$) compared to control (903 ± 188 $N \cdot s^{-1}$) condition. Our results from the stimulated contraction (i.e. without voluntary neural input) suggest that heat affects the mechanical behaviour of the muscle-tendon unit, enabling a higher RTD. The lack of this pattern for the MVC, however, point to a neural 'compensation' in the control and cold conditions by, more likely, higher motor unit recruitment. This mechanism allows for a constant RTD, enabling the muscle to respond consistently to activity demands, regardless of external temperature effects. Future studies should verify increased motor unit recruitment as the mechanism responsible and examine populations with established neural deficiencies, e.g. older people or neural disorders patients, using stimulated contractions as the reference pattern.

Does a staggered Internal Pre-Cooling Ingestion Protocol Improve 10 km Cycling Time Trial Performance in 30°C?

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Endurance performance is negatively affected in the heat (>30°C; Gonzalez-Alsonso *et al.* [1999] Journal of Applied Physiology*, 86, 1032-1039*). Internal pre-cooling has been shown to have a positive influence on athletic performance in temperatures of >30˚C (James et al. [2017] Journal of Strength and Conditioning Research*, 3, 1-25)*. Little is known, however, regarding the effectiveness of a staggered ingestion protocol. The current study investigated the effectiveness of a staggered delivery protocol of ice slurry on 10 km maximal time trial (TT) performance in 30°C. Following ethical approval, four trained male participants (mean ± SD, age, 22.5 ± 0.5 years; body mass 85.75 ± 19.89 kg; stature, 187.08 ± 14.86 cm) were recruited to complete 2 experimental 10 km TTs in a randomised order. Participants consumed 1.25 g·kg·BW^{-1} of ice slurry either as whole consumption (WC) 30 minutes prior to the 10 km TT or, consumed half of the ice slurry at 30 minutes prior and half 15 minutes (SC) prior to the10 km TT. The initial 20 minutes of the TT was maintained at a pre-determined steady state (55% Heart rate max) intensity in order to compare physiological measures at the same relative intensity between conditions. Measures of heart rate, rate of perceived exertion, thermal sensation, rectal core temperature, blood lactate, four site skin temperature and sweat rate were recorded throughout the TT and the steady state period but not during the 30-minute ingestion period. 10 km maximal TT performance was measured. Following the initial 20 minutes participants were then instructed to complete the remainder of the 10 km as quickly as possible. Results indicate that TT performance was not different between conditions (WC 1039.7 vs. SC 1050.76 s; P = 0.66) despite a significantly lower starting (WC 37.5 vs. SC 37.25°C; P = 0.03) and final core temperature (WC 38.15 vs. SC 37.75°C; P = 0.043*)*. The current study demonstrated a staggered delivery protocol of Internal pre-cooling, reduced starting and final core temperature but had no effect on TT cycling performance.

Cerebral autoregulation is improved by exercise training in the cold

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Sustaining sufficient cerebral blood flow (CBF) is crucial for maintaining normal cognitive function via a constant supply of oxygen and nutrients to the brain. The brain is unique, it has an intrinsic ability to autoregulate to maintain adequate perfusion during changes in blood pressure (BP; Paulson et al., [1990] Cerebrovascular and Brain Metabolism Reviews, *2,* 61-192), but this declines with age. Therefore, interventions which maintain or improve cerebrovascular function are warranted. Acute exercise and acute cold stress both increase cerebral blood flow and blood pressure, it is possible that combining exercise in a cold environment may be beneficial to cerebral autoregulation and is the aim of this study. It was hypothesised that exercise training in a cold environment elicits greater improvements in cerebral autoregulation. Following ethical approval 21 (16 male, 5 female) healthy individuals (age 22 ± 5 years; BMI, 23 ± 3) were randomly assigned to 8 weeks of steady-state cycling 70% HR_{max} for 50 minutes 3 times a week in a cold (5°C) or thermoneutral (15°C) environment. Middle cerebral artery velocity (MCAv; Transcranial Doppler), end tidal partial pressure of CO_2 ($PETCO_2$) and mean arterial blood pressure (MAP) (Finometer) were continuously measured at rest and throughout manipulation of BP with squat-stand manoeuvres (0.1 Hz) to assess dynamic cerebral autoregulation. Cardiorespiratory fitness and heart rate were also assessed prior to, and following the intervention. Cerebral autoregulation was quantified using transfer function analysis which provides indices of gain, phase and coherence in the low (LF) and very low frequency (VLF) domains. Data was analysed using general linear modelling and presented as mean± 95%CI. Cardiorespiratory fitness improved by 2.91 ml·kg·min^{-1} (95% CI: 0.49 to 5.34 ml·kg·min^{-1}, P = 0.021) following exercise training. There were negligible changes in MAP with training (mean difference: 2 mmHg, 95% CI: −1 to 5 mmHg; P = 0.16). Resting MCAv was similar following exercise (mean difference: 0.86 cm/s, 95% CI −6.00 to 4.28 cm/s; P = 0.73). Transfer function for phase and coherence did not change with exercise or between interventions (P < 0.05). However, there was a significant interaction (P = 0.014) for normalised gain in the LF. Normalised gain decreased by −0.173 cm^{-1}·mmHg^{-1} (95% CI −0.018 to 0.365 cm^{-1}·mmHg^{-1}) following the cold exercise training compared to a change of 0.140 cm^{-1}·mmHg^{-1} (95% CI −0.283 to 0.003 cm^{-1}·mmHg^{-1}) following thermoneutral training. These findings may indicate that exercise training in a cold environment elicits a similar response in fitness but could enhance cerebral autoregulation in young, healthy individuals.

The effects of exercise induced muscle damage on core temperature during a heat stress test

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Exercising in the heat increases thermoregulatory strain increasing the risk of exertional heat related illness (EHRI), characterised by core temperatures greater than 40°C. Different contributing factors such as sleep, body fat, age and gender may all contribute to EHRI. Furthermore, exercise- induce muscle damage (EIMD) has been identified as a potential additional pathway to the development of EHRI when exercising in the heat (Fortes et al., [2013], Medicine and Science in Sports and Exercise, *45*, 1915–1924). EIMD results in alterations to running gait, greater motor unit recruitment and muscle weakness, therefore an increase oxygen uptake within skeletal muscle and a decrease in running economy. These changes in economy further increase thermoregulatory strain through competing demands for arterial blood. Moreover, inflammatory response may exacerbate endogenous temperature through increases in circulating pro-inflammatory cytokines. It remains unclear to what extent EIMD increases heat strain during subsequent exercise-heat-stress. Thus, the purpose of this study was to investigate the effects of eccentric EIMD on core temperature during an exercise heat stress test (24 hours post). Ten non-heat acclimated males (mean ± SD, age, 22 ± 2 yrs, VO_{2max}, 49.3 ± 6.8 ml/kg/min) performed six sets of twelve maximal eccentric (ECC) hamstring contractions. Participants then completed a heat stress test (running for 30 minutes at 65% of VO_{2max} in 33°C, 40% humidity) 24 hours post EIMD. Trial two consisted of six sets of twelve concentric (CON) hamstring contractions followed by the same heat stress test 24 hours after. Ten days separated the two trials. Rate of oxygen consumption (ml/kg/min), rectal (T*re*) and skin (T*sk*) temperature were measured throughout the heat stress test. Creatine kinase (CK) and perceived muscle soreness were measured as markers of muscle damage. Compared with CON, ECC evoked significantly higher creatine kinase (*P*=0.003) and muscle soreness (P=0.001). There was a trend for higher T*re* at completion of ECC (38.6 vs. 38.3°C, P>0.05) and no difference in heart rate (P>0.05). VO_2 was significantly higher within ECC than CON (31.6 ± 6.6 vs 28.5 ± 6.8 ml/kg/min, respectively; P=0.032) and T*sk* was significantly higher in CON (P=0.011). Running economy decreased during exercise in the heat 24 hours after EIMD. Significant increases in creatine kinase within ECC indicate that muscle damage contributes to the increase of oxygen uptake through increase skeletal muscle demands. Thus, limiting blood perfusion within the periphery and decreasing the ability to reduce thermoregulatory strain. The pathways contributing to increase risk of EHRI need to be explored further in relation to exercise duration and intensity and the inflammatory pathways.

What are the differences in the uses of imagery between university level sprinters and long-distance runners?

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Imagery has been identified as the most popular mental training technique (Short et al., [2002] The Sport Psychologist*, 16*, 48-67) and is recognised by athletes, coaches, and sport psychologists as an important psychological skill for performance enhancement (Hall, 2001, In Singer, Hausenblas & Janelle (Eds.), *Handbook of sport psychology* (529-549), New York: Wiley). Higher level athletes have reported utilising imagery more extensively than lower level athletes in numerous sports including hockey, synchronised skating, golf, and track & field athletics. Imagery training programmes have also demonstrated performance improvements in high jump, basketball, and table tennis. Although imagery training can benefit performance and distinguish higher level athletes from lower level athletes, there is limited research comparing imagery use between two differing sports or events. Sprinters and long-distance runners (LDRs) were selected due to the contrasting requirements between events (high intensity short duration and low intensity long duration respectively). The main research questions for the present study include; 1) Will sprinters and LDRs report using the same functions of imagery? 2) Will sprinters and LDRs employ imagery functions differently? Ten participants (mean ± age = 20.1 ± 1.73 years) were divided into two focus groups (Group 1 - six LDRs; Group 2 - four sprinters). Focus groups were 25:01 minutes and 19:19 minutes in duration for groups 1 and 2, respectively. Dictaphones were used to record the focus groups, allowing data to be later transcribed and analysed using inductive thematic analysis. Four main themes (two similarities and two differences) were highlighted. Similarities- 1) Both groups utilised imagery to rehearse race tactics before races; 2) Both groups used imagery to visualise the benefits of pre-season training (achieving personal bests during the season). Differences- 1) LDRs utilised imagery to decrease focus, using the audience to help increase mental toughness, whereas sprinters utilised imagery to increase focus ("forget about everyone else"); 2) LDRs used imagery to motivate themselves to attend training, despite adverse situations (winter training), which was not reported by sprinters. Despite similarities present (rehearsing race tactics and visualising the benefits of pre-season training), crucial differences were also identified. LDRs aimed to decrease focus, whereas sprinters aimed to increase focus. In addition, LDRs utilised imagery to enhance mental toughness (overcoming adverse situations), which was not reported by sprinters. Results from this present study advances knowledge of imagery, allowing sports psychologists to construct imagery programmes more individualised to sprinters and LDRs.

Does the presence of an audience affect a) performance, b) state anxiety, and c) heart rate?

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Studies have suggested that audiences increase performance pressure, which can result in choking due to the misdirection of attention, as well as influencing a performer's state anxiety and heart rate. The aim of the present study was to investigate if an audience influenced performance, state anxiety, and heart rate within a golf-putting scenario, and whether any of the anxiety subscales of the CSAI-2 predicted performance. 20 University students (11 males and 9 females aged between 19 and 22) completed 10 lots of 9-foot golf putts, both with and without an audience in a repeated measures crossover design. The CSAI-2 was completed both before and after the task finished. Results showed the audience negatively affected performance (P = 0.03, T = 2.43) and increased heart rate (BPM) (P < 0.001, T = 4.78). There was a significant main effect of time on both cognitive anxiety ($F_{1,38}$ = 4.80, P = 0.035) and somatic anxiety ($F_{1,38}$ = 4.402, P = 0.043), with both factors increasing following performance. However, there was no significant effect for condition for either cognitive ($F_{1,38}$ = 1.45, P = 0.236) or somatic anxiety ($F_{1,38}$ = 1.11, P = 0.299), nor was there a significant interaction between condition and time in both cognitive ($F_{1,38}$ = 0.47, P = 0.496) and somatic anxiety ($F_{1,38}$ = 0.024, P = 0.879). There was no effect of condition ($F_{1,38}$ = 0.56, P = 0.461), time ($F_{1,38}$ = 0.02, P = 0.89), or time-condition interaction ($F_{1,38}$ = 0.04, P = 0.843) on self-confidence scores. Neither cognitive anxiety, somatic anxiety, nor self-confidence predicted performance with or without an audience. However, performance seemingly predicted cognitive anxiety without an audience (Rs = 0.624, P = 0.003), and self-confidence in both an audience (RS = 0.448, P = 0.048) and non-audience condition (Rs = 0.515, P = 0.02). The results imply that an audience results in decreased performance and increased heart rate, but does not have significant effects on anxiety or self-confidence, which are instead affected by the sporting task being performed. The results of performance refute the claims made by the Multidimensional Anxiety Theory (Martens et al [1990]. In Martens, Vealey and Burton (Eds.), *Competitive Anxiety in Sport* (117-190), Champaign, IL: Human Kinetics), but give weight towards the Individual Zone of Functioning (Hanin [1995]. European Journal of Sport Psychology, *1*, 29-72). Future research should explore factors that may result in poor performance due to an audience, such as the distraction theory or the self-attentional focus model.

Sensorimotor development in autistic spectrum disorders

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Sensorimotor experience facilitates the recognition of similar actions. Although there is evidence on how the sensorimotor system develops in the typical population (Calvo-Merino et al. [2004]. Cerebral Cortex*, 15,* 1243-1249), there is a requirement to understand this process in autistic individuals (Hannant et al. [2016]. Frontiers in Neurology*, 7,* 124) as the underlying sensorimotor system may contribute to altered social interaction, especially those individuals that require substantial support. To this end, the aim of the present study was to investigate sensorimotor development in severely autistic adults that have accrued specific trampolining experience. To accommodate for autism severity, a novel preferential attention protocol was developed to measure sensorimotor development. Compared to a *media* control group (0 hours experience at trampolining), the *trampolining* group (over 100 hours experience at trampolining) is expected to show trampolining specific visual attention when viewing familiar actions. The preferential attention protocol displayed two point-light autistic models performing the same action on either side of a monitor in a congruent (upright) or incongruent (inverted) orientation. Participants viewed two experimental trampolining actions (seat drops, twists), and two control actions (gait, straight jumps). Both groups watched each action 4 times (total n=16) in a randomised trial-order. Preferential attention was measured using *First Fixation Duration* that quantifies the length (ms) of the first fixation made on an area of interest. ANOVA revealed a significant Group x Congruency interaction ($P < 0.05$) for twists, which indicated the *trampolining* group had a greater *First Fixation Duration* for the congruent action (202 ms) than the incongruent action (142 ms), whereas the *media* group had a greater *First Fixation Duration* on the incongruent action (177 ms), compared to the congruent action (175 ms). A significant main effect for Congruency indicated the *trampolining* group and the *media* group spent a similar *First Fixation Duration* viewing the jumping action ($P < 0.05$). The *First Fixation Duration* data indicated the *trampolining* group and *media* group showed similar visual attention when viewing a control action. The *trampolining* group showed preferential attention when viewing an action based specifically on 100 hours of sensorimotor experience. This difference indicates the sensorimotor system in severely autistic individuals develops in an experience dependent manner. The findings are both empirically and clinically significant because they provide evidence that sensorimotor development is intact, and therefore provides a route to rehabilitation interventions that might ameliorate some of the symptoms of autism.

A letter to my younger athlete self: using hindsight to understand the experiences of chronic pain in athletes

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While the sport psychology literature has provided an extensive examination of the antecedents and responses to acute athletic injury, the experiences of athletes with a chronic injury have been overlooked. Chronic injury may be broadly defined as any injury that causes progressive, continuous or intermittently re-occurring pain, becoming more complex over time (Cole, Howden-Leach, Macdonald, & Carus [2012]. Overcoming chronic pain. Constable & Robinson Ltd: London). Therefore for the athlete experiencing chronic pain, this may become a pathological process, present for months or even years after injury and requiring the need to play through pain. This study aimed to explore the experiences of athletes in chronic pain, using hindsight to reflect on what could or would assist them in coping. Following institutional ethical approval this study recruited 21 participants (14 females and 7 males, 30.1 ± 13.2 years) from a range of athletic abilities (7 amateur, 6 regional, 4 national, and 4 International) who took part in a range of team (e.g., football, hockey, netball) and individual sports (e.g., athletics, triathlon). All participants had experienced chronic pain for at least 5 years and all had either declined or limited participation in their chosen sport because of their chronic injury. Participants were asked to write a letter back to their younger selves termed an "*older and wiser self*" letter. To assist the participant in writing this letter, open-ended prompts were provided as a guide (e.g., What advice would you like to give to yourself? What would be most helpful or comforting to hear?). Completed letters were emailed back to the researcher and a thematic analysis (Braun & Clarke [2013]. The Psychologist, 26, 120-123) was used to analyse the data. Results highlight a number of themes, including the use of self-directed instructions (e.g., calls to take action, to listen to medical advice), motivational statements (e.g., encouragement to play through pain), regrets (e.g., losing friends because of pain and irritability), and future reassurances (e.g., reassurance that life will continue after leaving sport). This study is the first to demonstrate the wealth of rich information that can be gained through the use of the 'older, wiser self' expressive writing technique. Further, results illustrate the support (informational, motivational, emotional) that individuals desire when experiencing chronic pain in sport. Such information may provide valuable suggestions for the applied practitioner supporting athletes in chronic pain.

Understanding meaningful affective connections to sport: introducing "athlemaphilia"

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Athlemaphilia combines "áthlima", the Greek word for sport, with the suffix "-philia", which specifies the existence of meaningful affectionate connections, to represent the meaningful affectionate connections we have to sport. The current understanding of athlemaphilia arose from the application of attachment and self-determination theories along with the three-factor theory of anthropomorphism in athletes' experiences of their interactions with sport. Following university ethical approval this mixed-methods programme of research was carried out over three studies. The first quantitative study explored whether athletes experience their athlemaphilic interactions like interpersonal relationships and how athlemaphilia was associated with wellbeing. Results revealed that athlemaphilic and interpersonal relationships: (a) existed using similar terminology; (b) varied in the presence of certain relationship features, and; (c) were differentially associated with variation in wellbeing. The second study utilised interpretative phenomenological analysis to explore experiences of need satisfaction within athlemaphilic relationships and found that athlemaphilic relationships can satisfy the secure-base and safe-haven functions of attachment figures. The final study tested how individuals primed with interpersonal insecurity might restore depleted affect by thinking about their athlemaphilic relationships. Result offered preliminary experimental evidence that athlemaphilic relationships are anthropomorphised, and that engaging with an athlemaphilic partner can compensate for thwarted interpersonal need satisfaction. Overall, these results suggest that sport can be viewed as a form of nonhuman attachment and that nonhuman sports are anthropomorphised and perceived to offer support like interpersonal relationships. Results also challenged the need for interpersonal connection to satisfy a sense of relatedness according to self-determination theory and exposed a variety of ways to understand an individual's motivation to engage, remain, or disengage in sport. Athlemaphilia is a protologism, a newly coined term hoping for further consideration; thus, future directions will also be presented to encourage further discussion.

A comparative study of blocked practice and game-based practice schedules implications on soccer passing performance

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The soccer skill of passing in the context of soccer and practice schedule has seen a resurgence of interest in the field of coaching science concluded as a key performance indicator with teams number of passes or greater possession correlating with success. Coaches have continuously aimed to identify the optimum practice conditions to develop this technical action across the continuum from Blocked to Games Based Practice. However, such studies have adopted a sample of players in the youth development phase (mean age < 13 years old), in contrast to this approach, national governing body directives (The FA, 2016) and motor learning literature (Martin et al. [2010] Acta Universatis Palankinae Gymnica, *11*, 7-15) conclude that within this developmental phase participants should be refining technical skill output (mean age <10 years old). However, such studies have not implanted this conclusion within research design. This study aims to analyse the potential implications of a Games Based (GB) or Blocked Practice (BP) on individual and team soccer passing performance, with the objective of providing a framework for coaches and practitioners to develop the soccer skill of passing in junior soccer players. Following ethical approval, two Pre-Academy soccer teams (18 male players, mean age, 8.5 ± 0.6 years) participated in the study. Teams were split and given a practice schedule intervention of 4 sessions with the GB or BP methodology with 18 days between test and retest. A test and retest protocol was adopted pre and post practice schedule intervention with the Loughborough Soccer Passing Test (LSPT) used to measure individual and collective passing score. Differences were assessed using an independent samples t-test with the alpha level set at $P < 0.05$ (SPSS, IBM, Chicago, USA). For individual passing scores the GB displayed the greatest decrease and improvement in individual passing scores (Δ9.6 s, mean 43 ± 28 s; $P = 0.012$) as opposed to (Δ9.3 s, mean 45 ± 27 s; $P= 0.042$) for the BP. In contrast, the collective passing score improvement for BP decreased by 12.7 s (20 ± 29 s) as opposed to 11.4 s (27 ± 10 s) for the GB. Furthermore, statistical analysis for the BP was displayed as significant ($P = 0.016$), with no significance for GB ($P = 0.067$). The study displayed that individual and collective passing scores decrease and improve with both practice schedules adopted in practice, however, greater studies adopting a longitudinal design over the course of a soccer season (9 months) must be adopted to measure retention and learning.

A case study exploring the practice structures implemented by academy soccer coaches

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Sports performance is generally considered to be governed by a range of interacting physiological, biomechanical and psychological variables (Glazier [2015], Human Movement Science, 56, 139-156). Therefore, a key role of the coach, is to establish a teaching and learning environment which facilitates the holistic development of these variables within athletes. To establish this, an important component of the environment is practice activity (Low et al., [2013], Journal of Sports Sciences, *31*, 1242-1250). However, there remains limited understanding of what practice activity looks like. Accordingly, the purpose of this study is to extend our understanding of how coaches structure practice activities within Academy soccer. In doing so extending our understanding of the strategy which informs practice structures, to increase practical application in youth soccer coaches. Following institutional ethical approval, nine Youth Development coaches (u12-16) of a category one soccer academy participated in semi structured interviews lasting between forty-five and ninety minutes. Interviews were transcribed verbatim and thematic analysis was conducted. An inductive and semantic approach was adopted allowing the data to drive the analysis process. The higher order themes identified were structure (practice activity, characteristics, components, ordering of activity); strategy/outcomes (theme, technical, tactical, physical, psychological, learning objectives); development experiences (experiential learning, informal learning, formal learning); and influences (resources, stakeholders). The findings suggest that structuring practice is a complex and challenging process, which stretches beyond a simple independent outcome focus largely conceptualised within research. Instead, coaches considered a multi-faceted approach to practice structure that integrates technical, physical and psychological outcomes whilst catering for individual and collective squad development. Coaches adopt a non-reductionist approach that integrates both training and playing form activities within practice. The manipulation of key practice components (task constraints) are considered by coaches in aiming to achieve specific performance outcomes. Coaches intend for practice to be representative of the competition environment, enjoyable and competitive. Coaches operate within a framework provided by the soccer club. Findings provide additional detail of practice structures that contributes to our understanding of Academy coaching practice. Thus, providing a welcome addition to existing knowledge of learning environments in the development adolescent domain.

Passing patterns before and after scoring a goal within elite youth football

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Passing patterns in association football both pre- and post-goal scoring have previously been identified as potentially important variables to analyse (Ridgewell [2011] International Journal of Performance Analysis in Sport, *11,* 562-574). Thus far, research into this facet has focused primarily on elite male competition. Literature has concluded that in the 5 minutes before a goal scored, the scoring teams would increase territorial possession in the middle and attacking thirds. However, in the 5 minutes following a goal, the scoring team's territorial possession was limited predominantly to the defensive third. It was suggested that the analysed teams in these instances gave up possession to try and defend a potential counter goal from the conceding team (Ridgewell [2011]). The scope of prior research is somewhat limited, given the restricted demographic studied. Therefore, this study aimed to analyse passing patterns before and after scoring a goal within elite male youth football, while answering the following question; do passing patterns change before and after a goal is scored in under 18's and under 23's football? Eighty-three goals from 30 matches in the 2016-17 season were analysed. The fixtures feature teams from a category 1 English football academy, sampling both under 18's (15 matches) and under 23's (15 matches) matches. The variables this study investigated were possession, attempted passes, pass success rate and attempts. These were investigated in the 5 minutes before a goal was scored, the 5 minutes after a goal was scored and the average per 5 minutes for the half in which the goal was scored in. Across the different variables and conditions, the under 18's data was very similar. However, in the under 23's, the scoring teams significantly increased overall and middle third pass success rate and overall possession in the 5 minutes before a goal was scored compared to the half average ($P < 0.05$). In the 5 minutes after a goal was scored, the conceding team increased overall and middle third passing frequency and overall possession compared to the half average ($P < 0.05$). Also, in the 5 minutes after a goal, the conceding teams increased pass success rate in their defensive third compared to the half average ($P < 0.05$). Furthermore, possession in the middle third also increased for the conceding team in the 5 minutes after a goal was scored compared to 5 minutes before a goal was scored ($P < 0.05$). In the under 23's matches, the key performance indicator in relation to successful performance would be ball retention. Further research needs to be conducted in the under 18's and below demographic.

'More than meets the (rationalistic) eye': enacting performance management practices in elite youth football academies

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This paper seeks to break new ground in the sport management literature by generating rich insights into the dynamic social worlds and practices of academy managers of professional football academies in England. To date, sport management research has largely focussed on the production of 'best practice' or guidelines and frameworks for effectively managing performance. In comparison, scant attention has been paid to the actual enactment of performance management processes from a sociological perspective. This paper aims to understand how managers enact performance management processes, what are they trying to achieve and with who, and how do they attempt to achieve desirable outcomes in their engagements and interactions with other contextual stakeholders (e.g., coaches, performance analysts, sport scientists)? In addition, this paper aims to understand what dilemmas and issues do academy managers face in this performance management aspect of their work, how do they attempt to navigate these challenges and why do they act in the ways they do?

Players' and coaches' perceptions of training load: relationship across different sports

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The concept of periodisation relates to the systematic planning of training and competition practices in order to elicit the highest possible adaptation and performance level (Bompa & Haff [2009] *Periodization: Theory and methodology of training*). If the optimal dose of training load is not received by the athlete, this may lead to overtraining (i.e. load too high) or deconditioning (i.e. load too low). Previous research has shown that there may be a mismatch of prescribed training load from coaches and the actual load experienced by athletes (Brink et al. [2014] International Journal of Sports Physiology and Performance, *9*, 497-502; Doeven et al. [2017] International Journal of Sports Physiology and Performance, *12*, 1151-1156). Despite this research, the comparison of load perceptions across different sports are not well understood. The aims of the present study were to examine the relationship between coaches and athlete's perceptions of training load across multiple sports. Twenty eight athletes and three coaches from university teams (badminton, rugby and tennis) were monitored over a 4 week period. Coaches filled in the session rating of intended exertion (RIE) on a 20-point Borg scale, (Borg [1982] Psychophysical bases of perceived exertion. Medicine and Science in Sports and Exercise, *14*, 377-381.). prior to each training session. After each training, players evaluated their own training by a session rating of perceived exertion (RPE) together with training duration in minutes (training load). Average RPE and training load prescribed by coaches were 14.8 ± 1.9 AU and 1494 ± 205 AU, respectively. Average RPE and training load scored by the athletes were 13.9 ± 2.1 AU and 1404 ± 222 AU, respectively. There was no difference observed between coaches and athlete's ratings of RPE and training load across all three sports ($P > 0.05$). These data demonstrate that athletes perceived sessions with the same difficulty as their coach. By ensuring consistency between coaches and athletes perceptions of training load, this will allow for the optimal training dose and response to be undertaken on a consistent basis.

Relationship between starting status variance and seasonal-long accumulative physical load data derived from global positioning systems in professional soccer

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Soccer is an intermittent activity, consisting of bouts of high-intensity and low-intensity activity (Varley & Aughey, [2013]. International Journal of Sports Medicine, 34, 34-39). Total distance throughout match-play typically equates to 10 – 14 km (Iaia, Rampinini and Bangsbo, [2009]. International Journal of Sports Physiology and Performance, *4*, 291-306), however recent communication suggests that greater levels of physical fitness are required to meet the high metabolic loads of soccer (Gaudino, Iaia, Alberti, Strudwick, Atkinson & Gregson, [2013]. International Journal of Sports Medicine, *34*, 963-968), as high-intensity distance and sprint distance account for 20 – 25% and 7 – 8% of overall total distance covered over the duration of a game (Di Mascio & Bradley, [2011]. British Journal of Sports Medicine, *15*, 13). With the exception of Anderson et al. ([2016]. International Journal of Sports Physiology and Performance, *11*, 1038-1046) whom produced data signifying high starting status percentage correlated to higher seasonal-long physical loads in players, limited research has investigated the physical load throughout training and match-play of an entire soccer season. Moreover, the majority of current research represents soccer teams from the English Premier League, and lack physical load variables (e.g., high-intensity distance and high accelerations) which have been shown to be lower in comparison to the English Football League (EFL) Championship (Bradley et al., [2013]. Human Movement Science, *32*, 808-821). Considering these findings, the purpose of this study was to investigate the relationship between the starting status of EFL Championship players and seasonal-long physical load data accumulated during training and match-play. GPS derived physical load data of 25 outfield professional English Football League Championship players (age, 24.92 ± 3.99 years; stature, 183.98 ± 6.78 cm; body mass, 80.04 ± 6.58 kg) were monitored using STATSports and TRACAB throughout the 2016/17 season recording all match and training sessions. Congruent with previous research, it was hypothesised that players with a lower starting status would have significantly lower high-intensity distances and sprint distances in line with the findings of Anderson et al. (2016). Analysis of the data could potentially allow for the implementation of training protocols to avoid high physical load differences within the first team squad and maintain overall squad fitness despite variances in starting status.

An investigation into the player load imposed on netball players during competition

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Played in four 15-minute quarters, netball is a non-contact, high intensity sport that places many demands on the body different to that of other sports (Wood [2013]. Journal of Australia Strength and Conditioning, *21,* 24-28). Little empirical evidence has investigated the physical demands of the sport therefore the demands of competitive netball remains poorly understood. It is unclear if laboratory physiological monitoring tests on which physical conditioning training activities are based accurately reflect match-play demands (Chandler [2014]. The Journal of Strength and Conditioning Research, *28,* 2732-2737). This lack of knowledge is problematic for generating sport-specific conditioning programmes. This study aimed to investigate the physical demands of competitive netball match play. Eight healthy, female, well-trained university netball players, currently playing in the First Team, participated in the study (age, 21.3 ± 2.3 years; body mass, 62.4 ± 3.2 kg; stature, 169.6 ± 6.6 cm). Data, by positional play, was collected across 3 competitive matches and mean values established for HR (Polar RS800CX HR monitor, Kempele, Finland) and player load (PL). Catapult Minimax S4 microsensor technology was used to capture data at 100 Hz in three planes (forward, side and vertical). Player load was calculated using manufacturer-specific algorithms and expressed in arbitrary units per minute (au/min^{-1}). Player position influenced player load. Centre (2.78±0.16; 2.81 ± 0.08 au/min^{-1}), Goal Attack (2.39 ± 0.16; 2.63 ± 0.07 au/min^{-1}) and Goal Defence (2.05 ± 0.33; 2.45 ± 0.54 au/min^{-1}) exhibited higher PL per minute in both the forward and sideways planes. Centre (4.76 ± 0.28 au/min^{-1}) and Goal Defence (4.07 ± 0.33 au/min^{-1}) also showed a higher PL than other positions in the vertical plane. The Goal Keeper position was shown to have the lowest player load demand in the vertical plane (3.38 ± 0.20 au/min^{-1}). All positions showed a decline in PL as the quarters progressed. Differences in player load between positions did not meet statistical significance (P>0.05). Heart rate data showed Centre (185 ± 1 bpm) and Goal Attack (179 ± 10 bpm) to produce the highest average heart rates over the course of the 3 matches. Results showed that the positions of Centre, Goal Attack and Goal Defence had higher physiological demands than other positions, however further research is needed on a wider scope to enhance the understanding of coaches and players around the specific player demands of each position to prescribe and optimise individualised approaches to training.

Performance profiling of elite youth football players: the effects of age on performance

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Previous research in academy-level football has shown a bias is often found towards individuals born early in the selection year, known as the 'relative age effect' (RAE) (Musch & Grondin, [2001] Developmental Review, *21*,147-167). Although adolescents experience the same steps in the process of growth and development, rate of maturation can be independent from chronological age. Anecdotally, the physical style of football in Scotland appears to have previously led scouts to sometimes mistake physical prowess on the field for talent. This can result in potentially more technically adapt players being released or ignored from academy systems due to their lack of physical stature. The study sought to investigate the RAE had on performance test scores within each chronological age group, along with the effects of maturation. The data aimed to test whether relative age effects are necessarily part of elite team sports alongside providing the club with an appropriate strategy for predicting physical performance. Ninety-three male elite youth players (13±1.9 years, 158.1±15.7 cm, 48.7±15.1 kg) spanning six squads, (U11 [n=19], U12 [n=12], U13 [n=17], U14 [n=14], U15 [n=15] and U17 [n=16]) were recruited. Physiological performance was assessed via a battery of tests consisting of countermovement jumps (CMJ)), 10m and 20m test, 505 test, and Yo-Yo IR1. Within each age category, participants were grouped based on their quartiles of birth (Q1 Jan-Mar, Q2 Apr-Jun, Q3 Jul-Sept Q4 Oct-Nov). Maturity status (years to peak height velocity [PHV]) was assessed via anthropometrics. Ethical approval was granted by the University of Glasgow ethics committee. Significant differences between chronological age groups for all measured testing variables (P<0.01) were observed. Players born in the Q1 within each squad did not appear to differ compared to those relatively younger due to low quartile sample size. Significant difference was witnessed between pre, circa and post groups (P<0.01). Circa-PHV and post-PHV groups produced significantly better results compared to pre-PHV. Furthermore, significant differences were found between circa-PHV and post-PHV groups across 10m, 20m and Yo-Yo IR1 (P<0.05), however no significant differences in 505 (P=0.13) and CMJ (P=0.26). Although a RAE was noted, the results suggested this had little influence on test scores performance. Findings also suggest more mature players outperform their less mature counterparts across all tests. Players should be compared based on their maturational age rather than their chronological or relative ages to remove any bias in physical stature. Recommended further research should look to confirm these findings to allow academies a greater understanding into the potential effects that relative age and maturation.

The role of critical velocity and the finite energy store component (W') on pacing within half marathon running

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Pacing is a vital necessity for endurance performance that has been broadly recognised in several athletic disciplines. The underlying concept to pacing is the conservation of aerobic and anaerobic metabolism. Critical velocity (CV) is a theoretical concept that presumes there is a certain exercise intensity, which may be upheld without exhaustion (Kolbe et al., [1995]. Journal of Clinics, *66*, 265-269). Above the CV, exercise may continue until the work equivalent to the magnitude of the anaerobic work capacity (W') has been depleted, at which maximal values (VO_{2max}) will occur. Previous research regarding optimal pacing and critical velocity have focused on events of a shorter duration than the half marathon. Therefore, the aim of this study is to assess the underlying role of the finite energy store component (W′), critical velocity and its contribution to pacing within half marathon running. Following institutional ethical approval, five active participants (age: 31.4 ± 8.6 yrs; mean mass: 66.1 ± 7.1 kg; stature: 168.6 ± 9.1 cm) were tested for critical velocity and completed the 2017 Cambridge Half Marathon. The CV was determined from times to exhaustion at four treadmill-running velocities between 95% to 110% VO_{2max} (46.0 ± 7.4 $ml \cdot kg^{-1} \cdot min^{-1}$). GPS (10 Hz) monitors (Catabolt, UK) were used during the half marathon to track race speed every 5 km. Separate linear regression analyses revealed that half marathon race speed (HRMS; mean ± SD = 11.85 ± 1.97 $km \cdot h^{-1}$) correlated more highly with W' (W′: 354.60 ± 90.27 J; r = 0.73; r^2 = 0.53), in comparison to CV (r = 0.64; r^2 = 0.41). A difference was observed between 5 km and 10 km split speed (P = 0.029). Small to moderate effect sizes were observed between CV and each 5 km split speed: 5 km (effect size (ES) = 0.27), 10 km (ES = 0.12), 15 km (ES = 0.37), 20 km (ES = 0.46) and 21 km (ES = 0.41). No differences were observed between actual race speed and even paced split (average speed for each 5 km divided by 21.1 km) (P > 0.05; ES = 0.01). Participants showed a positive pacing strategy during the half marathon. The findings showed a positive correlation between critical velocity and W' with the running speed during the half marathon race. The data suggests a potential link between W' and half marathon performance. Future studies should now focus on the distribution of W' above critical velocity during endurance performance.

The effects of inspiratory muscle training on cycling time trial performance

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Fatigue of the diaphragm and external intercostals can impede short-duration, high-intensity exercise performance, like that during rowing, whereby inspiratory muscle fatigue (IMF) may bring dyspnoea and thus a limitation to performance. The ergogenic effect of inspiratory muscle training (IMT) has been established to increase inspiratory muscle strength and delay metabolite induced IMF (Romer, McConnell, and Jones, 2002, Medicine and Science in Sports and Exercise*, 20*, 547-562). IMT is speculated to attenuate the metaboreflex, consequently reducing locomotor muscle vasoconstriction to offset fatigue and increase mean power during cycling time trial (TT) performance. Hence, the aims of the current study were; 1) to assess the impact of IMT on cycling TT performance, and 2) to examine the impact of IMT on selected physiological responses and occurrence of IMF during a 20 km cycling TT. Following ethical approval, five trained individuals (age 21 ± 1 years, mass 73.3 ± 3.4 kg, statue 1.79 ± 0.05 m) completed 4-weeks of IMT (30 breaths twice daily at ~50% maximal inspiratory mouth pressure [PI_{max}], POWERbreathe, UK). Participants competed a 20 km TT on a cycle ergometer pre and post IMT. Maximum inspiratory and expiratory mouth pressures were recorded before and after the TT, and physiological (Rf, V_T, V_E, $\dot{V}O_2$, $\dot{V}CO_2$, RQ, $\dot{V}O_2$/HR, HR, $\dot{V}O_2$/kg) and perceptual responses (RPE) were measured at distances; 0 km, 5 km, 10 km, 15 km and 20 km. Difference (Δ) is presented mean ± standard deviation (SD). A two-way repeated measures ANOVA displayed no significant differences in all physiological and perceptual response measures following IMT ($P > 0.05$). There was no significant difference in PI_{max} (Δ−1.4 ± 24.1 cmH_2O, $P = 0.903$), or IMF (Δ18.00 ± 30.96 cmH_2O, $P = 0.263$), following IMT. Large SD in both parameters reflect how a small sample size may have caused a type II error. These measurements are also sensitive to a practice effect; therefore, lack of finding may be resultant of inadequate familiarisation. Finally, there was no significant difference in TT time post IMT (Δ−44.6 ± 57.58 s, $P = 0.158$). This was attributed to the nature of the intervention period (festive break) for 4 out of the 5 participants, where training is typically reduced. Consequently, post intervention TT performance may have declined. In conclusion, IMT provided no improvements to TT performance or PImax. Future studies should ensure an adequate sample size, thorough familiarisation, and an optimal intervention period.

The effect of inspiratory muscle training on 20 km time trial performance in trained cyclists

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The potential ergogenic effects of inspiratory muscle training (IMT) can provide competitive advantages by increasing maximal inspiratory mouth pressure (PImax) and lessening the effects of inspiratory muscle fatigue (Romer, McConnell & Jones, [2002] Journal of Physiology, *20*, 547-590). This is because post IMT there may be an attenuated metaboreflex due to type IV and III afferent fibres having reduced responsiveness because of the repeated metabolite exposure during IMT. Therefore, increasing PImax via IMT can attenuate the metaboreflex resulting in an increased limb blood flow (due to reduced vasoconstriction) and thus, increased exercise performance from improved oxygen delivery. An attenuated metaboreflex may also increase the time to fatigue when exercising at the same relative submaximal workload (McConnell & Lomax, [2006] Journal of Physiology, *577*, 445-457). The purpose of this study was to investigate the effects of IMT on 20 km time-trial (TT) performance in recreationally trained cyclists. Following ethical approval, five healthy males were recruited and served as their own controls (age: 21.0 ± 1 years, mass: 73.3 ± 3.4 kg and stature: 1.79 ± 0.05 m). PImax and maximum expiratory mouth pressure (PEmax) were measured pre, and immediately post completion of a 20 km TT, before and after a 4-week IMT intervention (30 breaths twice daily at ~50% PImax; POWERbreathe, UK). In addition, pulmonary values including $\dot{V}_E$, $\dot{V}O_2$ & $\dot{V}CO_2$, peak and average power, ratings of perceived exertion (RPE 6-20) and heart rate (HR) were recorded at rest and every 5 km during the TT. The IMT protocol was not shown to significantly improve 20 km cycling ergometer performance ($P > 0.05$). Additionally, no significant differences were observed for pulmonary values, RPE or HR ($P > 0.05$). These results are in agreement with a large body of research within the scientific literature despite many recent studies observing ergogenic effects of IMT in trained cyclist. The general consensus is that studies with compromised experimental protocol fail to find statistically significant results because of the occurrence of a type II error; an inadequate IMT protocol, training effects in the placebo group or combination of these factors is believed to provide reasoning for the disparity between findings.

Elite physiological profile of an elite and amateur cyclist in a mountain time trial

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Mountain climbs are crucial in cycle races and it may be difficult to simulate the demands in laboratory conditions. We compared an elite rider with an amateur cyclist while they performed i) a maximal exercise test under laboratory conditions and ii) carried-out a field-based mountain climb. We aimed to describe the responses due to the testing situation and the standard of rider. The field test was a mountain time trial (9.2 km, mean gradient 6.7%). Respiratory responses were measured continuously and samples for blood lactate ([La-]) were taken pre-warm up, pre-exercise and, 3 and 5-min post-exercise. The maximal laboratory test was an incremental cycle-ergometer test, starting at 35 W, increments of 5 W/12 s until participants were unable to maintain 70-90 rpm. The following data were collected in the laboratory and field tests: VO_2, VCO_2, VE, RER, hearth rate (HR), cadence, speed, watts (W), and [La^-]. Body composition was assessed using a DXA. Mountain trial duration for the elite cyclist was 28:38 min, and for the amateur, 35:08 min. Peak values (VO_2, W, La- and HR) for the elite cyclist on the field test were 87.3 ml/kg/min, 416.3 W, 14.34 mmol/L and 190 bpm. The corresponding results for the amateur cyclist were 68 ml/kg/min, 388 W, 12.4 mmol/L and 197 bpm. In the laboratory test the peak results (VO_2, W, La- and HR) of the elite subject were 68.5 ml/kg/min, 455 W, 10.76 mmol/L and 188 bpm. And for the amateur 58 ml/kg/min, 395 W, 11.55 mmol/L and 199 bpm. The elite cyclist (64.4kg; 4% body fat) had a lower body fat percentage than the amateur rider (62.5 kg; 10.8% body fat). The conclusions of this research were that the elite cyclist could develop greater power, more VO_2 and higher [La^-] than the amateur, while the amateur cyclist reach a higher HR. Maximal peak results of (VO_2 and, [La^-], power) in the mountain climb were higher for both athletes compared to the laboratory test. The superior performance of the elite athlete in both tests may be partly attributed to the lower fat mass, and in a higher develop of power, more VO_2 Max and higher [La^-] on the blood samples.

Pacing strategies in 400 m freestyle swimmers with a major physical impairment

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Athletes of many middle-distance events adopt pacing strategies during competition, to enable a suitable distribution of energy and prevent the early onset of fatigue. Previous research in swimming has focussed upon able bodied individuals, with research in disabled swimmers lacking, despite recent reports of an increase in participation in disability sport. Consequently, the purpose of this thesis was to investigate the pacing strategies adopted by S6 classification (major physical impairment) 400 m freestyle swimmers at major competitions. Results were compared to able bodied swimmers. Data from 179 swim performances (able bodied n = 96, S6 n = 83) was obtained from public databases, from major competitions between 2012 and 2016. All swimmer groups adopted a reverse J-shaped pacing strategy. A one-way ANOVA reported significant differences in relative speed, between able bodied and S6 swimmers at each 50 m split ($P < 0.05$). A 3-way ANOVA reported a statistically significant three-way interaction between gender, ability and split ($P < 0.001$). Independent sample t-tests reported a significantly faster race time ($P < 0.001$) in able bodied swimmers (mean ± SD; 235.97 ± 10.05 vs. 342.4 ± 27.2 s, for able bodied and S6 swimmers, respectively), and a significantly faster reaction time ($P = 0.001$) in able bodied swimmers (0.73 ± 0.05 vs. 0.82 ± 0.20 s, for able bodied and S6 swimmers, respectively). The results showed able bodied and disabled S6 classification 400 m freestyle swimmers adopted the same pacing strategy, however, performance in able bodied swimmers was enhanced.

High-Intensity Interval Training (HIT) programs delivered by social influencers elicit similar acute physiological responses to scientifically designed HIT protocols

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High-intensity interval training (HIT) protocols based on research often rely on specialised equipment, limiting HIT's uptake by the public. Therefore, HIT protocols using simple body-weight exercises that could be performed at home without equipment have the potential to be effective at improving health and fitness. This is demonstrated by the growing popularity of workout videos on social media. However, many of these popular HIT (P-HIT) protocols do not apply the scientific principles of HIT, potentially reducing their effectiveness. Therefore, our aim was to investigate the physiological responses to two P-HIT programs compared to a highly controlled laboratory-based (L-HIT) and a scientifically designed home HIT (H-HIT) protocols. Twelve (6 male, 6 female) physically active participants completed a randomized crossover study, completing 4 acute HIT protocols, approved by the institution ethics committee. (1) L-HIT, 10×1 min intervals at 100% $Watt_{max}$ on a cycle ergometer, (2) H-HIT 10x1min intervals of body-weight exercises at >80% heart rate max (HR_{max}), (3) P-HIT-1, fitness blender, 20×20 s intervals of body-weight exercises, (4) P-HIT-2, Joe Wicks,15×40 s intervals of body-weight exercises. Participant's VO_2 and heart rate were recorded continuously. Participants completed the Intrinsic Motivation Inventory enjoyment (IMIE) scale following each protocol, and after all protocols were asked to rank their favorite. Differences between groups were analyzed using a one-way ANOVA. Interval peak HR was significantly lower (P=0.01) for P-HIT-1 (87% HR_{max}) compared to both L-HIT (92% HR_{max}) and H-HIT (92% HR_{max}) but not P-HIT-2 (90% HR_{max}) (P=0.28). Mean interval HR was not different between protocols (P=0.754). Interval peak VO_2 was significantly lower (P=0.004, P=<0.001) for P-HIT-2 (82% VO_{2peak}) compared to L-HIT (94% VO_{2peak}) and H-HIT (97% VO_{2peak}) respectively. Mean VO_2 was significantly higher (P=0.02) for P-HIT-1 (78% VO_{2peak}) than P-HIT-2 (66% VO_{2peak}). Energy expenditure was significantly lower (P=0.032) for P-HIT-2 (20 kJ/min) compared to P-HIT-1 (25 kJ/min) but there were no differences between the other HIT protocols. Participants ranked H-HIT their favorite (5 votes), followed by P-HIT-2 (4), L-HIT (2) and P-HIT-1 (1). However, there was no significant difference in the IMIE (P=0.105). Our multi-disciplinary approach suggested there is some slight differences in both the physiological responses and enjoyment to the HIT protocols investigated. However, the results imply each of the protocols would be effective exercise interventions, increasing the choice of HIT protocols available to the public. Future work should investigate the long-term effects, as recent work suggests that similar acute responses to HIT do not translate into long-term adaptations.

The influence of protocol design on the plateau at $\dot{V}O_{2max}$

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The primary criteria used to verify a $\dot{V}O_{2max}$ is the $\dot{V}O_2$ plateau. However, it is evident that not all participants elicit this whilst exercising to volitional exhaustion. This issue alone has received a plethora of attention from academics to try and elucidate the factor(s) behind the appearance of a plateau. The plateau is dependent upon the finite anaerobic capacity (Gordon et al. [2011]. International Journal of Sports Medicine, *32*, 1-6) and this, coupled with the datum that researchers have developed and adopted an overabundance of protocol designs poses the aim of the current study; to investigate the plateau response across different protocol designs, attempting to find an 'optimal' protocol. Following local institutional ethical approval, nine healthy males (age: 21.4 ± 1.4 years, stature: 174.0 ± 8.7 cm, mass: 75.0 ± 5.3 kg and $\dot{V}O_{2peak}$: 47.8 ± 6.2 ml·kg·min^{-1}) participated, each completing three different treadmill-based protocols twice. Protocol 1: initial stage, speed increased by 1 km·h^{-1}·3min^{-1} until lactate turn-point (LT2). Following a 7-minute rest, gradient increased by 1%·min^{-1} with speed held at that of LT2. Protocol 2: increase in gradient of 1%·min^{-1}, and protocol 3: gradient increased by 3%·3min^{-1}, all trials were to volitional exhaustion. All starting speeds were based upon heart rate data during a 5-minute warm-up. During all trials, pulmonary gas exchange ($\dot{V}O_2$, $\dot{V}CO_2$, $\dot{V}E$ and RER) was collected on a breath-by-breath basis. The last two 15-consecutive breaths were used to determine if a plateau had been attained using several plateau criteria. Findings reveal that the $\Delta\dot{V}O_2$ over the last two 15-consecutive breaths were different between protocol 1 and 2 (P = 0.038) however, wasn't between protocol 1 and 3 (P > 0.05). Despite this, a medium effect size was found between protocol 1 and 3 (d = 0.57). No differences were observed for $\dot{V}O_{2max}$, RER_{max} and HR_{max} across all protocols/conditions. The plateau attainment using an individually calculated criteria, was 93%, 64% and 82% for protocols 1, 2 and 3, respectively. These data demonstrate that protocol design and plateau criteria influence the plateau at $\dot{V}O_{2max}$. Potential reasons in protocol 1 appeared superior with regards to eliciting a higher frequency of plateaus likely attributes itself to the sparring of the finite anaerobic capacity. The exact mechanism(s) and their contributions towards this is unclear however, it is likely that the $\dot{V}O_2$ kinetics increased, subsequently reducing the O_2 deficit which reduced the utilization of anaerobic substrates at the onset or exercise, sparing the anaerobic capacity for the latter stages of the test.

Is the stroke volume response to incremental exercise a function of the protocol design?

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Stroke Volume (SV) responses to exercise are highly varied in the literature, with the four main reported responses being: 1. plateau; 2. plateau with a drop; 3. plateau with a secondary increase; and 4. Progressive increase up to maximal oxygen uptake (VO_{2max}). The variance in the reported findings in research have been shown to be a function of training status in participant groups, as well as age, sex and exercise modality. However, little is understood regarding the influence of the protocol design on the SV response, despite a plethora of work eluding to the impact on such variables as maximal heart rate, minute ventilation and VO_{2max}. Therefore, the aim of the current study was to investigate the effect of protocol design on SV response. Nine healthy males participated in the current study, after providing informed consent and local institutional ethical approval, each completing three different protocol designs twice (protocol 1: Initial lactate threshold test with 3 minutes running at 1% gradient, and increasing speed of 1km·hr^{-1} per stage until lactate turnpoint (LT2) was reached, followed by a VO_{2max} trial with a set speed and increasing gradient of 1%·min^{-1}. Protocol 2: Set speed with increasing gradient of 1%·min^{-1}. Protocol 3: Set speed with increasing gradient of 3%·3min^{-1}). Pulmonary gas exchange data was collected through use of a pre-calibrated (in accordance to factory guidelines) metabolic cart (Metalyzer 3B-R2, Cortex Ltd, Leipzig, Germany) on a breathe-by-breathe basis, and cardiovascular data was collected continuously throughout the test and beat-by-beat basis using physioflow (PF05 Lab1, PhysioFlow, France). This study indicated that performing incremental exercise tests to exhaustion after a lactate threshold test significantly increases SV in the earlier stages of exercise (50%, 60% and 70% VO_{2max}).This is illustrated by a large effect size between protocol 1 and 2 (d=1.0 at 50%, d=0.9 at 60%, d=1.0 at 70%, d=0.8 at 80% and d=1.0 at 90% VO_{2max}), large effect size between protocol 3 and 1 (d=0.9 at 40% VO_{2max}) and a large effect size between protocol 3 and 2 (d=1.0 at 40%, d=0.8 at 50%, and d=0.8 at 90% VO_{2max}). This suggests that whereas there was little effect throughout most stages of the different protocols, there is still large effect sizes to support the claim that protocol design has an effect on SV response, but the participant size was not great enough to produce statistical power. The results from the current study lend insight into how protocol design effects the response of SV during exercise.

The reliability of muscle size measurements using Magnetic Resonance Imaging (MRI)

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Muscle size is a key differentiator between healthy and clinical populations, and indeed, between trained and untrained populations. Reliably establishing baseline muscle size and monitoring changes is critical in training, rehabilitation, and injury prevention programme design. Muscle size is commonly represented using muscle volume (MV) but research investigating whole lower limb MV and MV asymmetry is limited. The aim of this study was to evaluate the reliability of Magnetic Resonance Imaging (MRI) measurements of lower limb muscle size, and establish typical lower limb MV and asymmetry in healthy, adult males. Following University ethical approval, bilateral axial spin-echo T1-weighted 3-T MRI images were acquired from the iliac crest to the base of the foot in fifteen healthy, recreationally active males (age: 26.5 ±4.6 years, height: 1.81 ±0.09 m, body mass: 80.4 ±12.4 kg). Slice thickness (5 mm) and inter-slice spacing (0 mm) remained constant across individuals. Cross-sectional areas (CSA) of 36 muscles per limb were manually digitised every 15 mm from origin to insertion. Within- and between-session (12 hours) reliability of CSA measurements was established by re-digitising slices at 25% and 75% of thigh and shank length, for fifteen participants. A complete re-digitisation of one participant was conducted to establish MV reliability. MV was estimated using the summed volume of adjacent 15 mm blocks, calculated as truncated cones. Reliability was evaluated using percentage differences and intra-class correlation coefficients (*ICC*). Directional asymmetry was calculated for each muscle as preferred minus non-preferred limb MV, expressed as a percentage of the mean volume of the two (Symmetry Index; SI). Absolute asymmetry was calculated using the absolute difference between legs (Absolute Symmetry Index; ASI). Asymmetry was evaluated statistically using Cohen's d_z effect sizes and paired samples t-tests (significant when $p < 0.05$). CSA reliability was acceptably high with small percentage differences and high ICC found within- and between-sessions (mean *ICC*: 0.97 and 0.96, respectively). MV reliability was good (*ICC* > 0.9) although large percentage differences between-sessions were found for the small hip external rotators, popliteus and psoas. SI was low (mean: 0.6 ± 4%), with higher ASI (mean: 12.8 ± 2.4%) observed, likely due to positive and negative SI cancelling each other out in the group mean. Only popliteus showed statistically significant asymmetry (*ES*: 0.93, *P* = 0.047). This study suggests good reliability in manual digitisation of MRI images. Typical MV and MV asymmetry has been established in recreationally active adult males.

Comparison of central nervous system function during an isometric squat and isometric knee extension

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Many investigations have employed transcranial magnetic stimulation (TMS) to assess neuromuscular responses after whole-body exercise, but the assessment is usually performed in a single-limb, isometric model. It has been suggested that when assessing neuroplasticity following different types of intervention, the motor task for testing should replicate the motor task performed during intervention as responses may be task specific. The squat is commonly prescribed exercise in resistance training interventions, but previous studies have mainly assessed squat-induced neuroplasticity during isometric knee extension. However, before assessing the testing specificity following an intervention, it is first important to elucidate whether there are differences in intracortical and corticospinal function between isometric knee extension and a modality that closely replicates the characteristics of the squat. Accordingly, the aim of this study was to compare short-interval intracortical inhibition (SICI) and corticospinal excitability (amplitude of motor evoked potential; MEP) in the *vastus lateralis* during isometric knee extension (KE) and a joint angle-matched isometric squat (IS). Eleven young male adults who reportedly squatted at least once a week, completed the study (age: 27 ± 4 years; stature: 181 ± 7 cm; mass: 87 ± 16 kg). In both KE and IS, single and paired-pulse TMS was delivered during a 10% maximal voluntary contraction (MVC) to assess SICI, and single-pulse TMS was delivered at 25, 50, 75 and 100% MVC to assess MEP normalised to the maximal muscle response obtained during the same contraction strength (MEP/M_{max}). SICI was similar in the IS and KE (0.70 ± 0.14 vs. 0.63 ± 0.12%; $t_9 = 1.330$, $P = 0.216$), but the agreement between modalities was poor ($ICC_{3,1} = 0.15$ [0.00-0.67]). On average, MEP/M_{max} was similar between IS and KE (0.43 ± 0.21 vs. 0.39 ± 0.17%; $F_{1,10} = 1.06$, $P = 0.327$, $\eta_p^2 = 0.096$), but the agreement was poor ($ICC_{3,1} = 0.15$ [0.00-0.68], 0.59 [0.00-0.87], 0.63 [0.08-0.88], 0.41 [0.00-0.79] at 25, 50, 75 and 100% MVC, respectively). These data demonstrate the lack of agreement in central nervous system function between isometric knee extension and during a isometric squat. The observed differences may have been due to dissimilarities in characteristics of the tasks (e.g. bilateral vs. unilateral, single vs. multi-joint, posture). These findings may have implications for selecting the testing task following resistance training interventions using the squat exercise.

The effect of neuromuscular fatigue on the vestibular control of balance

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The vestibular system is a key sensory input for the control of human balance. In sport and exercise, balance is essential as it improves posture and coordination, which in turn, reduces the risk of injury. Numerous studies have found poor balance ability to be significantly related to an increased risk of ankle injuries. Neuromuscular fatigue - defined as "an exercise-induced reduction in maximal voluntary force" (Gandevia [2001]. Physiological Reviews, *81*, 1725-1789) - has been shown to increase postural sway. However, at present there is no known research into if, and how, the *vestibular* control of balance is affected by fatigue. Stochastic vestibular stimulation (SVS) is a technique that can be used to investigate the vestibular control of balance by applying an electrical current over the mastoid processes. The current creates a sensation of rotation consistent with activation of semi-circular canal afferents which, in standing individuals, brings about a whole-body balance response. Accordingly, the aim of the study was to determine the effect of neuromuscular fatigue on the SVS response. Ethical approval was granted by the Human Sciences Research Ethics Committee at the University of Derby. Ten participants (age: 22 ± 3 years; stature: 1.71 ± 0.06 m; body mass: 66 ± 13 kg) provided written consent to participate in the study. Each participant had no known neurological disorder and no lower leg surgery/injuries in the last year. The participants were instructed to stand on a force plate with the eyes closed, the head turned 90° to the right and arms relaxed by the sides. Postural sway was recorded for the duration of two 65 s trials (5 s without the application of SVS and 60 s with SVS). A time-domain measure of correlation was used to assess the peak magnitude and latency of the SVS response. This was completed at baseline (pre) and after 10 minutes of seated rest (post-rest). The same measurements were taken again following completion of the yo-yo intermittent recovery test, level 1, to volitional exhaustion, which acted as the fatigue protocol (post-exercise). The results demonstrated a significant increase in sway from post-rest to post-exercise ($P = 0.042$). However, the response to SVS was not significantly different between the time points in terms of peak magnitude (0.17 ± 0.06) or latency (313 ± 49 ms). To conclude, fatigue impairs balance, but the current results suggest that this impairment is not due to a change in vestibular control.

Patterns and predictors of self-reported sedentary behaviour in people with inflammatory bowel disease

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In recent years, attention has been drawn to the health implications of time spent engaging in sedentary behaviours (prolonged sitting/ lying characterised by low energy expenditure, ≤1.5 metabolic equivalents). Compromised quality of life and body composition, muscle degeneration, osteoporosis and cardiometabolic outcomes have all been associated with this lifestyle. This may pose as a potential problem for patients with inflammatory bowel disease (IBD) who are already at an increased risk of developing these adverse health outcomes (Levine and Burakoff [2011]. Gastroenterology and Hepatology, *7*, 235-241). Although reduction of sedentary behaviour has been suggested to improve these risk factors, limited data have explored the influence of psychological and physiological variables on sedentary behaviour. Therefore, this study aimed to investigate patterns and predictors of self-reported sedentary behaviour in people with IBD. Following intuitional ethics approval, cross-sectional data were gathered on 859 adult participants with IBD (75% female, 52% Crohn's disease, 37.3 ± 11.6 years of age [mean ± SD]) through an online survey conducted between May and June 2016. Sedentary behaviour was assessed using the single-item 'sitting' question from the short-form International Physical Activity Questionnaire. Candidate predictors were disease severity, time since diagnosis, depression, anxiety, fatigue, and perceived benefits and barriers of exercise. Mean sitting time was 428.6 min/day and excessive sitting time (defined as ≥9 hours/day) was apparent in 26% of respondents. Sitting time did not differ markedly between IBD subtypes (P = 0.963), however, it was significantly higher in people with active disease (Δ = 52.5 min/day, 95% CI, 19.9 to 85.1; P = 0.002), higher levels of depression (Δ = 48.9 min/day, 95% CI, 14.6 to 83.2; P = 0.005) and higher levels of waking time felt fatigued (Δ = 47.1 min/day, 95% CI, 13.0 to 81.3; P = 0.007). In multivariable analyses adjusting for moderate-to-vigorous physical activity, significant predictors of sitting time were disease activity, gender, perceived exercise benefits, and perceived exercise barriers (R^2=0.329, P < 0.001). Comparison with Health Survey for England data (adults aged 16-44 years; Scholes et al [2016] PLoS ONE, *11*, e0151647) suggests a higher prevalence of excessive sitting in people IBD than in the general population (26.0% versus 18.5%). Future research is needed to determine the feasibility and effects of different approaches to reducing sedentary behaviour in people with IBD.

The effect of the active 10 application on exercise participation of GP referral clients

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Current guidelines suggest an accumulation of 150 minutes of moderate or 75 minutes of vigorous exercise weekly (NHS choices [2015] Physical activity guidelines for adults). However, 6.3 million 40-60 year olds fail to achieve 10 minutes of brisk walking monthly, which may reduce risk of death by 15% and provide an economic saving of £310 million per year (Public Health England, [2017]), with 1 in 2 60-65 year olds currently suffering from a health condition (Roberts, Townsend & Foster [2016]. Preventative Medicine Reports, *4*, 50-60). Alternative methods such as high intensity interval training have been proposed, however, lack of compliance has been adopted through perceptions of the activity being too hard (Biddle & Batterham [2015]. Journal of Behavioral Nutrition and Physical Activity, *12*, 95). This highlights a current failure to promote regular physical activity effectively amongst the population. The Active 10 mobile application (app), developed by Public Health England, aims to prompt and encourage at least 10 minutes of moderate intensity per day via an autonomous tracking system. However, as a relatively new app, research exploring the effectiveness and feasibility at increasing physical activity is scarce. Therefore, the primary aim of this study is to explore the effectiveness and feasibility of the Active 10 app on walking duration (min) and intensity (low/moderate) when compared with a non-prompting fitness tracker (Pacer). With ethical approval, granted by the Sheffield Hallam Ethics Committee, twenty participants currently referred on to an exercise programme will be randomly allocated into two groups (Intervention; Active 10 or Control; Pacer app). Participants will report weekly walking duration using their allocated app over a 4-week period. Additionally, both groups will complete an app feasibility questionnaire upon cessation of the intervention with the main focus on the app's ability to motivate participants to promote and sustain a moderate intensity (adopted from Kristjansdottir et al. [2011]. BMC Musculoskeletal Disorders, *12*, 51). Data will be analysed using a repeated measures ANOVA to observe differences in walking duration and intensity. Feasibility of the app will be presented via a percentage of participants in agreement to support and explain any findings found. Data from this study could inform larger trials exploring the effectiveness of prompted bouts of moderate activity in increasing levels of physical activity. Furthermore, understanding key app features in effectively promoting physical activity targeting a sedentary population.

Parental views on childhood obesity and physical activity

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Childhood obesity is becoming an epidemic in the UK, in part, due to the increase in sedentary behaviour and a reduction in physical activity (PA) levels. (Farooq et al. [2017] British Journal of Sports Medicine*, in press*; Nader et al. [2008] Journal of American Medicine*, 300,* 295 - 305). Public Health England (2016) reported one quarter of 2-10 year olds and one third of 11-15 year olds are overweight or obese. The World Health Organisation (2017) recommends that children should engage in at least 60 minutes of moderate to vigorous PA every day and resistance training three times a week. It has recently been shown that only 21% of boys and 16% of girls meet the PA guidelines (Trigwell et al. [2015] BMC Public Health*, 15,* 1 - 11). Parental interventions in previous literature found parents can influence their child's view on physical activity and that parental programmes were influential (Brockman et al. [2009] BMC Public Health*,* 1 - 7; Robertson et al [2008] British Medical Journal*, 93,* 921 – 926.) Additionally, Brown et al (2016, Obesity Reviews*, 17,* 345 – 360) found that if family members aren't involved in PA there is a lower chance that long term physical activity in children will occur. Hence, the aim of this study is to explore parental perspectives on PA and its role in of childhood obesity in 7-11 year olds. The objectives were to explore parental perceptions; 1) as to whether children meet the recommended PA guidelines; 2) on the perceived barriers for children engaging in PA, and 3) on the societal structures responsible for the provision of PA. Participants (n=59; 3 males, 56 females) completed an online questionnaire which comprised 16 questions including demographic data e.g. parental income, parent and child's physical activity, and if the parents know about World Health Organisations (WHO) recommendations for physical activity. Parents were asked about barriers to physical activity and the consequences of no physical activity. As the children are siblings it is quite common that if child one does more physical activity then so will child two or vice versa. This was found to be a significant correlation between child 1 and child 2 (*rho*= .81, *P* <0.01). From the descriptive data, we found that both time and expense were major barriers to children's physical activity although parental income was not significantly correlated with child physical activity or extra-curricular activities. In conclusion, we found that although parents believed there were barriers to physical activity, 29 children were still getting the WHO's recommended daily amount of activity.

How does a physical activity intervention programme influence active participation in primary school aged children?

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Childhood obesity is a global epidemic, causing numerous health concerns, such as, cardiovascular disease, type 2 diabetes, an upsurge in hypertension and musculoskeletal discomfort (Maffeis [2001]. Journal of Hormone Research in Paediatrics, *55*, 42-45). These obesity-related diagnoses have resulted in 525,000 admissions in the National Health Service across 2015/16 (Saunders [2007]. Journal of Public Health, *8*, 354-355). Hospital admissions are due to active behaviours being displaced by more sedentary pursuits. A preventable method to tackle childhood obesity is through an active lifestyle routine, comprising of physical activity (PA) and adequate calorie control. If these attainable ways are overlooked possible risks of morbidity and mortality in children will be present. Almost all researchers agree that prevention could be the significant approach for directing the current epidemic of obesity. Thus, children should be considered the priority population for intervention schemes. This research considers a particular government intervention known as PACE (Physically Active Children Everywhere). This focuses on PA behaviour change in primary school aged children. There has been a lack of presence in literature of interpretivist views from children towards PA. In addition, minimal research has considered the effect of school-based PA interventions in primary school aged children. This emphasies the importance to find managable ways to lessen the risk of childhood persisting into adolescence and adulthood. Accordingly, the aims of the present study were: 1) To examine the effectiveness of school-based interventions for the reduction of childhood obesity. 2) To investigate perceptions, attitudes and opinions towards PA school-based interventions, through identifying positive and negative themes associated to PA and PACE. The objective of the study will determine whether PA school-based intervention can inform and alter PA perceptions, attitudes and opinions in primary school aged children. Following institutional ethical approval, semi-structured focus groups were conducted in two primary schools in Derbyshire, England. One a PACE-intervention institute, and one a non-intervention institute. The focus group consisted of 6 participants per institute, aged 5-8-year olds, who were homogeneous in knowledge of PA and nutrition. The data was analysed through a thematic analysis, which was used to identify key themes and subthemes. Predicted emergent themes to be foreseen within the study include positive and negative views in relation to childhood obesity, PACE, nutrition in an institution setting. It is also expected that the PACE-intervention institute will show a better understanding towards overall PA, due to a regular exposure of PA, and nutritional education classes.

The energy expenditure differences between unilateral transtibial and transfemoral amputees during a walking task

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The two most common types of amputees are transtibial (TT, below the knee) and transfemoral (TF, above the knee). The energy expended during walking is greater in individuals with an amputation compared to able-bodied individuals (Genin et al [2008] Journal of Applied Physiology, *103,* 655-663), with able-bodied individuals opting for a faster preferred walking speed (PWS; Wezenberg et al [2013] Archives of Physical Medicine and Rehabilitation, *94,* 1714-1720). However, there is limited research investigating the energy demands of walking in TT and TF amputees. The aim of the present study was to investigate the energy expended during walking in unilateral TT and TF amputees. Following ethical approval eight non-vascular amputees completed the study (four female, four male), four TTA and four TFA (age 35 years ± 14, stature 175.2 ± 11.2 cm, mass 75.8 ± 13.1 kg). Participants completed two visits to the laboratories, arriving in a 3-hour fasted state. Resting metabolic rate (RMR) was measured using indirect calorimetry, followed by a 20-minute submaximal walking test. During the initial visit, participants were asked to select their PWS, the submaximal tests were then completed either 12.5% faster or slower than their PWS, this was randomised throughout. Trials were interspersed by 7-days, during this time activity was monitored. There were no significant differences in participant characteristics between groups. Significant differences were found in the weight of the prosthesis (P=0.002) with above knee prosthesis weighing 40% more than below knee. PWS between groups was significantly different (P=0.027), TT amputees walked 51% faster than TF amputees. A strong, negative correlation was found between weight of the prosthesis and PWS (r = −0.636), the heavier the prosthesis the slower the PWS. No significant difference was found in energy expenditure (EE) or weekly steps between groups. Significant differences were found in total active time (P=0.047) with TT amputees spending on average 100 more active minutes per week compared to TF amputees. Distance travelled (km) was significantly different (P=0.022), TT amputees walked 62% further than TF amputees, time spent walking was also significantly different (P=0.029) TT amputees walked on average 49% longer compared to TF amputees, this could be linked to a higher PWS. In conclusion, TT amputees preferred to walk faster and were more active daily when compared to TF amputees, however this had no significant effect on EE. Further research is required in order to determine the influence of prosthetic weight on quality of life and physical activity levels in TT & TF amputees.

The effect of exercise on mood in adolescents and young adults with depression

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Depression is a globally widespread and growing issue, characterized by low mood and anhedonia (Brigitta, [2002] Dialogues in Clinical Neuroscience, *1*, 7-20). With better medical education and awareness of signs and symptoms, more people than ever, are being diagnosed (Bramesfeld, Grobe & Schwartz, [2009] Social Psychiatry and Psychiatric Epidemiology, *45*, 329-335). Exercise of various forms has been documented to improve mood and alleviate symptoms of depression (Schuch et al., [2016] Journal of Psychiatric Research, *77*, 42-51). This study aims to study the relationship between exercise and mood in depressed individuals between the ages of 13 to 24. A literature search was conducted in Pubmed, Medline, and Embase. Search terms were combined to create a comprehensive search strategy and were stratified from 1994 – current (based on the publication date of the DSM-4 classification of depression). The search returned 312 studies, of which 279 remained after de-duplication. An eligibility form was created leaving 8 studies. Generally, the eligible studies demonstrated positive effects for exercise in the short and long-term on improving mood in depressive and anxiety disorders. Two out of the nine studies (Cohen-Kahn, [1999] Dissertation Abstracts International, *55*; Lau et al., [2004] Journal of Exercise Science and Fitness, *2*, 115-120) observed no significant changes in mood with response to resistance training. Some studies demonstrated conflicting findings, for example a 2012 study by Carter et al. concluded a positive effect on depressive symptoms after 6 months and not in the short term; whereas the Beffert ([1994] Dissertation Abstracts International, *54*) concluded beneficial results after treatment and up to 8 weeks after intervention. The findings of this review highlight the beneficial effects exercise may have on improving psychological symptoms in adolescents or young adults with depression. It should direct clinicians in implementing exercise as part of its management regime.

Applied Sport Psychology: supporting athletes with disordered eating

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Under the professional practicing guidelines of the BPS, sport psychology practitioners are required to work within their boundaries of competence, particularly when it comes to clinical issues (BPS Generic Practicing Guidelines, 2008). That is, unless clinically trained, practitioners should always refer clinical issues encountered within their applied practice to a specialist with the certification and experience to deal with such issues (Gardner & Moore [2004]. The Sport Psychologist, 18, 89-109). However, athletes who are not displaying signs and symptoms sufficient to warrant a formal diagnosis may have sub-clinical levels of disorders for which they need help. Ambiguity about the 'blurred lines' between performance enhancement and counselling/clinical services can leave both practitioners and clients feeling confused about roles and expectations. Both clinical and performance enhancement components are indeed important aspects within applied practice, but arguably the emphasis depends on personal preference, training, expertise and staying within one's realm of competence. This leads to one advancement necessary for the future of Applied Sport Psychology (ASP); the issue of ethical and competent practice with athletes experiencing disordered eating. Given that nearly fifty-percent of athletes involved in sports emphasising a lean body shape and low weight have been reported to present with features of disordered eating, sport psychology practitioners are likely to consult with athletes experiencing eating issues. Accordingly, the aim of this research was to explore the experiences, reflections and challenges encountered by sport psychology practitioners regarding their role in supporting athletes with disordered eating. Participants were ten sport psychology practitioners (six male and four female) purposively selected based on their experience working within high-level sport. The following research questions were explored: (a) What are the experiences of practitioners consulting with athletes with disordered eating? (b) What ethical and professional challenges do practitioners encounter when supporting athletes with disordered eating? (c) What are the experiences and reflections of practitioners' professional education and training regarding service-delivery competence with athletes with disordered eating? Thematic analysis revealed practitioners' consulting experiences reflected three themes: holistic support, athlete-focused support, and a lack of responsibility. Practitioners faced three main ethical and professional challenges: a lack of competence, role clarity, and barriers to support and referral. Practitioners advocated additional disordered eating education and reflective accounts of applied practitioners consulting with athletes with disordered eating. This study highlights the need for additional guidance for practitioners supporting athletes with disordered eating.

The role of pre-event music and its performance effects on 200 m swim performance

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The findings of previous research have been mixed when considering the effects of pre-task music on motor tasks, although benefits are thought to accrue through a variety of different mechanisms – synchronisation, distraction or arousal (psych-up effect). Current research explores the effects of listening to music during performance, but less about before completing the task. The aim of this study was to explore if prescribed or self-selected music significantly enhanced 200m swimming time trial compared to a control condition. Prior to data collection ethical approval was provided by the University of Lincoln. Seventeen university level male (N=10) and female (N=7) swimmers (19±5 years, 161.1±24.9 cm, 66.4±14.4 kg) performed three 200m freestyle swimming time trials. A randomised counterbalanced within-subjects experimental design was utilised were participants were exposed to 5 minutes of either self-selected or motivational (pre-task music conditions) music or 5 minutes of silence (control condition) and after 30 s performed the swimming task. Self-selected music was chosen by the participants with instruction to select music that would be motivating prior to exercise. Motivational music was defined as popular chart music and using the Brunel Music Rating Inventory-2 (BMRI-2) with the four most popular songs scoring over 32 points being selected for the trial (Karageorghis et al. [2006]. Journal of Sports Sciences, *24*, 899-909). Swimming times were recorded using Two Finis 3X 300M stopwatches, accurate to 0.01s. Shapiro-Wilks test for normality was conducted and allowed us to conclude all data was normally distributed. One-way repeated measures ANOVA was used for parametric data analysis. Results indicated that 200m swimming times during the motivational music trial (mean ± SE, 162.76 ± 18.14 s), self-selected music trial (164.16 ± 19.56 s) and silence (166.10 ± 20.21 s) were not significantly different (all $P > 0.05$). Although 12 participants improved using pre-task self-selected music and 14 participants improved when using pre-task motivational music. A small effect size ($\eta^2_p = .147$) occurred, suggesting that pre-task music may elicit small but not significant improvements in performance. Music is a legal and additional aid which can be used by competitive athletes. It can be concluded music can be used in warm-up before performing maximal effort swims but, will only have a small effect on performance. It is possible that with a larger sample size differences between music conditions and control may have become significant.

The effect of martial arts training on mood state

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A substantial proportion of quantitative research has shown physical activity to have a positive influence on mood state and mental well-being. Despite this, less research has been conducted on the effect of martial arts training on mood state. Martial Arts is a broad term that branches into several disciplines (e.g. Karate, Judo, Aikido, Kung Fu and Tai Chi), originating from ancient cultures of Asia. The basic purpose of martial arts is the control of mind and body. The aims of the study were: 1) assess mood state prior to and post martial arts training; and 2) through interview analysis determine whether martial arts training is beneficial for improving mental health well-being. Ten participants (age, = 25.3 + 6.8 yrs) were recruited from a local martial arts club. The male and female participants trained in Kickboxing, Taekwondo and Budotaijutsu. The Profile of Mood States was administered fifteen minutes before training and immediately after a one-hour training session. The POMS is a psychometric test consisting of 65 adjectives which are clustered into 6 categories (tension, depression, anger, vigour, fatigue, confusion and other), describing people's feelings. To gain greater insight into participants' thoughts and feelings about their cognitive experiences a semi-structured interview guide was developed. The interviews were conducted immediately post martial arts training. Open ended questions (e.g. how would you describe your thoughts and feelings before a training session) were asked and follow up probes were used to clarify participant responses. Total mood disturbance (TMD) was calculated by adding tension + depression + anger + fatigue + confusion – vigour, giving a value between -24 and 177, with lower scores representing more stable mood profiles. Mood state was significantly lower (i.e. a more stable mood profile) post compared to pre-training *(4.40 ± 10.03 vs. M= 19.60, ± SD = 20.05; P = 0.013).* Ten face-to-face interviews were conducted and recorded. Four interviews were randomly selected to be transcribed and content analysed using thematic analysis. *Results* pending.

Dance as therapy and its' effect on the mood of university students

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Physical activity (PA) is an important mental health tool used in the treatment and prevention of physical and psychiatric diseases. It is established that regular PA is beneficial to mental health and mood (Peluso & Andrade [2005]. Clinics*, 60,* 61-70). Positive mood can increase resilience to life stressors and life satisfaction (Cohn et al. [2009]. Emotion*, 9,* 361-368). Whilst at university PA has been found to decline and students have been identified as an at risk group regarding mental health problems, notably depression (Hicdurmaz et al. [2017]. Psychological Reports*, 120,* 650-669). Research has suggested that exercise conducive to mood improvement requires predictable activities at a moderate-aerobic intensity with an absence of anticipated failure and competition (Berger & Motl [2000]. Journal of Applied Sport Psychology*, 12,* 69-92). These characteristics are applicable to recreational dance and could explain why dance-specific interventions have been found to have significant therapeutic effects (Koch et al. [2014]. The Arts in Psychotherapy*, 41,* 46-64). Mental health problems are under recognised demonstrating the need for prevention and treatment (Hicdurmaz et al. [2017]). This study aims to examine the effect of dance therapy on the mood state of university students. The Profile of Mood State (POMS; Grove & Prapavessis, [1992]. International Journal of Sport Psychology*, 23,* 93-109) was used which has a reliability co-efficient of .798. Sixty female university students were recruited. Intervention participants (*n* = 30) were from the Dance Society and following informed consent, participants completed the POMS pre-and immediately post a 45-minute dance intervention. POMS was again re-measured 48-hours post-intervention. An early evening lecture group (n = 30) was used as a sedentary control group for level of activity, and was tested in parallel. A two-way mixed ANOVA was used to determine mean mood change within and between groups. A significant group × time interaction in all mood subscales, excluding fatigue, was found post-intervention; evidencing a significant difference in mood over time between groups ($P < 0.05$). Negative mood constructs: tension, anger, depression, and confusion decreased; and positive mood constructs: vigour and esteem-related-affect increased. A limitation of previous research is that mood has only been measured immediately after activity, therefore longevity effects were tested in the current study. Insignificant interactions were found 48-hours post-intervention, yet descriptive statistics evidenced a sustained elevation in all mood subscales, excluding fatigue and vigour. Collectively, total mood disturbance, an overall measure of affect, significantly decreased post-intervention in comparison with the control group, and remained below the baseline measure 48-hours post-intervention.

The perceived effects of emotions and self-efficacy on concentration regulation during cricket batting performance

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Emotional control and self-efficacy are viewed as major predictors of cricket batting performance. High levels of regulated concentration have also been shown to positively impact upon such performance due to the constant required involvement of the batsman throughout an innings. The three variasaunbles interlink, positively correlating with each other in a wider sporting context, highlighting positive emotions and positive self-efficacy to induce a performance of high concentration (Vast, Young & Thomas [2010] Australian Psychologist, *45*, 132-140). However, no studies to date have specifically investigated these links in cricket batting performance despite the known importance of each attribute to the sport. The aim of this study was to establish if concentration levels during batting performance could be linked to certain types of pre-performance emotion and self-efficacy rating. Forty club-level cricketers, all of whom specialise as batsmen, were recruited from three cricket clubs. All participants provided informed consent and University ethical approval was granted. A quantitative approach utilised three psychometric questionnaires. The Sport Emotion Questionnaire (Jones, Lane, Bray, Uphill & Catlin [2005], Journal of Sport and Exercise Psychology, *27*, 407-431) measured the strength to which a range of emotions were experienced by participants pre-performance. Similarly, an adapted version of the Self-Efficacy for Exercise questionnaire (Bandura [2006] Self-Efficacy Beliefs of Adolescents, *5*, 307-337) provided a pre-performance measure of self-efficacy. Following a net batting training session, participants completed an adapted version of the Attentional Control Scale (Derryberry & Reed, 2002, Journal of Abnormal Psychology, *111*, 225-226). Raw data was split into 'high' and 'low' concentration groups based on mean values from the Attentional Control Scale. Independent t-tests established differences between the groups in levels of self-efficacy (P=0.006) and each of the emotion constructs; anxiety (P=0.026), dejection (P=0.016), excitement (P=0.035), anger (P=0.137) and happiness (P=0.015). Findings indicate significantly higher scores in the 'high concentration' group for each dependant variable, aside from the anger category of emotion. Further bivariate Pearson's correlation tests were performed to analyse the strength of the relationship between each group and each dependant variable. These results infer high concentration to have a weak link to high self-efficacy (r=0.140) and no link to the experience of any emotions (r<0.1). However, low concentration levels were shown to strongly correlate to low levels of self-efficacy and each of the emotion types (r>0.5). This insight is valuable to coaches and sports psychologists when implementing effective skills training programmes to improve self-efficacy and emotional control.

An analysis of task and ego orientation in modern and postmodern sports

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McEwan (2016, In T. Delaney [Ed.], *Sportsmanship: Multidisciplinary perspectives*, 269-280, Jefferson, NC: McFarland) indicated that motivation in modern and postmodern sports can differ, this could possibly align to either a task or ego orientation amongst participants. Goal orientation itself can assist in predicting why individuals are motivated towards certain types of sporting activity. Potential reasoning behind high ego scores among extreme sports participants (for example in skydiving) could be due to social gain individuals experience (Duda, [1989], Journal of Sport and Exercise Psychology, *11*, 318-335; Duda, et al. [1991], Research Quarterly for Exercise and Sport, *62*, 79-87). The different goal orientations an individual can possess can be classified as: task orientation, which demonstrates mastery of skills, or ego orientation which shows satisfaction is derived from superior ability to another individuals (Duda & Nicholls, [1992], Journal of Educational Psychology, *84*, 290). Task orientation predicts increased performance, and ego orientation predicts reduced enjoyment of sport participation (Jagacinski & Strickland, [2000], Learning and Individual Differences, *12*, 189-208). The purpose of this study was therefore to identify task/ego personality differences between participants in a range of postmodern sports. A sample of postmodern sports participants (*N=1496,* 66% male, 34% female, aged 34.4 ± 14.8 years) were recruited representing a range of sports (*k=20*). Each respondent completed the task/ego orientation questionnaire. Several groups emerged after Multi-Dimensional Scale analysis (*MDS*, Kruskal & Wish, [1978], Multidimensional scaling, *11*, 7-28, USA: SAGE) following further testing the groups were found to have similarities. After regrouping, five groups appeared to emerge. A dichotomous relationship appeared within ego orientation, in that it is either high or low. More subtly for task orientation there appears to be four distinct categories, low, moderate-low, moderate-high and high. This created eight possible outcomes based on the task and ego groups. However, results showed that sports sampled only appeared in five of these analysed. This is the first research to explore task/ego orientation with modern and postmodern sport using multiple groups and will add to a bank of literature on goal orientation. It will also provide a critical insight into the traits of modern and postmodern sports participants. Such information will be useful for marketing products and services to sports consumers as well as those who use such activities within the 'sport for development' sector.

An analysis of the Thrill and Adventure Seeking traits amongst 'modern' sports participants

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An individual's chosen sport can be beneficial in understanding their willingness to take risks, through the use of Zuckerman's sensation seeking scale Form V. It contains four subscales, however, it is Thrill and Adventure Seeking (*TAS*) that is synonymous with moderate and high-risk sports. The *TAS* sub-scale is useful within this study as it assesses an individual's desire to engage in sports or other physically risky activities, which provide unusual sensations of speed or the defiance of gravity Modern sports tend to represent either a moderate risk (rugby, football & hockey) or low risk (tennis, golf & bowls) of injury. However, combat sports for example, present a high risk to participants. The level of risk a sport poses to the individual has been related to *TAS* levels, therefore insinuating a psychological draw to such activities. This study focuses on comparing multiple modern sports (*k=11*) along with a control group of university sports students with the aim of evaluating the *TAS* differences between the sample groups. The sample consisted of 770 respondents (*k=11*, *n=70*) plus a control group (*n=70*, therefore *N=840*, with a predicted split of *~70% male and ~30% female*). Respondents completed an online questionnaire containing the *TAS* subscale of the *SSS-V* questionnaire, which was posted on social media and online forums. Firstly, a Multidimensional Scale Analysis will be used to group and categorise the respondent groups. Due to the ordinality of the data this will include the use of median, upper and lower ranges within the data sets. Following this, non-parametric tests of difference will be conducted on the categorised groups using an appropriate Bonferroni correction. As the data has not been fully analysed it cannot be definitively stated what results will occur. The expectation is the high and low risk sports will have significantly different scores to that of the control, whilst moderate risk sports will not show significant differences.

An analysis of thrill and adventure seeking amongst post-modern sport participants

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The Thrill and Adventure Seeking (TAS) subscale within the Sensation Seeking Scale (Zuckerman, [1971], Journal of Consulting and Clinical Psychology, *36*, 45-52) has become synonymous with high risk sport participants (Barlow, Woodman. & Hardy. [2013], Journal of Personality and Social Psychology, *105*, 458-475). Contemporary literature around sensation seeking (SS) and TAS suggests all extreme sports are high in risk and related to high TAS scores (Freixanet, Martha. & Muro. [2012]. Annals of Psychology, 28, 223-232). However, this may not be an accurate representation. For example, McEwan ([2016], in Delaney (Ed.), Sportsmanship: Multidisciplinary perspectives, 269-280, Jefferson, NC: McFarland) found that mountain biking can be categorised into sub-formats and that participants presented either high or moderate TAS scores based on respective sub-formats. Therefore, this study looked to sample participants in a range of extreme sports to retest the assertions made in previous research. Participants (N = 1071, 66.9% male, 33.1% female, aged 37.7 ± 14.9 years, currently) were drawn from a range of post-modern sports (k = 13). Respondents were recruited through social media to complete a questionnaire containing the TAS subscale of the Sensation Seeking Form-V (SSS-V, Zuckerman, Eysenck & Eysenck [1978], Journal of Consulting and Clinical Psychology, 46, 139-149). To analyse the data, a Multi-Dimensional Scale analysis (MDS, Kruskal & Wish, [1978], Multidimensional Scaling, *11*, 7-28, USA: SAGE) was employed to reduce the data. Emerging groups were statistically analysed to establish variance using non-parametric statistics, due to the ordinal nature of the data. Three clear groups emerged from the data with high, moderate or low TAS traits aligning with previous research. However, two intermediate groups also emerged, which were classified as moderate-high and moderate-low TAS. This challenges the underlying concept laid out previously that suggests that sports fall into high, moderate or low TAS groups. The sports in the higher TAS groups appear to be more inherently risky, corresponding with the work of McEwan ([2016], 'an analysis of pluralised markets, identities and participant trait characteristics in mountain biking', unpublished thesis, University of Portsmouth). This study is of use to marketers using postmodern sport in advertisement to the personality traits of individuals who are most likely to enjoy participating in risky activities. Individuals who are high sensation-seekers are also more likely to be at risk of substance abuse (Munsey, [2006], Monitor on Psychology, *37*, 40) and therefore this work can assist those working with drug rehabilitation patients.

Assessing the aspirations and motives of athletes participating in Special Olympics through a qualitative design

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Many individuals with intellectual disabilities (ID) feel isolated, rejected and marginalised from physical activities. The Special Olympics (SO) is an organisation that provides them with an opportunity to participate in sport and exercise in an environment free from negative judgement. Research has focused on the parents' views. What has not been explored in great detail are the athlete's perspectives regarding their experience and motives for taking part in SO and how much responsibility and choice they are given during training and competition. A holistic view of the athletes' experience is needed. Five athletes from a local SO athletics club agreed to take part in focus-group interviews, which were recorded and transcribed. Thematic analysis was used to identify any emerging themes and patterns of interest between participant responses. Thematic analysis identified the following themes; 1) responsibility, how much responsibility the athletes are given during training and competition; 2) choice, how much choice they are allowed to make and how much they would like to make; 3) meaning, what training and competing in the SO means to them and if there is anything they would change. In relation to previous published research there was a better understanding of the SO athletes' needs. Athletes appeared to request more responsibility during training (i.e. having the opportunity to coach other athletes) and more choice on training session content, preferring a variety of track and field events and less running events. They expressed an increased motivation to improve through hard work and felt training is a good place to meet new people and to participate in sport. Success allows them to feel happy, pleased and impressive but failures cause them to feel angry, disappointed and frustrated. They stated that life without sport would be worse as they feel they'd become sedentary and have decreased energy levels. Results are discussed in terms of the support of choice and responsibility in training and competition. Additional opportunities to participate in sporting related activities could create a better environment for the examined athletes as participation in SO provides a highly valued endeavour. Further research is needed focusing on other SO sports in an effort to enhance participation rates for other SO clubs/groups.

The psychological impact of anterior cruciate ligament injury and return to competitive sport

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Anterior Cruciate Ligament (ACL) injuries are very common in sports. Commonly this type of injury requires a surgical intervention to reconstruct the damaged knee joint's ligament, often resulting in lengthy periods of physical rehabilitation. Previous research suggests that the psychological impact of the injury may delay or prevent successful return to competitive sport. However, emerging evidence suggests a combination of physical and mental therapy enhances the chance for successful return to pre-injury physical activity level or a return to recreational sport. The aim of the review was to identify the psychological factors that are predictive of clinically relevant ACL reconstruction outcomes for successful return to sports. A systematic search was performed in Discover, Pubmed, Google Scholar and Science Direct that recognised 123 possible research articles for potential inclusion. The inclusion criteria included: ACL injury, psychological/physiological affect prior- and post-ACLR, athletic performance, and return to competitive sport. Eight studies were included in the final review. The mean sample size per study included in the review was 89 patients. The post-surgical follow-up time-period ranged between 7 days and 25 months. Psychological measures, such as kinesiophobia, pain catastrophizing and reduced self-efficacy were predictive factors, reducing the chance for a patients' successful return to sports. Mental training included techniques like imagery, positive self-talk, meditation and social support that were key aspects within physical rehabilitation. Psychological factors are prognostic of ACL reconstruction outcomes that determine a possible chance of successful return to previous physical activity level. Physical measures like knee pain, swelling, range of motion, muscle weakness and instability caused a psychological barrier - kinesiophobia. According to the review, the kinesiophobia was a main psychological obstacle for patients who struggled to return to sports. A combination of mental training with ACLR rehabilitation protocols showed an increased effective post-surgical period and efficacious return to prior ACL injury sport's level.

Attitudes and beliefs about taking steroid and image enhancing drugs: a systematic review of studies with gym users

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The use of steroid and image enhancing drugs (SIEDs) by gym users is a health concern (Brennan, et al. [2016] Health and Social Care in the Community, *25*, 1459-1531). The beliefs that underpin the attitudes of gym users towards using SIEDs are unclear. Previous systematic reviews have concluded that SIED use may be motivated due to appearance, performance gains, body image disturbance and pursuit of health and youth. The aim of this study therefore was to explore the beliefs and attitudes of gym users regarding use of SIEDs. A systematic review following PRISMA guidelines was conducted. We searched literature published between 2005 and 2016 for studies of gym users and SEIDs that had identified beliefs or outcome beliefs as part of their study. No language restrictions were enforced. Literature was managed using EndNoteWeb and subjected to eligibility criteria yielding 48 eligible research articles. Thematic analysis resulted in four types of themes and one key theme that appears under-represented in publish research. These themes were categorised as physical health (physical appearance, body weight, muscular strength, muscle mass and performance), psychological (body image dissatisfaction, admiration, striving for masculinity and euphemistic labelling), sociological (compartmentalising and peers, trust and distrust and advantageous comparison) and vocational (personal security, public service culture and coping mechanism) beliefs. Physiological beliefs were the most frequently reported followed by psychological beliefs. However, the finding that some beliefs are related to vocational outcomes suggests there may be a sub-group of gym users that hold beliefs that differ from those using the gym use for health gains. There is limited, evidence into how attitudes towards use of SIEDs and the beliefs that underpin these are formed. In addition, vocational populations are under researched and there is a need to research how SIEDs are used to enhance professional efficiency. Future research into the motivation for use of SEIDs should consider relevant theoretical frameworks to study the differences between sub-groups of gym users that may hold different outcome beliefs to understand the reason for differences reported in beliefs.