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Graduate Journal of Sports Science, Coaching, Management, & Rehabilitation

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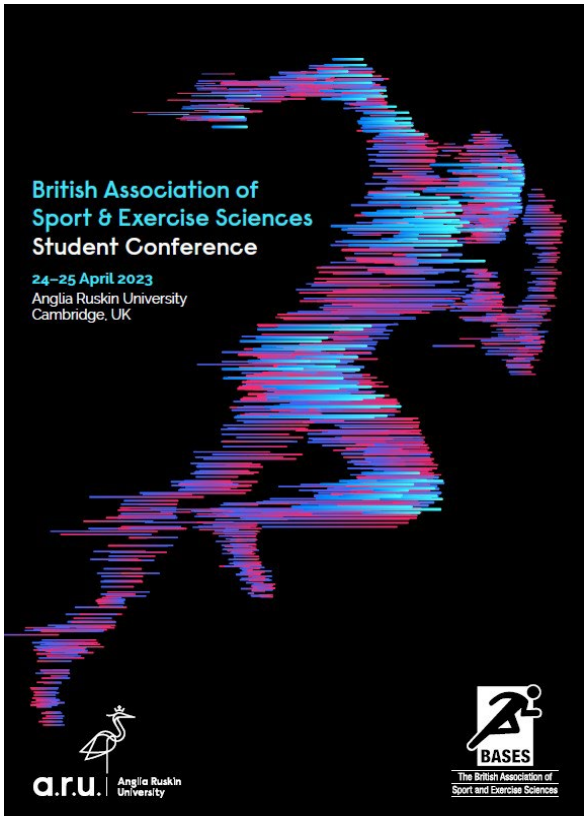

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Section A - Physiology & Nutrition

A01 - Cardiorespiratory adaptations following four weeks of high-intensity interval training with blood flow restriction.

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Blood Flow Restriction (BFR) is known to increase both muscular strength and hypertrophy but has also shown improvements in maximal aerobic power ($\dot{V}O_{2max}$) when using low-intensity training (Bennett & Slattery, 2019). However, the effects of low volume high-intensity interval training (HIIT) combined with BFR (HIIT+BFR) are unclear and need further investigation. In addition, the effects of occlusion pressure during training on central cardiovascular and peripherical metabolic adaptations are poorly documented. Thus, this study aimed to investigate the effects of HIIT+BFR on $\dot{V}O_{2max}$ and the effects of different occlusion pressures on central cardiovascular adaptations. With institutional ethics approval, 25 participants (11 females, 14 males; 19 ± 7 years; 175 ± 8 cm; 66.8 ± 7.9 kg; 17.3 ± 8.2% of body fat; 9 ± 5 h of physical activity per week) were trained three times a week for four weeks with BFR at different levels of occlusion (G1 = 20 mmHg [SHAM]; G2 = 40% Limb Occlusion Pressure [LOP]; G3 = 60% LOP). Training consisted of 4 to 7 bouts of 90 seconds HIIT+BFR performed at 90% of $\dot{V}O_{2max}$ on a cycle ergometer, interspersed with 2 min recovery bouts, where cuffs were deflated. Pre and post-cardiorespiratory fitness was assessed. Groups and sessions were compared using mixed ANOVA. Training did not affect $\dot{V}O_{2max}$, but significantly improved maximum power attained at volitional exhaustion for all groups, with no difference between groups (269 ± 45 vs. 300 ± 51 W, $P < 0.05$). Training enhanced power at both Gas Exchange Threshold (175 ± 48 vs. 212 ± 48 W, $P < 0.05$) and Respiratory Compensation Point (227 ± 43 vs. 265 ± 51 W, $P < 0.05$), for all groups with no difference between groups. Four weeks of HIIT combined with BFR is not enough to improve the participants' $\dot{V}O_{2max}$. However, the increase in maximum power attained without any increase in $\dot{V}O_{2max}$ shows a training-induced improvement of cycling efficiency, suggesting peripherical metabolic or/and neuromuscular adaptations (Jessee et al., 2018). With this training modality, the stress stimulus induced by blood flow restriction during exercise was insufficient to induce significantly higher central cardiovascular adaptations, but induced peripherical adaptations even with low peripherical resistance, implying that higher pressures are not needed.

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A02 - Effect of seated and standing cold water immersion on recovery from exercise induced muscle damage.

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A normal consequence of strenuous eccentric exercise or unaccustomed exercise is exercise-induced muscle damage (EIMD), which results in an overall decrease in activity and damage to the muscle, the detrimental effects affiliated with EIMD have been thoroughly documented. The English Institute of Sport conducted an in-house audit in which they suggested that cold water immersion (CWI) was a highly popular recovery strategy and that it had gained a lot of attention in the recent years. The increase in popularity is not only because it reduces muscle soreness and promotes recovery but mostly due to the positive physiological mechanisms related to pressure induced changes and temperature, which helps athletes in recovery. Accordingly, the aim of this study was to elucidate the effectiveness of two different hydrostatic pressures (seated and standing) during cold water immersion protocols at attenuating the detrimental effects of fatiguing exercise on indices of damage and recovery. Thirty recreationally active participants completed 100 drop jumps and repeated sprints (20 × 20 m) to induce muscle damage. To allow for equal distribution, subjects were matched to one of three intervention groups (standing cold water immersion [14°C for 14 min], seated cold water immersion [14°C for 14 min] or control based on their weight and gender (7 male subjects and 3 female subjects were allocated to each group). Counter-movement jump, 30 m sprint time, maximal voluntary isometric contraction, delayed onset muscle soreness and serum creatine kinase were measured before and up to 48 h following the muscle damaging protocol. There was a strong indication of muscle damage and physiological stress following the muscle damaging protocol as all dependent variables showed main effects for time ($P < 0.05$) post exercise. There were no significant group differences between either of the CWI groups and control. Sitting cold water immersion was associated with lower serum creatine kinase activity than control (effect size = 1.17, $P = 0.044$). This investigation suggests that an increase in hydrostatic pressure during cold water immersion does not provide any additional benefits for recovery, and that neither sitting nor standing cold water immersion provide any benefit in stimulating recovery following exercise-induced muscle damage.

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A03 - The effects of facial cooling on physiological and perceptual responses during simulated competition in male épée fencers.

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The aim of this study was to investigate the effects of a novel facial cooling intervention on physiological and perceptual responses during simulated competitive fencing. Ethical approval was granted by the St Mary's University Ethics Committee (ClinicalTrials.gov identifier: NCT05302739). Using a randomised, crossover design; six competitive, male fencers (age: 27 ± 9 years; height: 1.87 ± 0.05 m; body mass: 83.7 ± 5 kg) completed two trials. Trials included seven simulated fencing matches. Matches were comprised of 22 × 10 s bouts of maximal intensity fencing movements. Static rest (12 s) divided each 10 s, with extended rest (60 s) after the seventh and 14th bouts. During the experimental condition, participants were sprayed with a facial water mist and fanned. Various physiological and perceptual responses were recorded during each trial. Relative to the control condition, facial cooling reduced tympanic temperature (mean difference: 0.2 ± 0.03°C; 95% likely range: 0.13 to 0.3°C); heart rate (mean difference: 12 ± 3 beats·min^{-1}; 95% likely range: 5 to 20 beats·min^{-1}); the percentage of maximum heart rate achieved (mean difference: 6.2%; 95% likely range: 2.4 to 10.1%); and ratings of perceived exertion for the dominant arm (mean difference: 2; 95% likely range: 1 to 3), legs (mean difference: 2; 95% likely range: 1 to 3), and total exertion (mean difference: 2; 95% likely range: 1 to 3). Additionally, the effects of facial cooling on ratings of perceived exertion of the dominant arm ($P < 0.001$) and legs ($P = 0.049$) were magnified as the competition progressed. Ratings of perceived comfort, during matches six ($P < 0.001$) and seven ($P = 0.004$) were also reduced post-cooling. In conclusion, facial misting positively affects both physiological and perceptual variables during fencing. However, the performance benefits of the intervention require exploration.

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A04 - The effects of adding potentiation exercises to a warmup on subsequent repeated 6 s sprint cycling performance.

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The strength of a muscle's contraction is influenced by its contractile history. Whether subsequent muscle contraction is increased or diminished, is dependent upon the coexistence of fatigue and potentiation. Previous research has demonstrated that strength resistance exercises, and plyometric exercises, can cause post-activation potentiation. It has also been shown that a strength training background impacts this relationship between fatigue and potentiation. The aim of this study was to evaluate the effects of adding potentiation exercises to a warmup on peak power and average power of subsequent repeated 6 s sprint cycling performance. The secondary aim of this study was to assess whether participants' baseline squat strength and training status influenced the outcome. With institutional ethics approval, a group of 15 participants, composed of athletic (n = 7, 26 ± 4 years, 179 ± 3 cm, 85 ± 5 kg) and recreationally active (n = 11, 23 ± 3 years, 180 ± 7 cm, 76 ± 15 kg) participated in the current study. Participants were categorised based on the ratio of their squat one repetition max and bodyweight (athletic = ≥1.75, recreationally active = <1.75). Their peak power and average power were assessed following two different warmup protocols involving 1) raise, activate, and mobilise (RAM) or 2) raise, activate, mobilise, and potentiate (RAMP). The post activation potentiation conditioning exercise was one set of three repetitions of three countermovement jumps performed immediately following the mobilise stetches. Both conditions waited 4-min before completing three 6 s sprints on a Watt bike pro, with 3-min of passive pedalling recovery between each sprint. No differences were found in peak power (RAM = 959 ± 357 W, RAMP = 952 ± 325 W, P = 0.660) or average power (RAM = 848 ± 335 W, RAMP = 835 ± 298 W, P = 0.186) during the sprints, between the RAM and RAMP warmup protocols. Baseline squat strength and training status did not influence the change in peak power (athletic P = 0.189, recreationally active P = 0.989) or average power (athletic P = 0.517, recreationally active P = 0.541). To conclude there were no differences in measures of peak power or average power between RAM and RAMP warm up protocol, as such it appears the three-countermovement jump was not an effective potentiation exercise to enhance sprint performance in athletic or recreational individuals.

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A05 - The influence of cuff location on the oxygenation and reperfusion of the foot during ischaemic preconditioning: a reliability study.

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Ischaemic preconditioning (IPC) involves the application of an occlusion and periods of reperfusion, typically prior to exercise. IPC is commonly applied at the thigh or arm; however, few studies have investigated the reliability of near-infrared spectroscopy (NIRS) during lower limb IPC. Furthermore, there were no relevant publications identified investigating the application of IPC at the ankle. Therefore, the purpose of this study was to investigate: 1) if applying IPC at the ankle is a valid approach, and 2) whether there is intra-session reliability in the NIRS measurements during three repeated occlusions. With institutional ethical approval, 18 participants volunteered to participate (12 males, 6 females; age: 26.17 ± 9.45 yrs; height: 171.6 ± 9.7 cm; body mass: 72.20 ± 14.25 kg). Participants visited on one occasion, where IPC was applied at the thigh, ankle and arm in a randomised order involving 3 cycles of 5-minutes occlusion and reperfusion at each location. A pressure of 220 mmHg was applied at the arm and thigh, and an individualised arterial occlusion pressure was adopted at the ankle (average: 212 ± 24 mmHg). All occlusions were performed on the right side, with a NIRS device applied to the abductor hallucis muscle and a photoplethysmography (PPG) sensor applied to the big toe. NIRS technology recorded tissue oxygen saturation (SO_2), oxygenated haemoglobin (O_2Hb) and deoxygenated haemoglobin (HHb), allowing total haemoglobin (THb) to be calculated (sum of O_2Hb and HHb). An arterial occlusion occurred in 83% of the occlusions, as determined with the pulsatile blood flow from the PPG. Of the 18 participants, three participants had blood flow present despite the cuff inflation. Reliability was assessed using intraclass correlation coefficients (ICC) with 95% confidence intervals. For all NIRS measurements assessed including SO_2, O_2Hb, HHb, and THb, there was excellent reliability during the inflation and deflation phases at the ankle for the average, minimum and maximum values, and the haemoglobin difference (all ICC > 0.944, $P < 0.001$). ΔHHb and ΔSO_2 also resulted in excellent reliability (ICC = 0.978, 0.956 respectively, $P < 0.001$), whereas ΔO_2Hb offered good reliability (ICC = 0.867, $P < 0.001$). The results indicate that IPC can successfully be applied at the ankle for future interventions, as well as the more traditional locations of the arm and thigh, while offering reliable measures between three repeated occlusions within a session.

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A06 - Thermal perception awareness and exercise in the heat.

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Human beings make use of complex autonomic and behavioural thermoregulation to survive while exposed to a wide range of environmental conditions such as the heat (Vabba et al., 2022). Autonomic mechanisms have a finite capacity whereas the capabilities for behavioural temperature regulation are limitless however behavioural thermoregulation continues to be overlooked (Flouris and Schlader, 2015). Previous research surrounding this area has used perceptual scales, thermal sensation (TS) and thermal comfort (TC), to measure the changes of perception during exercise in the heat, but interoception within this area is limited. Interoception refers to the body to brain signalling of sensations of the body's physiological state, including signals from inner organs as well as thin afferents in the skin (Crucianelli et al., 2022). Previous research verified that TS is predominantly dictated by skin temperature (Tskin), independent of the core temperature (Tcore), concluding that thermal perception and sensation are capable behavioural controllers and the effect interoception and thermoception has on behavioural thermoregulation should be researched deeper (Schlader et al., 2011). The aims of the proposed study are to quantify the degree that interoception is affected after exercise in the heat to further investigate Tskin and the links to behavioural thermoregulation. It is hypothesized that people with low interoceptive ability will be less sensitive at detecting Tskin changes causing a decrease in the likelihood of eliciting behavioural changes, such as clothing removal or hydration, in turn increasing their Tcore. The study design will include both female and male volunteers with three visits to the laboratories: (1) a familiarisation session of both thermal and cardiac interoceptions (2) an assessment of both interoceptive abilities while resting in a temperate environment; (3) an exercise protocol in the heat followed by the interoceptive tasks. For the data analysis the participants will be split into two groups based on high vs low interoceptive ability. The proposed research will add a novel dimension to the effect exercise in the heat has on thermoception by using the thermosensor to detect temperature change perception and cardiac interoception to understand at a deeper level the precise role Tskin and interoception plays in behavioural thermoregulation. I propose to use this study as a starting point to my PhD where I aim to conduct a neurophysiological investigation of the elderly in simulated heatwave conditions.

A07 - Comparison of methods of physiological testing and exercise prescription available to elite triathletes.

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The parameters critical power (CP), lactate turn point (LT2) and the respiratory compensation point (VT2) are frequently used to prescribe training and evaluate athletes' performance capacity. However, the association of these parameters has not previously been explored in elite triathletes. This study determined the proximity of these parameters and subsequently examined measurement agreement between LT2 and VT2 in highly trained participants, recruited from the National Triathlon Performance Centre, Wales. As part of winter training, participants (n=6) performed a staged lactate threshold test consisting of eight, 5-min exercise bouts to facilitate specific and precise training prescription. Permission was sought from the head coach and physiologist for the data obtained to be used as part of this undergraduate study. Participants also performed a 3-min CP test and a 12-minute incremental VO2max test (GXT). All procedures gained institutional research ethics approval and participants provided written informed consent. Absolute and relative values of power associated with CP, LT2 and VT2 were determined from the 3-min all-out, 5-min staged and GXT test respectively and compared using a one-way, repeated-measures analysis of variance. Subsequently, the relationship of power associated with LT2 and VT2 was quantified using separate inter-class Pearson's product moment correlations. Individual percentage differences in absolute power associated with LT2 and VT2 was calculated using pooled mean values. The mean ±SD absolute value of power associated with CP (376 ± 36 W was significantly higher compared to LT2 320 ± 21 W; P = 0.015) and VT2 (318 ± 26 W; P=0.003). However, extremely high correlations coefficients ($p<0.01$) existed between absolute ($r = 0.95$), and relative power values (4.32 vs. 4.29 $W \cdot kg^{-1}$; $r = 0.98$) associated with LT2 and VT2, respectively. The greatest individual difference between VT2 and LT2 was 4.7%, with a group mean(±SD) value of 2.0 ± 1.8%. Comparing this to published values of test re-test reproducibility it was concluded that LT2 and VT2 can be used interchangeably to aid the prescription of training and evaluate performance capacity of elite triathletes. The practical impact of a 12 min GXT test is also a crucial factor to consider for the monitoring of performance in an elite environment. When compared to the currently 5 min staged test the impact on routine training is significantly reduced. Further work is needed to validate the proximity of LT2 and VT2 by monitoring the physiological changes when power outputs associated with LT2 and VT2 are maintained for extended periods of time and a larger sample size would substantially improve statistical power.

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A08 - Does the use of a training mask alter internal and external loads during the Loughborough Intermittent Shuttle Test?

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A key component of team-sport performance is aerobic capacity. There are numerous methods to improve aerobic capacity in athletes, but more recently the use of respiratory training masks has increased in popularity. However, the effects training masks on the internal and external load during exercise is unknown. The aim of this study was to investigate the effect of training mask use on performance during a modified LIST (LIST-P). Fifteen team-sports athletes (14 male and 1 female) took part in the study which consisted of performing a LIST-P on 2 separate visits, with and without a training mask in a randomised order (>7 days apart). The LIST-P, which was self-paced consisted of 5 steps which made one LIST-P block. The steps were 1) 3 × 20 m walking, 2) 1 × 15 m sprint, 3) 4 seconds recovery, 4) 3 × 20 m running, and 5) 3 × 20 m jogging. Internal and external loads measured included heart rate, rating of perceived exertion (RPE) and total distance covered. Heart rate and RPE were calculated after every block during the LIST-P and total distance covered was calculated once the test had ended. The test duration was 15 minutes per LIST-P. The training mask was worn for 15 minutes before the LIST-P and set on the valve that was most open. There was no effect of condition on heart rate or RPE ($P > 0.05$) but there was a linear increase in heart rate and RPE across the blocks ($P < 0.05$). Mean heart rate with the training mask (167 ± 12 BPM) and without (171 ± 2 BPM) was different between conditions ($P < 0.05$). The total distance covered was 1,900 m with the training mask and 1,919 m without ($P < 0.05$). The minor differences found with the data need further investigations. Those using training masks should be mindful that their use can alter the internal and external load response to self-paced intermittent exercise. Future work is needed to confirm these data, particularly in female team sport athletes.

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A09 - Optimising Liquid Cooling Suit use when worn under an Explosives Ordnance Disposal Suit in hot conditions.

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Explosives Ordnance Disposal (EOD) suits protect the wearer from blast fragmentation, extreme heat and fire. EOD suits are fully encapsulating and form a microclimate between the wearers skin and the inside of the suit. Uncompensable heat stress (UHS) occurs when the environmental capacity for sweat evaporation is lower than that required for heat balance and results in increased body heat storage (BHS). Accordingly heat strain risk is elevated at higher ambient temperatures and higher metabolic rates. An approach to mitigate this effect is cooling via supplementary conduction. The efficacy of wearing a liquid cooling suit (LCS) directly on the skin (OS) compared to over a cotton layer (OC) is yet to be investigated. Therefore, the purpose of this study was to examine the effect of LCS clothing layer order on the magnitude of LCS heat absorption (HA) and BHS. With institutional ethical approval and following a randomised crossover design, participants (N=5, of a projected 8; height: 1.85 ± 0.04 m; mass: 86.8 ± 16.1 kg) walked at 2.5km·hr^{-1} for 60 min in an EOD suit, in hot conditions (40.9 ± 0.3°C; 25.1 ± 0.9% relative humidity), on two occasions separated by seven days. In both OS and OC the LCS continuously delivered water via tubing circuits around the body and head. The LCS reservoir contained 1 kg of ice with the addition of 0.5 kg room temperature water immediately prior to entering the environmental chamber. Physiological measures (heart rate, skin temperature, rectal temperature) were recorded and block averaged into 5 min intervals. Perceptual measures (thermal sensation, RPE) were recorded at 10 min intervals. BHS, physiological strain and perceptual strain were calculated. Total LCS HA was calculated using LCS circuit inlet and outlet water temperatures. Less heat was absorbed in OS compared to OC (138 ± 5 vs. 147 ± 17 W; d = −0.72) which is also reflected in an increase in BHS at trial completion in OS (4.89 ± 0.29 vs 4.67 ± 0.57 J·g^{-1}; d = 0.49). Physiological strain was reduced in OS (4.84 ± 0.75 vs. 5.30 ± 1.33 J·g^{-1}; d = −0.42), as was perceptual strain (6.07 ± 1.49 vs. 6.46 ± 1.74; d = −0.24). When the LCS was worn directly OS BHS increased alongside reduced physiological and perceptual strain compared to when the LCS was worn OC. Reduced skin blood flow in OS compared to OC is likely a contributing factor. This work has enabled scientific evidence-based user recommendations to be made and has potential utility for other heavy encapsulating PPE users.

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A10 - The effect of omega-3 polyunsaturated fatty acid supplementation on endurance performance and HR recovery in masters athletes.

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The aim of this study was to investigate the effect of omega-3 poly unsaturated fatty acid supplementation on endurance performance and HR recovery in masters athletes. Previous research has suggested that omega-3 is an important dietary requirement and has the ability to aid recovery and improve performance in endurance athletes. However, there is a lack of literature exploring the effects of omega-3 in the masters population. This study obtained ethical approval from Northumbria University ethics department (ethics code: 1695). A sample size estimation using G*Power gave a suitable sample size of 84 people (42 in each group), however due to the impracticality of recruiting that number of subjects, a pilot study was performed. Eight well trained masters endurance runners aged between 35-65 (males n=4, females n=4, weight 64.4 ± 11.9 kg, height 171 ± 14 cm) completed baseline testing involving a 3 km running time trial (TT), followed at least 48 hours later by a high intensity endurance session (16 × 400 m with 1 min recovery). To measure performance, average speed (mph) throughout the duration of the 3 km TT was calculated. To measure recovery, HR was recorded immediately before (HR1) and immediately after (HR2) each repetition during the session, as well as immediately after (HR2) and a further 1 minute after (HR3) the 3 km TT. Four participants were randomly assigned into the omega-3 group (900 mg/d containing 540 mg/d EPA + 360 mg/d DHA) and four participants took a placebo (maltodextrin). All participants took the supplement for a period of 2-weeks, then the testing protocol was repeated. The data showed a non-significant improvement in HR recovery from both the 3 km TT and high intensity endurance session in the omega-3 group compared to the placebo group (MD = 5, 95% CI −5 to 14 bpm, d = 0.4). There was no change in 3 km speed between both groups (MD = 0, 95% CI −3.3 to 3.3 km/h, d = 0). The findings suggest a possible improvement in HR recovery between the two groups, however a conclusion could not be drawn due to a lack of significance. The findings show that omega-3 could have the ability to improve HR recovery in masters athletes but also indicates that perhaps omega-3 is less effective for maximal efforts. Future research must address the limitations of this study and further investigate the effect of dosage and the supplementation period. This would allow more accurate formulation of evidence-based nutritional strategies to ultimately help masters athletes remain competitive.

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A11 - The use of near-infrared spectroscopy (NIRS) in the physiological assessment of sprint triathlon.

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Despite the knowledge that the physiological demands of sprint triathlon are greater than the sum of its parts, the inclusion of all three disciplines in triathlon research is rare. The current literature makes use of a wide variety of measurement tools that have been utilised to observe the global physiological responses (oxygen consumption, heart rate, blood lactate concentration among others) that occur during participation. Near Infrared Spectroscopy (NIRS) is a light-based technology that reports on the relationship between oxygen delivery and utilisation at the sight of gas exchange in the muscle, a key indicator of performance in aerobic events such as sprint triathlon. NIRS has been effectively used to monitor muscle oxygen responses in all component parts of a sprint triathlon; swimming, cycling, and running, as well as other multi-sport events such as biathlon, but has not yet been applied to a complete sprint triathlon. The purposes of the present investigation were: 1) to explore the utility of NIRS as a measurement tool within sprint triathlon; 2) create a profile of the physiological responses to sprint triathlon. With institutional ethics approval a laboratory-based study explored the utility of multi-site NIRS as a measurement tool within triathlon using recreational male triathletes (n=11). Participants completed maximal incremental exercise tests on a treadmill, cycle ergometer, and swim ergometer, before completing a simulated sprint distance triathlon. A comprehensive profile of global and peripheral responses throughout the sprint triathlon was created, including pulmonary oxygen consumption ($\dot{V}O_2$), heart rate, blood lactate concentration, rating of perceived exertion and multi-site NIRS (vastus lateralis and latissimus dorsi). Repeated measures ANOVA was used to analyse the differences between relative intensity of tissue saturation index (TSI) (%), heart rate and $\dot{V}O_2$ responses across triathlon stages. NIRS devices were able to inform upon muscle oxygenation status across the simulated triathlon. NIRS identified different oxygenation responses between upper and lower limbs throughout ($P = 0.016$) and identified a greater peripheral measurement variability between participants compared to global physiological measures. As a measurement tool NIRS has the potential to increase the specificity of physiological information available to athletes and coaches. NIRS observed different peripheral muscle desaturation profiles in individuals, indicating variability in efficiency between athletes. This finding will have implications when creating strategies to be applied in sprint triathlon training and competition.

Section B – Sport & Exercise Psychology

B01 – The Influence of Expertise on Visual Search and Behaviour in Naturalistic Badminton Play – Comparing Gaze Pattern Strategies through Quiet-Eye Tracking.

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In badminton, the ability to gather relevant visual information quickly and effectively is a crucial determinant of performance. However, exploration into gaze behaviour been neglected within naturalistic game settings (with relation to expertise), nor associated to performance. Thus, exploration into the effects of expert athletes exhibiting superior fixation-durations creates equivocal assumptions towards the mechanisms behind success. Given that expertise revolves around the ability to predict actions, extracting postural cues, observed correlations between visual inputs and cognitive processing can yield ocular information to optimise control. Whilst this primarily incorporates the application of visual search behaviours, the importance in racket sports is underexplored, requiring further investigation of saccades, contextual mechanisms, spatial and temporal parameters. Therefore, the current study aimed to explore gaze behaviour and quiet-eye durations within naturalistic badminton play, concluding fixation oscillations between expert and amateur participants. This is an indispensable, novel field of research intending to conclude the presence and importance of visual behaviours in racket sports for successful athlete development. A total of 32 individuals between 18 and 28 years, with a minimum of one year playing experience, will be recruited. Two groups (expert and novice) will randomly be assigned into pairs, equipped with eye-tracking glasses for the execution of five serves and the receival of five additional serves. Rules will mirror a standardised singles matches, with the rallying continuing until one shot is missed. This protocol will be completed for two different serve variations: a flick and high serve. Here, two components will be explored, the preparatory (quiet eye) and anticipatory (visual search) phases in a repeated measures design. The independent variable is expertise for both phases however, the dependent variables will be differentiated based upon the preparatory or anticipatory performance. Here, mean fixations per location, fixation duration and mean quiet-eye duration will be scrutinised, allowing fixation oscillations between both groups to be explored. Based on previous research, it is hypothesised that expert players will utilise superior visual preparatory, anticipatory and search behaviours compared to less-skilled counterparts. This will provide desirable advantages, augmenting attentional control towards the task. Vine, Moore and Wilson (2011) acknowledged this notion, theorising that longer QE creates an extended duration of dorsal attention, minimising distraction from other internal or environmental cues. Such mechanisms are postulated to enable remote information identification from end effectors, creating correlations between quiet eye responses in both the preparatory and anticipation phases. Consequently, the present study aims to determine whether gaze duration will extend for experts through the implementation of visual search patterns on movement readiness during the execution or receival of serves. This will provide essential comparisons on the process of information extraction, insights into strategy optimisation through concurrent exploration of preparatory and anticipatory behaviours. Sequential effects will be observed for both coaches and athletes, providing fundamental knowledge for perceptual-cognitive skills training and visual exploratory activity implementation, excelling the development of expertise; a concept often neglected by coaches in the field of racket sports.

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B02 – Strong mind; self-kind: An Interpretative Phenomenological Analysis exploring male and female elite student-athletes' lived experiences and subsequent perceptions of mental toughness and self-compassion.

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Performance sport predominantly focuses on ameliorating athletic performance and winning (Dwyer et al., 2019). It is suggested that mental toughness enables athletes to "cope better than their opponents with the demands of sport whilst remaining determined, focused, confident and in control under pressure" (Jones, 2002, p.213). In addition, self-compassion has been recognised as providing athletes with a 'psychological edge' and has been conceptualised as connecting with one's own feelings and emotions without judgement and understanding failure as an inherent aspect of humanity whilst taking an active role in alleviating emotional challenges (Neff, 2003). This study used Interpretative Phenomenological Analysis (IPA) to gain a detailed idiographic insight into elite student-athletes' lived experiences and subsequent perceptions of mental toughness and self-compassion in the context of performance sport, with the aim of advancing conceptual understanding. Following institutional ethics approval, six University of Derby students and Team Derby Sports Scholars (three male and three female) were recruited via purposeful sampling and interviewed using a semi-structured format. Following the guided principles of IPA (Smith et al., 2009), analysis of the six transcripts revealed three main themes: 'Utilisation of mental toughness and self-compassion as context-dependent', 'Balancing self-criticism and self-kindness' and, 'Socio-environmental influences on mental toughness and self-compassion. The findings of the present study indicated that mental toughness and self-compassion are both valid psychological constructs in the context of performance sport. Athletes' perceptions and subsequent use of mental toughness and self-compassion differ depending on context, with participants tending to value self-criticism over self-kindness. Athletes holistically understood mental toughness more comprehensively than self-compassion, expressing ambiguity about whether self-compassion is an innate or nurtured construct. Athletes expressed ambivalence about how being compassionate towards others, receiving compassion from others and being compassionate to oneself; the flow of compassion, features in elite sport. Future qualitative studies should consider collecting data from more than six participants to guarantee saturation. Likewise, topics such as the role mindfulness plays in facilitating mental toughness and self-compassion, the impact self-compassion has on athletic identity and the contextual factors that influence mental toughness and self-compassion could be more thoroughly explored. The present study evidenced conceptual differences between athletes' comprehensive understanding of mental toughness compared to self-compassion, potentially reflecting performance narratives in elite sport which favour mental toughness over self-compassion. Future research could explore this, as well as consider interventions that habitualise self-compassion whilst facilitating mental toughness.

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B03 – What do recreational athletes perceive to be the biggest psychological challenge to recovery from a sports injury?

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The physical demands of sport can amount to an increased likelihood of experiencing injury. Existing research consistently suggests that engaging in sport and physical activity is allied to higher injury rates. Physical health is integral to capability to engage in sport, so an injury for a keen sports person has a considerably more consequential impact on their livelihood than simply just preventing everyday tasks. The psychological challenges experienced after injury onset for elite athletes are understood and focused on in existing research due to their sports participation being linked to their career. Injuries can be traumatic, cause periods of depression, stress and isolation. Recreational athlete's participation in sport is not comparable to elite athlete's as it is not for career purposes. The purpose of this study is to understand the psychological impact of sports injuries on recreational athletes, and to identify the psychological challenges that they face during their recovery period. The research has been conducted within an interpretivist paradigm, to enable an open-minded, participant-led and exploratory "letter to the self" writing approach. Following local institutional ethical approval, we recruited 15-25 participants via purposeful sampling. Inclusion criteria were participants needed to be over 18, participate in sport recreationally and have experienced a sports injury. Through an online platform (Qualtrics, London, UK) participants were asked to write a letter to their pre-injury-self describing the psychological challenges they faced during injury recovery. Additional questions asked to describe the psychological impact of their injury at onset and during recovery, and what the expected the psychological impact of a reoccurrence of an injury would be. Responses will be analysed using narrative analysis. Narrative themes identified from current responses were that recreational athletes experienced feeling disheartened, embarrassed and disconcerted by the pain from the injury. Participants also experienced feelings of worry and uncertainty due to lack of knowledge of injury timescales and outcomes. Recreational athletes experience a range of psychological challenges during the recovery from a sporting injury, many of which like those experienced by elite level athletes despite the difference in circumstances. It appears that some of the psychological challenges experienced are contributed to by lack of knowledge of injuries and clear support options.

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B04 – Gymnastics Coaching: Perceptions, Styles, and Coach-Athlete Relationships.

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An individual's coaching style impacts all athlete-related interactions (Marcone, 2017). There are many different types of coaching styles (e.g., autocratic, democratic) that are used throughout the sport of gymnastics. The type of coaching style used can influence coach-athlete relationships, thus impacting performance. The purpose of this study was to: (a) examine the different coaching styles and behaviours adopted by gymnastics coaches and (b) to examine the effectiveness of coaching styles on coach athlete relationships. Non-participant observations were used to observe the coaches' behaviours first-hand in the normal dynamic sporting environment (Taylor, 2018, pp.116). Follow-up qualitative semi-structured interviews were then conducted, allowing rich data to be gathered. A total of five coaches were recruited through convenience sampling. A behaviour observation was completed. Observed behaviours included 'instruction', 'praise', 'technical feedback', 'motivational feedback' and 'discipline'. These behaviours were tallied in accordance with occurrence. Semi-structured interviews were then completed, examining: (a) coaches' perceptions of their style; (b) methods adopted; (c) behaviours displayed and (d) impact on coach-athlete relationships. Results (expected). There is not one specific way to coach a session, with coaches adopting various styles throughout the same session. The style in which a coach adopts is dependent on the athletes needs and environment in which the session occurs. Behaviours and methods adopted by coaches are similar, regardless of their perceived coaching style. Coach-athlete relationship was shown to be beneficial for athlete success. The findings emphasise the fluidity of the coaching process and the various factors that impact this, whilst also highlighting the importance of coach to athlete relationship on success. Moving forwards, gymnastics coach education programmes and educational institutions could consider this when delivering courses. Further, both current and aspiring coaches could use these findings to benefit their personal reflections on their own coaching style and philosophy. This could also be a point of consideration for mentors and tutors.

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B05 – Cognitive function in males and females following cold water immersion?

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Sudden cold-water immersion (CWI) elicits a cold shock response (Shattock, and Tipton, 2012), defined as a powerful cardiorespiratory response comprising an initial gasp and subsequent hyperventilation (Datta, 2006). When the human body is exposed to cold stress, such as cold water, the sympathetic nervous system is activated with subsequent physiological change (Daanen, 2009). Paulauskas et al, (2015) researched the acute effects of CWI on cognitive function, exposing participants to 14°C water to shoulder level until the core temperature had dropped to 35.5°C. Findings demonstrated an effect of cold on working memory and attention with a need for further investigation of the effect of gender (Falla, 2021). The aims of this study were to 1) investigate gender differences in cognitive function after CWI. 2) Investigate the influence of gender on rectal temperature change during CWI 14 participants (7 M and 7 F) volunteered to complete the study. Participation required three visits to the laboratory comprising a familiarization and two main trials. Familiarisation involved practice of cognitive function tests including the Stroop and n-back to minimise any potential learning effect. The second and third trials were randomised and participants were immersed to the level of the shoulder in either cold (14°C) or thermoneutral water (33°C). Throughout the protocol, Tcore (core temperature), HR (heart rate), TC (thermal comfort), TS (Thermal Sensation) and Cs (cold sensation) for the experimental trial, were used to assess the participants physiological response during both trials. Cognitive function was assessed pre and post immersion for number of correct / incorrect responses and response time. Results and conclusions are pending.

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B06 – Examining the psychological characteristics of developing excellence profiles of male English youth soccer players: Differences across ages and performance levels.

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In soccer, talent identification and development systems (TIDS) exist to produce elite players. The ultimate aim of these systems is to select and then develop players who will, in the future, outperform those players who are either not selected for academy programmes or de-selected somewhere along the pathway. Traditional talent development models, however, have often been criticised due to adopting an overly narrow focus on individual elements of performance rather than adopting a more holistic approach. Previous research has highlighted the importance of gaining a greater understanding of the key psychological characteristics that may provide the foundations for players to optimise their technical, tactical and physical development, in addition to enhancing life skills outside of soccer. Very little research has explored psychosocial profiles in academy soccer players. Accordingly, the aim of this study was to investigate differences in psychological characteristics of developing excellence (PCDEs) across different age groups (U13, U14, U15, U16 and youth team [YT]) and categories of participation (Categories 1, 2 and 3 at academy level, and grassroots [GR]) in male English youth soccer players (N = 375). A further aim was to examine differences in PCDEs across age groups at each category of participation and vice versa, to determine interaction effects of age and category of participation. Data was gathered using the PCDE questionnaire version 2 (PCDEQ2). Differences between age groups and categories of participation were analysed using the Kruskal-Wallis H test. Across age groups, highest differences were reported in perfectionistic tendencies ($d = 0.57$, $P < 0.01$) and adverse response to failure ($d = 0.49$, $P < 0.01$), with youth team players reporting the highest scores. Across categories of participation highest differences in PCDEs were observed in perfectionistic tendencies ($d = 0.64$, $P < 0.01$), self-directed control and management ($d = 0.63$, $P <0.01$) and adverse response to failure ($d = 0.58$, $P < 0.01$), with Category 1 players reporting the highest scores. YT and Category 1 players also demonstrated the highest scores in use of imagery and active preparation (IAP), with Category 1 players also demonstrating the highest and lowest score on use of active coping strategies and presentation of clinical indicators, respectively. The findings of the current study have important implications for key stakeholders involved in the planning and monitoring of a players talent development environment. Careful consideration should be given to identifying and developing players' psychological characteristics to ensure positive nurturing throughout their journey.

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B07 – Exploring the narratives of attachment among youth sport coaches.

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The purpose of this study was to identify and explore the narratives of attachment among youth sport coaches, to understand their impact on the coach-athlete (CA) relationship. With ethical approval from Anglia Ruskin University the research programme recruited 17 participants (level 2 or higher qualified UK based youth coaches) across multiple sport domains. Data was collected through the Experience in Close Relationships – Relationship Structure questionnaire (ECR-RS) to determine participants' attachment orientation, and through story completion to gather C-A oriented storied data. Story completion is a projective technique which assumes that when a person responds to an ambiguous stimulus, they do so by drawing on their experiential resources to make sense of that stimulus. The participants were presented with 2 story stems (short textual introductions presenting two differing attachment triggering scenarios, a physical event and an emotional event) and produced short stories from each of the stems. The data from the stories was analysed within each story stem group using Dialogical Narrative Analysis (DNA). The study found that the big story (dominating collective story) from story stem 1 was Doing the right thing, a storied instance of the safeguarding narrative, one that was dominated by procedural caring. While the big story from story stem 2 was Restoration of the athlete, a narrative that demonstrated a higher degree of empathetic caring. The study also found that individuals' pairs of stories varied in their expression of empathetic caring as mediated by their attachment orientation. Existing research suggests that by offering improved secure attachment orientated behaviours coaches can improve the wellbeing of their athletes. However, this research demonstrates that the socio-cultural narratives that percolate within the coaching environment have implications for such a delivery, highlighting as it does, the mediating effect these narratives, particularly safeguarding, can have on the expression of attachment's caregiving system.

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B08 – Coaches' experience of the importance, development, and integration of decision-making and visual exploratory behaviour in an elite football academy setting.

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The ability for a football player to make accurate decisions both with and without the ball during a game of football is a key component to successful performance. The superiority in decision-making skills (e.g., anticipation and situational assessment) among elite football players is partly attributed to the visual information (where they look and for how long) acquired prior to making the decision. Experienced youth football coaches approach the training of visual exploratory activity (VEA) and decision-making in considerably different ways. Therefore, a deeper understanding of coaching practices is needed to enhance VEA and decision-making in players. The purpose of this study was to investigate how coaches develop, integrate, and view the importance of VEA and decision-making. Following institutional ethical approval 12 male, UK-based League One (Tier 3 of the English football league structure) football club's youth academy coaches participated in semi-structured interviews. Data was analysed using interpretive phenomenological analysis (IPA) to develop an understanding of their experiences. The coaches described three main areas when talking about VEA and decision-making which were represented by three superordinate themes. The first theme 'Importance of VEA and decision-making' concerned consistency and speed of thought which the coaches believed separated elite players from world class players, The second theme 'Developing VEA and decision-making' concerned using video analysis and questions to determine a player's intent with outcome of an action being seen as secondary. The third theme 'Integrating VEA and decision-making' revealed that coaches believed 'chaotic training that provided opportunities for players to utilise problem solving skills was most effective at developing VEA and decision-making. The efficacy of 'chaotic' sessions was impacted by coach experience, with less experienced coaches tending to favour organised, structured sessions. In addition, the VEA demands of different playing position were discussed alongside the demands required by small and large team/area practice with the later revealing disagreement between coaches on what they felt was the most effective. The findings of the present study expand on previous work which suggests that a coach's approach to developing VEA skills in youth players is a multifaceted process. This study provides new insight into how the development of visual search is dependent on the coach and player having a mutual understanding of the demands and requirements of VEA.

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B09 – The coach social support-athlete burnout relationship: The mediating role of perceived stress.

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For over two decades, research has attempted to understand the antecedents of athlete burnout. However, research has focused largely on individual athlete factors, whereas scant research has examined social factors. One social factor which has predicted lower levels of athlete burnout is perceived social support. In this regard, an important individual in the support network of athletes is an athlete's coach. Although research has identified that coach social support predicts lower levels of athlete burnout, the mechanism as to how it prevents the development of burnout has yet to be examined. To this end, as athlete burnout is considered to be a stress-based process, perceived social support might prevent athlete burnout by preventing stress. The present study aimed to examine whether stress mediated the perceived coach social support-athlete burnout relationship. Following institutional ethical approval, 237 participants (43% Female; mean age = 23.33 ± 7.17 years) completed the Perceived Available Support in Sport Questionnaire, the 10-item Perceived Stress Scale, and the Athlete Burnout Questionnaire. Structural equation modelling showed that perceived coach esteem support had an indirect effect on each of the athlete burnout symptoms via stress: reduced sense of accomplishment (−0.07, 95% CI = −0.15 to −0.02), emotional and physical exhaustion (−0.09, 95% CI = −0.16 to −0.02), and devaluation of sport (−0.06, 95% CI = −0.14 to −0.02). The remaining indirect effects were not different, whereas each dimension of perceived coach social support negatively predicted all three athlete burnout symptoms directly. The findings provide partial support for the mediating role of stress in the perceived coach social support-athlete burnout relationship. The present study also provides further evidence that perceived coach social support is an important factor for protecting against athlete burnout. Although evidence for the mechanistic process of the relationship between esteem support and athlete burnout is present, the mechanism for the remaining social support dimensions has yet to be established. Consequently, future research should explore other possible mechanisms to explain the relationship.

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B10 – The association between dietary intake and mental wellbeing in university students: a scoping review.

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Unhealthy dietary behaviours are one of the top health risks in university students. Student dietary habits have been well investigated, with alarmingly high reports of poor diet choices in the population. An increasing number of studies reveal nutrition effects mood and mental wellbeing, but the prevalence and magnitude of this relationship amongst a student population is unknown. This systematic scoping review aimed to (i) explore how dietary intake and mental wellbeing amongst university student populations are measured, and (ii) identify literature reporting on potential associations between dietary intake and mental wellbeing among university students. PubMed, Google Scholar, Crossref and SCOPUS databases were searched in February 2021, and results were screened for eligibility based on title, abstract and full text. The inclusion criteria of the search were: published in a peer-reviewed journal in English; examined undergraduate and/or postgraduate university students; and investigated the association between dietary intake and at least one eligible component of mental wellbeing. Exclusion criteria were: literature review studies; studies of non-university students (e.g., high-school, or vocational); studies of disabled students; and articles that assessed stress, psychological distress, depression, anxiety, or any other clinical derivatives of mental health. Of 1,207 studies identified, eight articles were included for review. Three research themes were identified based upon the component of mental wellbeing assessed: quality of life, affect, and mental wellbeing. Of the limited number of studies identified, these studies were heterogeneous in the measures used. There were two instances where a food frequency questionnaire (FFQ) was utilised and affect was measured, two with FFQ and life satisfaction, one with FFQ and global mental wellbeing and one with eudaemonic wellbeing. There were two instances of 24-hour recall food diary (FD-24) utilised and affect was measured, and two with FD-24 and quality of life. There was one instance of 7-day recall food diary used and global mental wellbeing was assessed. Included articles commonly reported a positive association between healthier dietary intakes and habits and a key component of mental wellbeing. At present, there are limited studies in this area. However, despite methodological heterogeneity between studies, most reports noted a positive association between mental wellbeing or a component therein, and healthier dietary habits. Greater consideration for methodological consistency is required for future studies in this area.

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B11 – Investigating in-situ cognitions of elite football coaches: exploring methodological mechanisms.

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There is an absence of information, and more research is required to better understand how coaches mentally operate. To date, much of the existing research fails to capture a coach's cognitive process. Recently, studies have used Think Aloud Protocol and Stimulated Recall to examine the in-situ thought processes of athletes, but not for coaches. By combining the two methods, the study aims to help better understand how coaches mentally operate within a coaching session. This study aims to comment on the adequacy of using a new method by combining the two known methods. It is then anticipated that the findings will contribute to coach education and a new methodological mechanism which can then be established in this field of study. This study examined six football coaches who work within West Ham United FC. The coaches work with junior academy players aged nine to fourteen years old. Institutional ethical approval was granted for this study. The research carried out recordings of the participant's training sessions. Prior to the recordings, participants were required to watch a bespoke online webinar to explain the elements of Think Aloud Protocol and Stimulated Recall. Each coach was required to be recorded three times. Each time, they used Think Aloud Protocol during their session and the next day, completed a review session to use Stimulated Recall. Transcripts were made that included both the Think Aloud Protocol and Stimulated Recall and were accordingly analysed using thematic analysis. The results highlighted that the coach's thought process was guided by previous experiences and the knowledge gained. This allowed coaches to recognise patterns within the session. Once recognised, the coaches again relied on experience to deal with those situations. Trends recognised from coaches were their ability to recognise technical and tactical scenarios, in addition to managing the training session with time management, equipment, and communication with players and other staff members. From these observations, we can understand why coaches recognise certain situations. From this, we can begin to map how we can create experiences for coaches so they can recognise more situations in their sessions.

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B12 – A comparison of group cohesion pre- and during UK lockdown in club-level swimmers.

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It has been noted that enforced lockdowns during the COVID-19 pandemic have had an impact on how people perceive their social environment. The focus of this research is in the area of sport team cohesion during the COVID-19 pandemic. In attempting to control the COVID-19 virus, the UK government implemented a series of measures to prevent the spread of the virus. Examples of these measures include lockdowns which affect people's physical proximity by keeping people apart. Physical proximity is an environmental factor that is itself a moderating antecedent in cohesion in sports teams (Carron, 2002). The aim of this research was to investigate the extent to which these restrictions have affected the perceived cohesion in swimming teams. The research method involved thirty-three swimmers in three different swimming teams completing the Group Environment Questionnaire (GEQ) in reference to two different time periods: October 2020 and February 2021. With institutional ethical approval, participants were asked to respond with the prerequisite as to how they felt generally within either month. Within October 2020 there were less UK government imposed restrictions whereas in February 2021 a UK nationwide lockdown was imposed. Overall, cohesion as measured by the GEQ subscales and analysed using a repeated measures MANOVA, did not change significantly (Pillai's Trace = 0.25, F (4,29) = 2.4, P = 0.073; η^2 = 0.249). There was univariate significance (P < 0.05) in the AG-T; GI-S and GI-T subscales but not the ATG-S subscale. There was a large effect size for the study. However, the omnibus observed power value (0.615) suggests that the study was under powered. The findings from this research indicate that physical restrictions leading to decreased physical proximity in teams during lockdown didn't have a significant effect on a team's perceived level of cohesion. The findings partially support the conclusions of Fan et al. ([2020]. Journal of the Royal Society Interface, 17, 1-10) that physical proximity does not affect emergent social cohesion in natural disasters which COVID-19 is as it is just the ATG-S subscale that didn't reach significance; where in times of crisis there is an increased need to share information that brings people together to be able to deal with the crisis. Recommendations are that during times of crisis, teams maybe able to exploit an opportunity to enhance cohesion through the emergent social cohesion of the situation.

B13 – What are netball athletes' experiences of psychological injury risks?

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Netball is a highly dynamic sport, played by millions of people worldwide, predominantly females. Despite sports injuries being more common in females than males, there is a paucity of research for females, and for elite netball. This is concerning due to netball injury incidence being higher than other comparable sports. Sports injuries have a significant psychosocial impact with serious long-term implications on health, performance, and finances. Key models regarding sport psychology injury research are: The Model of Stress and Athletic Injury (Williams & Andersen, 1998, The Biopsychosocial Model of Stress, Athletic Injury and Health (BMSAIH, Appaneal & Perna, 2014) and the working model of psychological risk factors for sports injury (Tranaeus et al., 2014). The biopsychosocial approach has been 25increasingly adopted in research due to the complex interaction between biological, psychological, and social factors, including environmental and emotional roles, and cognitive and behavioural variables. The aim of this exploratory study was to understand psychological injury risk factors in elite netball. The research question was "What are elite netball athlete's experiences of psychological injury risks?". The objectives were to identify psychological injury risk factors in elite netball, and then to understand the effect different contexts impact on these risk factors. Aligning to the Pragmatist paradigm, a longitudinal, cross-sectional mixed methods approach was taken. Stress data was quantitatively analysed from questionnaire results, utilising descriptive analytics, and qualitative methods (thematic analysis) employed for semi-structured interviews to get a richer contextual understanding on athlete's injury experiences. Participants were from one UK netball Superleague club (n = 15). Research data was handled following guidelines and ethical approval granted (reference 96507). Rich detailed results within the thematic analysis aligned to previous sport injury research. Core themes identified were history of stressors, person factors, psychophysiological factors, psychosocial factors, and ineffective coping. Results demonstrated the substantial burden on these elite netball athletes, with multiple competing demands. Elite netball athletes face complex, interrelated, organisational and socio-cultural stressors that influence psychological injury risk, specifically psychosocial factors. More support is required for athletes to implement adaptive, effective coping mechanisms to reduce multi-contextual stressors. Improvements to support structure for athletes are key, using a bio-psychosocial, multi and inter-disciplinary team approach focussed on developing intra- and inter-personal relationships to improve the socio-cultural environment in elite netball. Practical recommendations are given for athletes and their wider support network, including sport cessation guidance for overuse injuries. Future research directions include larger scale, longitudinal studies.

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B14 – The Psychological Effect of Modern Wrist-worn Fitness Trackers.

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The objective of this study was to evaluate the psychological effects that modern wrist-worn fitness trackers have on participants. The benefits that devices such as Fitbit and Garmin bring are widely known, however, only a small number of studies have examined the psychological effects of such devices. Qualitative semi-structured interviews allowing open-ended questions to be asked and an abundance of data to be collected, including body language. Participants (n=12) as part of this study were asked to take part in a 1-hour semi-structured face-to-face interview. Open-ended questions were asked to gain an in-depth perspective on the psychological impact of trackers on participants. Behaviour and body language were analysed as part of the interview to collect further information on the participant and subject matter. The sample size and design influenced by a similar study conducted by Goodision (2013). The data was analysed using a thematic analysis. Analysis so far has shown strong correlation between the purchase of fitness devices and social influence such as friends, family and aspects of conforming to 'social normalisation'. Other results have indicated that there is a significant link (51%) between the use of wrist-worn trackers and compensatory behaviours which could indicate exercise addiction among users, thus impacting behaviour and mindset. Whilst having many positive effects, modern wrist-worn fitness trackers can also have psychological implications for wearers in terms of compensatory behaviour and exercise addiction. The industry could consider altering targets and expectations (e.g., 10,000 steps per day) within their technology to decrease the pressure on wearers to reach particular benchmarks. Brands could also consider how they may disseminate broader information on how wearers can set realistic, specific goals for their exercise.

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B15 – This Mum Can: A Targeted Physical Activity Intervention.

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Only 17% of mothers are prioritising exercise as part of their day-to-day life (Sport England, 2022). Whilst the barriers to this are well-cited, there remains a lack of accessible exercise programmes that mothers of all ages can participate within. The purpose of this study was to (a) examine mothers' perceptions of physical activity (PA) and (b) create an accessible intervention programme that requires no equipment to participate within. Qualitative interviews, allowing rich data to be collected. A private Facebook group to disseminate the main content of the intervention. Five mothers who participate in under 150 minutes of PA per week were recruited via purposive sampling. Semi-structured interviews were conducted before and after a 5-week intervention. Pre-intervention interviews aimed to ascertain participants current PA levels, as well as exploring their perceptions of PA activity. Post-intervention interviews aimed to ascertain the impact of the intervention programme on participants perceptions of PA. For the intervention, participants were provided with information about the benefits of exercise, psychological tips, and advice from the Government, NHS, Sport England and other official bodies. They were also provided with PA exercises they could do that did not require equipment, fitness classes or the gym. Interview data was analysed using a thematic content analysis and presented as themes within the report. Results (expected). The mothers increased their physical activity. Initially barriers were lack of time, children, family duties, lack of motivation, financial and a perception that they need equipment. This intervention provided them with the knowledge that they do not need equipment and gave examples of activities they can do from home or without financial implication. In the second half of the intervention, some challenges were set, for example aiming to do 10000 steps a day for the next week. This helped some increase their physical activity time. Participants found the intervention helpful, and it allowed them to attach greater importance to PA. Mothers serve as role models to those around them (UCL, 2022). If all mothers were given the opportunity to participate in fun and accessible forms of exercise, this could have broader positive physical and psychological implications for the country as a whole. PA organisations and National Governing Bodies could consider the accessibility of physical activity for this demographic.

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B16 – Mapping the psychosocial factors and gym-enthusiasts' attitudes towards performance enhancement methods.

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Performance enhancing substances (PES) are becoming increasingly normalised and used within normal gyms and fitness populations. Several studies have developed frameworks to describe the behaviour of anabolic-androgenic steroids users or have established factors which might lead to PES use. However, researchers are still trying to fully explore PES use behaviour amongst recreational gym users. The aim of this investigation was to explore the relationship between determinants, attitudes, psychosocial factors, and experiences of gym-enthusiasts PES use. An online questionnaire including quantitative and qualitative items with the Performance Enhancing Attitude Scale (PEAS) REPORT Recognised questionnaires. Ethical approval was granted via Cardiff Metropolitan University School of Sport and Health Sciences Ethics Board. Eighty-two gym users male (n = 33), female (n = 49), aged 18-60 of whom 24 reported previous or current use of PES completed the questionnaire. Kruskal Wallis tests confirmed that those with stronger attitudes towards PES reported greater PES use than weaker attitudes (P= 0.050). Men were more likely to report use of PES (P < 0.001), while younger adults (P < 0.001) and adults with low education level attainment (P = 0.004) had more higher attitudes towards PES. Many participants (n = 43) raised concerns that external pressures, especially from social media and online forums influenced their decision to use and were identified as risk factors to other gym members. Participants claimed that peers use of PES were significantly greater than their own. The findings of this research reveal attitude as a mediator of intention to use PES and outline the pressures felt by gym-enthusiasts. In light of these results, practitioners in contact with gym users should help to educate them on the effects of PES and provide some tools to manage the pressures leading to PES use. Future research should aim to develop an educational framework to direct gym-enthusiasts towards their fitness goals by managing pressures while maintain a healthy lifestyle.

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B17 – A study investigating the barriers and facilitators for inactive people in engaging in physical activity during the COVID-19 pandemic recovery.

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The ongoing Coronavirus disease (COVID-19) was declared a pandemic on the 11th March 2020 by the World Health Organisation. The COVID-19 pandemic has had an effect on the everyday lives of individuals through measures to stop the spread of the disease. One of the consequences of these measures has been a decrease in physical activity levels since the declaration of the pandemic, as denoted by Sport England's Active Lives Surveys from 2019 to 2021. The aim of this study was to identify the barriers and facilitators of how the COVID-19 pandemic is affecting the ability of inactive people to engage in physical activity. In doing so, the results could be used within the leisure industry to help inactive people become more active. This research had an exploratory design with future research recommended to keep abreast of the evolving nature of understanding COVID-19. Members of the public (N=35) who were aged between 18-65 years and deemed physically inactive completed two online questionnaires: The International Physical Activity Questionnaire Short Form (Craig et al., 2003) and the COM Questionnaire (Keyworth et al., 2020), with additional open-ended questions added to the COM Questionnaire that allowed triangulation of the data. With institutional ethics approval, reflexive thematic analysis was used to analyse the data which was guided from a deductive perspective by the COM-B model (Michie et al., 2011). This study identified the facilitators and barriers for inactive people which were then linked to behaviour change techniques (BCTs) to facilitate intervention development. Overall, 17 facilitators and 18 barriers were identified. Participants highlighted the importance of facilitators such as having the necessary knowledge, available opportunities and relationship support. COVID-19 was denoted as a barrier faced by inactive people as well as not having the necessary knowledge or opportunities. These could be minimised through appropriate BCTs of "shaping knowledge" and "restructuring the physical environment". Findings from this study highlight the importance of the social and environmental factors in enabling physical activity participation for inactive people. Tackling physical inactivity is a key priority of the UK's executive agencies including Public Health England. COVID-19 has provided added difficulty in engaging inactive people into physical activity with the UK's executive agencies recommended to consider environmental restructuring if physical inactivity levels are to be reversed.

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B18 – The effects of psychological skills training during novices' learning of a motor skill on subsequent performance under pressure.

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Why do some individuals remain composed within high stress environments, whereas others choke under pressure? Whilst this has been widely researched in sporting and performance contexts and appears prevalent, as stated by Vickers and Williams (2007). Recently researchers, such as the likes of Mesagno and Beckmann (2017), have explored methods of avoiding performance deterioration under pressure. Interest has focused on the learning environment where skills are developed prior to performance under pressure, including the use of different practice conditions (e.g., level of pressure), instructions (e.g., implicit learning, analogy learning) and perceptual interventions (e.g., quiet eye). However, whilst psychological skills have been shown to be important for elevating choking under pressure (e.g., pre-performance routines and imagery), little is known about how they can be developed whilst concurrently learning a motor skill. Therefore, the aim of the present study was to assess whether the application of psychological skills training (PST) during novices' learning of a motor skill can benefit performance under pressure. Novice speed cup stackers with no prior psychological skills training or sport psychology experience were randomly assigned to either an Imagery, Reflective Practice or Control group. Individuals practiced a 3-6-3 cup stacking task (8 blocks of 5 stacks) whilst also completing Imagery (guided PETTLEP imagery), Reflection (post-task guided reflection) or no intervention during the inter-block period. Participants were then required 24 to 48 hours after practice, to complete retention and pressure tests. Anxiety, heart rate, movement time, and mental readiness were measured throughout the retention and pressure tasks. Pressure was induced during the pressure trial through a combination of social evaluation, social threat, prize incentive and deception (Gröpel and Mesagno 2019), found these to be reliable means of inducing pressure. The following hypotheses were tested: during the pressure test the Imagery and Reflective practice groups would maintain or improve their average cup stacking time, heart rate, movement time and mental readiness scores compared to the retention test. Whereas the control group would alternatively suffer a decline in performance. The final results of the study are pending completion.

B19 – The effect of coaches' encouragement and criticism on elite youth players' physical performance in small-sided-games.

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Small-sided games (SSGs) have been widely adopted in football to develop players. Coach behaviour within SSGs affects players' physiological responses. Previous studies have proven that players exercised at a higher intensity in SSGs with coach encouragement compared to those without. However, the majority of these studies only investigated the internal load, and the findings for the external load were inconsistent. Furthermore, those studies only compared active-coaching SSG to passive-coaching SSG. Also, no study has investigated coaches' criticism. Therefore, the present study aimed to examine the effect of different levels of coach encouragement and criticism on youth players' running performance in SSGs. Two teams (U13s and U16s) from a Premier League academy played four SSGs each. In random order, their coaches delivered four different coaching styles: normal coaching (NC), low-positive (LP), high-positive (HP) and high-negative (HN). The behaviours of coaches were audio-recorded, analysed using hand notation and computer software, and presented in repetitions per minute (RPM). Coach behaviours were significantly different between the 4 conditions ($P < 0.001$), with HP and LP having the highest and lowest RPMs of encouragement, respectively, and HN having the highest RPMs of criticism. Total distance (TD), high-intensity running distance (HIR), sprint distance (SD), max speed (MS), the distance of intense acceleration (IA) and intense deceleration (ID) were quantified using a Global Positioning System (GPS). There were significant main effects for age: U13s had higher TD ($P = 0.04$) and SD ($P < 0.001$) but lower HIR ($P < 0.001$), MS ($P < 0.001$) and IA ($P < 0.001$) compared to U16s. There were no significant effects for coach behaviour on TD, IA, or ID ($P = 0.198$, 0.193, and 0.348, respectively). There were significant main effects for coach behaviour on MS and HIR ($P = 0.005$). Higher MS was found in HP (6.75 ± 0.61 m/s) and HN (6.98 ± 0.56 m/s) than in NC (6.48 ± 0.56 m/s). On HIR, a significant main effect for coach behaviour ($P < 0.001$) and a significant age*coach behaviour interaction ($P < 0.001$) were found. U13s players performed more HIR in HP (43.62 ± 31.5 m) and HN SSGs (4.64 ± 24.06 m) in comparison to NC (22.69 ± 22.8 m) and LP (28.0 ± 1.45 m), however, U16s had more HIR (132.86 ± 37.20 m) in LP than NC (56.90 ± 8.97 m) and HP (68 ± 10.03 m). A significant age*coach behaviour interaction was also found on ID ($P = 0.026$). U13s covered more ID in LP SSGs, whereas U16s delivered more of them in HP. These data suggest that coach behaviour affects physical performance differently between age groups for different training stimulus.

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B20 – Strong mind; self-kind: An Interpretative Phenomenological Analysis exploring male and female elite student-athletes' lived experiences and subsequent perceptions of mental toughness and self-compassion.

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Performance sport predominantly focuses on ameliorating athletic performance and winning (Dwyer et al., 2019). It is suggested that mental toughness enables athletes to "cope better than their opponents with the demands of sport whilst remaining determined, focused, confident and in control under pressure" (Jones, 2002, p.213). In addition, self-compassion has been recognised as providing athletes with a 'psychological edge' and has been conceptualised as connecting with one's own feelings and emotions without judgement and understanding failure as an inherent aspect of humanity whilst taking an active role in alleviating emotional challenges (Neff, 2003). This study used Interpretative Phenomenological Analysis (IPA) to gain a detailed idiographic insight into elite student-athletes' lived experiences and subsequent perceptions of mental toughness and self-compassion in the context of performance sport, with the aim of advancing conceptual understanding. Following institutional ethics approval, six University of Derby students and Team Derby Sports Scholars (three male and three female) were recruited via purposeful sampling and interviewed using a semi-structured format. Following the guided principles of IPA (Smith et al., 2009), analysis of the six transcripts revealed three main themes: 'Utilisation of mental toughness and self-compassion as context-dependent', 'Balancing self-criticism and self-kindness' and, 'Socio-environmental influences on mental toughness and self-compassion. The findings of the present study indicated that mental toughness and self-compassion are both valid psychological constructs in the context of performance sport. Athletes' perceptions and subsequent use of mental toughness and self-compassion differ depending on context, with participants tending to value self-criticism over self-kindness. Athletes holistically understood mental toughness more comprehensively than self-compassion, expressing ambiguity about whether self-compassion is an innate or nurtured construct. Athletes expressed ambivalence about how being compassionate towards others, receiving compassion from others and being compassionate to oneself; the flow of compassion, features in elite sport. Future qualitative studies should consider collecting data from more than six participants to guarantee saturation. Likewise, topics such as the role mindfulness plays in facilitating mental toughness and self-compassion, the impact self-compassion has on athletic identity and the contextual factors that influence mental toughness and self-compassion could be more thoroughly explored. The present study evidenced conceptual differences between athletes' comprehensive understanding of mental toughness compared to self-compassion, potentially reflecting performance narratives in elite sport which favour mental toughness over self-compassion. Future research could explore this, as well as consider interventions that habitualise self-compassion whilst facilitating mental toughness.

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Section C – Sport & Performance

C01 - Coaches' perceptions on the impact of a short-sprint coach education intervention: a mixed-method study.

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Fundamental to the development of high-quality coaching is coach learning. Coach education (CE) is a major part of coach learning and development, specifically at the elite level. While the literature available demonstrated a significant association between coach education and coaching efficacy, surprisingly, evidence is scarce on the impact of coach education programmes (CEPs), specifically in track and field. Therefore, the purpose of this study was to investigate coaches' perceptions of the impact of a formal CE setting designed to promote short-sprint coaches in their coaching practice. With institutional approval, data were collected from eight short-sprint coaches through nonparticipant observations, an evaluation survey within two weeks of their participation in the CE and semi-structured interviews again six months later in order to investigate how coaches developed professional knowledge (skills and practices) as a result of the CEP. Quantitative and qualitative data were analysed using descriptive and thematic analysis respectively. Quantitative results centred around four principal themes; (1) Perceived benefits; (2) Perceived future benefits; (3) Enjoyment; and, (4) Future Plans while qualitative findings resulted in four principal themes; (1) Personal and Professional Knowledge; (2) Coaching Efficacy; (3) Coaching Practice; and, most significantly, (4) the use of the Periodized Training as a way of effectively maximise athlete's performance. Results revealed that coaches gained knowledge through rich learning experiences that were contextually appropriate to their coaching context. The findings indicated that coaches developed knowledge through the rich learning environment that was relevant to their coaching context. Coaches felt more prepared to develop elite athletes' performance as a result of the knowledge gained through the CEP. Combined, these results highlight the importance of providing formal CE that is learner-centred, offers a wide range of learning experiences, and incorporates informal learning concepts into formal learning contexts. For these coaches, deep learning appeared to occur, allowing them to modify, for example, how they approached periodized training. The implications of these findings are a demand for elite CEP to assist practitioners in accepting and living with the complex and anxiety-inducing uncertainty in their roles by providing realistic strategies for dealing with it. Additionally, these findings shed light on how coaches may improve their practices and on how national governing bodies (NGBs) can implement more effective CE practices.

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C02 - Comparing officials' view to see differences in management and development processes between China and Spain.

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This research focuses on Spain and China and compares how basketball is managed and developed in these states by focusing on cultural differences between the countries. The aim is to identify notable differences in how basketball growth is approached in these nations. This study used a mixed-methodologies approach to data collecting, including both qualitative and quantitative methods. In particular, the study was issued by the Ethics Committee of the Polytechnic University of Madrid with DATOS20220629-CACM-Comparativ, which demonstrates that the study meets the ethical requirements. Triangulation was used to combine data from semi-structured interviews with basketball specialists, surveys with basketball players and coaches, and a study of relevant literature. The comments of the interviewees indicated that the Spanish Basketball Federation (FEB) and the Chinese Basketball Association (CBA) approach athlete training, coach evaluation, government assistance, regional development, and talent acquisition in different ways. The data analysis software utilised was a mix of Atlas for qualitative data analysis and SPSS for quantitative data analysis. The qualitative data was evaluated using content analysis to discover themes and patterns in the replies. The literature review was integrated into the methodology to provide a broader understanding of the cultural differences between Spain and China and how they may impact the development and management of basketball. The study's findings indicated several significant variations in basketball management and development between Spain and China. Basketball was discovered to be more professionalised and centralised in Spain, with a major emphasis on player development and conditioning. Basketball in China, on the other hand, was discovered to be more community-based, with a focus on grassroots promotion. The statistics also revealed considerable discrepancies in each country's amount of investment and resources dedicated to basketball, with China investing more in infrastructure and facilities to promote the sport's development. Furthermore, the study indicated disparities in the coaching styles and training methods employed in the two nations, with China emphasising physical training and conditioning and Spain emphasising technical and tactical training. Overall, the findings suggested that cultural differences have a substantial impact on how basketball is handled and developed in these two nations. Thus, while basketball has a strong culture in both Spain and China, the sport is governed and promoted differently in each nation due to cultural differences such as history, customs, and government interests.

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C03 - Marathon pacing: even pacers think differently to those that slow.

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Hitting the wall is an extreme version of slowing in the marathon and runners with an expectation of hitting the wall were more likely to do so (Buman et al., 2008). Therefore, perceptions on pacing may be associated with marathon pacing outcome. However, to date, minimal studies have investigated this relationship. The aim of this analysis was to determine if perceptions on marathon pacing are related to pacing outcome. With institutional ethics approval, 185 participants (45 females, 140 males; age: 42 ± 11 years; marathon race time: 3:25 ± 0:36 h:min) completed an online questionnaire prior to marathon race day. Participants were asked to rate on a scale of 1 to 5 (1 being the least and 5 the most) a series of questions on pacing views. They rated: 1) how flexible they were with pace at the start of the race, 2) how important pacing is to performance, 3) how much control they have in pacing, and 4) how closely linked pacing is to finish time. Split times were extracted from race websites to calculate the percentage difference between the first and second half, termed percent slowing. For analysis, participants were placed into three different groups based on their percent slowing. The groups were: 'even pacers' (−2.5 to 2.5% slowing), 'positive splitters' (>2.5 to <10% slowing) and 'significant slowers' (≥10% slowing). Kruskal-Wallis analyses with pairwise comparisons were conducted to compare the groups on the question scores. There was a main effect of pacing group in pacing flexibility ($P < 0.01$, $^2 = 0.07$) and pacing importance ($P < 0.01$, $^2 = 0.05$), but no main effect of pacing group on pacing control ($P > 0.05$) or pacing link to performance ($P > 0.05$). Even pacers (2.6 ± 1.0) rated their pacing flexibility lower than both positive splitters (3.3 ± 1.2, $P < 0.05$) and significant slowers (3.1 ± 1.1, $P < 0.05$). Furthermore, even pacers (4.6 ± 0.7) rated pacing as more important than positive splitters (4.1 ± 1.0, $P < 0.05$) but not significant slowers (4.5 ± 0.8, $P > 0.05$). The results provide insight into the mindset of runners with even pacing ability, indicating the possibility of improving pacing outcome by changing perceptions on pacing. Runners may wish to consider being disciplined in their speed at the start of the race and ensure they realise the importance of race pacing.

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C04 - An investigation into the effects of pre-cooling on temperature variables throughout a maximal 2 km rowing test.

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The capability of the body to regulate temperature during physical activity plays a significant role in improving performance. When the body heats up it leads to an increased core body temperature, decreasing the body's range in which thermal homeostasis is maintained. This results in a quicker onset of thermal strain. The concept of precooling and, keeping body temperatures low leads to a reduction in lactic acid produced in the muscles, higher blood flow to muscles, and prolonged performance. Therefore, the aims of the current study were to investigate; 1) the effect of precooling via ice vests compared to a standard warm up procedure on heart rate, 2) the impact on core and skin temperature, 3) the impacts of ice vests on power output during rowing. The study received clearance from Durham University's research ethics committee before data collection began. Participants were screened to ensure they met the requirements and provided informed consent. Six competitive male rowers (age, 19.17 ± 1.17 years; height, 187.42 ± 5.36 cm; body mass 82.25 ± 16.59 kg) completed two tests – one control, and one wearing an ice vest. The control test consisted of a 10 min warmup and a 2 km rowing test. The experimental test matched this with an addition of a 10 min stationary period with an ice vest prior to the warmup. Pre and post measures of body mass and core temperature were obtained. Every minute throughout the 2 km protocol heart rate, mean skin temperature, and thermal stress were recorded. The change in heart rate between tests was calculated for the first and last minutes of the rowing protocol. Heart rate values showed a significant increase ($P = 0.013$) across the two tests, a 0.28% and 0.09% increase in the ice vest trial, compared to the control trial. Mean skin temperature showed a significance decrease ($P = 0.002$) across the two tests, a 1.96% and 1.06% decrease in the ice vest trial in minutes 1 and 7 respectively, compared to the control trial. Lower skin temperature and a higher heart rate was evident throughout the 2 km test, therefore demonstrating the potential to improve rowing performance.

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C05 - Effect of acute exercise-thermal dehydration on 3km sprint cycling performance and decision-making.

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Elite road cyclists often train and compete in extreme environments where dehydration is inevitable. The effects of fluid loss on physiological capability and decision-making towards the latter stages of a race are unknown. Therefore, the aim of this study was to examine the effects of acute exercise-induced thermal dehydration on sprint cycling performance and decision-making. Seven male participants (age, 20.00 ± 0.82 years; mass, 79.87 ± 15.64 kg; stature, 1.77 ± 0.05 m) completed three, 30-min stages comprising 25 min cycling at 88 W and a 5-min seated recovery. Participants completed two experimental conditions, euhydrated (E-trial) and dehydrated (D-trial), in a randomised cross-over repeated measures design. The D-trial required participants to wear a plastic sweat suit and resulted in a significant decrease in body mass loss (D-trial, 1.75 ± 0.20%, $P < 0.001$). The E-trial was completed in sports clothing, with both conditions and 3 km TT conducted in a laboratory (21.00 ± 0.50°C). Decision-making was evaluated using a Cued Go/No Go (GNG) task pre and post 90-min intervention (Fillmore, 2003). After 25 min, significant increases ($P = 0.05$) in D-trial physiological and perceptual measures; including heart rate (HR), tympanic temperature (Ttymp), skin temperature (Tskin), ratings of perceived exertion (RPE), thirst, thermal comfort (Tc) and sensation (Ts) were evident. A significant increase in 3 km TT performance time was seen in the D-trial (E-trial, 4.45 ± 0.22 min vs. D-trial, 4.58 ± 0.29 min; $P = 0.033$, Δ2.92%). No significant differences were identified in peak HR (E-trial, 186 ± 13 bpm vs D-trial, 187 ± 14 bpm) and RPE (E-trial, 19.29 ± 1.25 vs D-trial, 19.57 ± 0.79). No significant difference was evident between conditions for the GNG task. In conclusion, this study shows that acute exercise-thermal dehydration leads to impaired cycling performance but has no effect on decision-making.

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C06 - Assessing the influence of social media on university sport participation.

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Regular physical activity is essential for maintaining optimal health and well-being. The largest drop off in physical activity occurs at the time of leaving school and entering university. University students are the largest users of social media with 98% of students regularly online. Inactivity rates are continuing to rise in the UK and studies have shown that increased social media use is associated with reduced physical activity. Previous research has investigated how social media influences university students' academic performances and how social media influences the rising inactivity in children, but limited research has been conducted on how social media influences the amount of sport university students participate in. Therefore, the aim of the study is to help understand how social media has influenced current university students' levels of physical activity in a positive or negative way by identifying common themes and experiences. To achieve this a qualitative approach using focus groups was used. This allowed participants to build on each other's responses allowing for more richer detailed data on student's experiences. Following ethical approval, a purposeful sampling approach was used, and 8 students were recruited and split into 2 focus groups. One focus group was online, the other was face to face and both lasted around 30 minutes. The focus groups were recorded and then transcribed. Thematic analysis was used to analyse the data allowing for exploration and identification of themes and patterns across data. The findings will be organised into themes which could potentially be the role of social media in promoting sports participation, potential addiction and time displacement, the role of social media in creating virtual communities around sports and the impact of social comparison on sports participation. So far students use of time and addiction to social media were identified as a common area of concern when it came to factors negatively impacting sports participation, but it was found that being exposed to social media posts where peers and role models were participating in sport often motivated students to join sports clubs. These results are important as it identifies common areas where students have been positively or negatively impacted by social media. Therefore, future research should focus on how the content people engage with online influences their motivation to take part in sport to further understand if seeing sports related posts online increases physical activity.

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C07 - The science of shinty: a needs analysis and training considerations.

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Little research exists on the sport of shinty other than some historical pieces and injury related studies. Due to this, research from the sport of hurling, shinty's cultural and sporting cousin, was drawn upon. As movement patterns are comparable, and with researchers within hurling having already gathered and analysed fitness testing and GPS data to develop a needs analysis, it would seem logical to produce a similar study for the sport of shinty. To develop a needs analysis for shinty and identifying training considerations, the aims were 1) to distribute a questionnaire to identify the current training practices and uses of technology within shinty, 2) to conduct a battery of field based fitness tests, and 3) to gather GPS match-play data. This study consisted of three parts, with participants (n = 17) recruited for a JISC online questionnaire which was later analysed using a thematic analysis. Participants (n = 48), defenders (n = 19), midfielders (n = 10) and forwards (n = 19) age, 22.73 ± 7.76 years, height 176.3 ± 6.50 cm, weight 74.0 ± 12.65 kg, were recruited for the fitness testing battery from three clubs, with data analysed via a one-way-ANOVA (IBM SPSS v28). The fitness testing battery comprised of hand grip strength, countermovement jump (CMJ), using Optojump Next, 5 and 10 m sprints, 5-0-5 change of direction, all using Witty Microgate system, and a 1,500-metre timed maximal aerobic speed (MAS) run. Finally, GPS match-play data, using STATSports Apex GPS units, was collected over 7 competitive league matches from participants within one club (n = 11) and compared to existing data from hurling. Prior to the study commencing, ethical approval was granted by the University of the Highlands and Islands. The JISC questionnaire results showed that there were a variety of training practices and levels of technology use across the shinty clubs responding. Fitness testing results showed no significant difference between the three positional groups for any of the tests. The results were handgrip left (46 ± 10 kg), handgrip right (47 ± 9 kg), CMJ (35.2 ± 6.3 cm), 5 m sprint (1.1 ± 0.10 s), 10 m sprint (1.91 ± 0.12 s), 5-0-5 (2.12 ± 0.37 s) and MAS (4.13 ± 0.4 m/s). GPS data collection included total distance (8,769 ± 178 m), distance per minute (97 ± 17 m/min), high speed running (413 ± 178 m), high intensity distance (1,222 ± 312 m), maximum speed (7.8 ± 0.5 m/s), sprints (15 ± 6), sprint distance (296 ± 160 m), accelerations (41.9 ± 12.2) and decelerations (41.3 ± 7.9). The findings of this study can be used by clubs to inform the design of training programmes to improve performance while also reducing the likelihood of player injury.

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C08 - An investigation into the ability of sport-specific tests to differentiate between playing levels in volleyball.

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Fitness testing is a popular method of talent identification as it allows a sport's physical demands to be broken down into its key components. Fitness tests have been implemented in more mainstream sports, such as football and rugby, to establish how these demands differ between playing levels. Whilst similar studies have been conducted in volleyball the tests implemented often lack ecological validity, failing to capture the sports-specific movements that occur in volleyball. Fitness tests that have an appreciation for these movements and the complex sport-specific skills performed by volleyball players have been proposed, yet there is a lack of empirical data to demonstrate their validity and reliability. Therefore, the aim of this project was to investigate the ability of volleyball-specific fitness tests in differentiating between volleyball players in two different divisions. Following ethical approval, 12 male volleyball players competing in BUCS Division 1 and Division 3 volunteered to take part in the study. First anthropometric measures were taken. This was then followed by tests that isolated lower body power; squat jump test (cm), countermovement jump test (cm), drop jump test (cm & RSI), spike jump test (cm), block jump test (cm), and the 30 s BOSCO test (number of contacts, mean power (W), average, best and worst jump heights (cm). Following a rest period, the participants performed three tests regarding sport-specific upper body power: standing spike velocity test (km/h), standing spike velocity (km/h) test at the net, and spike velocity test (km/h). The final spike velocity test combines upper and lower body power with contact height (cm) also being recorded. Once the data has been collected all analysis will be conducted through SPSS, with an independent t-test being conducted to establish differences between the two cohorts. Cohen's d effect sizes will also be established using the following boundaries: ≤0.20 = trivial; 0.20–0.60 = small; 0.60–1.20 = moderate; 1.20–2.00 = large; ≥ 2.00 = very large (Hopkins et al., 2009). The relationship between variables will be explored using Pearson's correlations coefficients with the magnitude (r) being determined using the Hopkins Scale (r < 0.1, trivial; 0.1–0.3, small; 0.3–0.5, moderate; 0.5–0.7, large; 0.7–0.9, very large; >0.9, nearly perfect; and 1 perfect; Batterham and Hopkins, 2006). Significance will be set at 0.05. The results of this study are currently pending.

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C09 - Factors influencing marathon performance and pacing outcome.

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The marathon is a popular endurance race with more than 1 million runners participating worldwide each year, of which the majority are recreational. For many runners, marathon pacing is a potential source of performance improvement and individuals showing more even pacing are considered to have superior pacing ability. The aims of the present study were: 1) to demonstrate that marathon pacing has a significant association with race time, and 2) investigate demographic and training variables, and their relationship with marathon pacing outcome. Following institutional ethics approval, 185 participants (45 females, 135 males; age: 42 ± 11 years; marathon race time: 3:24 ± 0:36 h:min) completed an online questionnaire (JISC online surveys) in the four weeks prior to marathon race day. Marathon split times were extracted from race websites for the calculation of marathon pacing outcome, which was the percentage difference between the first and second half, termed percent slowing. Simple linear regression was used to test if percent slowing significantly predicted marathon time. Overall, the regression was statistically significant (R^2 = 0.15, $F_{1,178}$ = 34, P < 0.01) and percent slowing significantly predicted marathon time (P < 0.01). Multiple linear regression was used to test if distance per week and percent slowing significantly predicted marathon finish time; overall the regression was statistically significant (R^2 = 0.54, $F_{2,177}$ = 105, P < 0.01). Distance per week (P < 0.01) and marathon pacing outcome (P < 0.01) independently predicted marathon finish time. A further multiple regression was performed to test if marathon time, sex and distance per week were significant predictors of marathon pacing outcome; the overall regression was statistically significant (R^2 = 0.19, $F_{3,181}$ = 15, P < 0.01). Sex (P < 0.01) and marathon finish time (P < 0.01) independently predicted marathon pacing outcome. However, distance per week did not independently predict marathon pacing outcome (P = 0.180). Results indicate that marathon pacing is an important predictor of finish time and should be considered to optimise performance. Males and slower runners in particular, should recognise they are at greater risk of slowing and pay attention to pacing. Increasing running distance per week in training may improve marathon time by improving endurance capacity, rather than pacing outcome *per se.*

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C10 - Energy availability and bone mineral density in an endurance athlete population.

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A mismatch between energy intake and expenditure leads to Low Energy Availability (LEA) which, if sustained, can result in Relative Energy Deficiency Syndrome (RED-S). This is a complex syndrome characterised by performance and health impairments, including poor bone health, menstrual disturbances, decreased immune function, low mood, and an increased risk of injury. RED-S can occur in any sport or activity with high energy expenditures and is most common in endurance sports. This study aimed to identify the prevalence of athletes with self-reported LEA (though validated questionnaires), low bone mineral density (BMD) and psychological stress in an endurance athlete population. Athletes from clubs, athlete forums, and performance centres were invited to participate in the study. Fifty-five endurance athletes (23 females: 45 ± 12 years, 23.91 ± 3.76 kg/m^{2}and 32 males: 43 ± 13 years 27.74 ± 17.40 kg/m^2) predominantly of club standard or competitive age-group athletes, volunteered to participate in the study. In a cross-sectional design, participants completed a series of questionnaires, including the LEAF-Q or an adapted low energy availability in males questionnaire (LEAM-Q) and Athlete psychological strain questionnaire (APSQ), together with a lumbar BMD dual energy X-ray absorptiometry (DEXA) scan. Results showed that 56.3% of male and 73.9% of female participants were considered 'high risk' of RED-s as determined by the LEAF-Q or LEAM-Q. Assessment of lumbar BMD z-score revealed 31.3% of male participants and 8.7% of female participants 'had low BMD (z-score <1), a symptom of RED-s'. A chi-square test for association in different genders found no statistically significant association between LEAF/LEAM-Q score and BMD. A Spearman's rank-order showed a correlation between BMD and psychological strain in females (R^2 =0.458, P 0 < 0.001) and in males (R^2 = 0.477, P 0 < 0.001). There was a high prevalence of endurance athletes with a LEAF/LEAM-Q score that indicated a high risk of RED-s of this study. There was, however, no association between athletes identified as at high risk of RED-s though LEAF-LEAM-Q and athletes with low-BMD indicating that these are not identifying the same athletes. There was a significant correlation between BMD and psychological strain, both symptoms of RED-s. It is possible that LEAF-Q and LEAM-Q do not correctly identify individuals at risk of RED-s in a general endurance athlete population.

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C11 – A split decision based on vision: an empirical approach to classify athletes with a vision impairment competing in short-distance track athletics.

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The aim of this study was three fold, with exploring the profile of athletes with a vision impairment (VI), investigating the relationship of monocular visual acuity (VA), and sprinting performance and establishing the optimal cut-off point(s) between classes in a new, evidence-based classification system in short-distance track athletics for VI athletes. Data of VI athletes, including ocular pathology, sex, age, nationality, sport class, monocular VA and running performance (100 m, 200 m, and 400 m race times in seconds) was collected through the IPC Sport Data Management System (ISDMS). Correlations were conducted to investigate the relationship between VA and sprinting performance. Decision tree analyses were used to determine if the data supported splitting short-distance track - athletics for VI athletes into more than one sport class, and if so, what the optimal cut-off point(s) between these classes should be. VA was significantly associated with 100 m, 200 m, and 400 m race times ($R = 0.26$, $P < 0.001$; $R = 0.26$, $P < 0.001$; $R = 0.24$, $P < 0.001$; respectively). Decision tree analysis suggested to split the data into two groups with a VA cut-off of 2.1 logMAR. However, different cut-off points were suggested when analysing the data according to sex, with a VA cut-off of 2.6 logMAR for male VI athletes and 2.1 logMAR for female VI athletes. Stability assessment using bootstrap sampling suggested a split into two groups but showed considerable variability in the cut-off point between 2.1 and 3.2 logMAR across the three distances. A two-class system with a separation based on VA with a suggested cut-off point between 2.1 and 3.5 logMAR would provide legitimate competition for athletes with VI in shortdistance track athletics. Yet, other visual functions should be included in future research and consultations from a multidisciplinary perspective might prove critical to establish the most legitimate way to structure classification in VI athletics.

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C12 - How can parent-coaches hinder or nurture youth athlete development?

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Within the last decade, parents have become increasingly involved in their children's athletic journeys with past research highlighting 90% of coaches in youth sport are parents (Kerins, Fernandez and Shinew, 2017). This increase of involvement is suggested to come from the rise in competition for athletic scholarships and the additional draw towards professional sports with parents wanting to coach their own child to this (Cumming & Ewing, 2002). Although numbers of parent-coaches are high, there is a dearth of research within this field which has led to indicate that the role has yet to be fully outlined and understood. Past research has highlighted the effects of the parent-coach could be both negative and positive. Suggesting the effects of the parent-coach on their child athlete's development has yet to be fully concluded in wider detail. With the aim of investigating how parent-coaches could hinder or nurture youth athlete development, a qualitative research approach was undertaken after receiving ethical approval. Three parent-coaches were selected (Judy Murray, Earl Woods, and Richard Williams) after fitting the selection criteria of being a parent-coach who has coached their child-athlete who has been successful in their respected sport. Suggesting their impact was a positive one towards nurturing their development into a successful career. Using Dialogical Narrative Analysis (DNA) following Frank (2012) steps in order to create collective stories from the narratives of the three parent-coaches. Five collective themes were formed: 'Becoming the parent-coach', 'Committed to the child or the sport', 'Knowing the child best', 'Providing a nurturing environment', and 'The blurred line between the dual role of the parent-coach'. Findings have indicated alignment between past research and the current study. Concluding ways in which parent coaches can nurture their child-athlete's development. Key themes such commitment are highlighted as heavy influencers that could either hinder or nurture the child athlete development depending on the approach undertaken by the parent-coach. This research hopes to present ways parent-coaches can conduct their coaching and ways to handle their dual role in order to nurture their child-athlete's development and additionally leave room for future research to take place to open up this currently lightly researched field.

C13 - The effect of 4-weeks CrossFit training on strength and markers of health in females.

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The American College of Sport Medicine (ACSM) recommends 150 minutes of moderate intensity exercise or 75 minutes of vigorous-intensity exercise, combined with two resistance training sessions per week. Adhering to these physical activity guidelines is associated with a reduction in the prevalence of cardiovascular diseases, including, atherosclerosis, heart attacks, stroke, and high blood pressure, and thus, a reduced financial burden on the national health service. Despite the known benefits of regular physical activity, the World Health Organisation report that 27% of adults do not meet recommended physical activity guidelines. CrossFit is a structured strength and conditioning exercise class involving high intensity functional movements which provides a fun, unique, and varied training environment that can be adapted for a range of fitness and experiences levels, which is suggested to promote positive changes in exercise adherence. The purpose of this study is to investigate the effect of CrossFit training on markers of moody, health, strength, and exercise adherence. Seven females (age: 23 ± 4 years; weight: 64 ± 9 kg; height: 167 ± 1 cm; BMI: 23 ± 2 kg·m^2; routine training volume: 1.3 ± 0.5 hrs/wk) completed 4-weeks of CrossFit Training. Measurements of mood state, body fat percentage, resting heart rate, strength, and CrossFit specific work capacity were collected pre- and post-intervention. All seven participants complete the three CrossFit sessions each week for 4-weeks, increasing their routine training from 1 hr/week to 5 hr/ week. CrossFit reduced body fat percentage (pre: 20.9 ± 1.8% vs. post: 20.6 ± 1.7%; P = 0.007), resting heart rate (pre: 61 ± 8 bpm vs. post: 59 ± 7 bpm P = 0.01), and increased lower body strength (pre: 73 ± 15 kg vs. post: 71 ± 15 kg; P = 0.003). There were no differences in measure of mood state, upper body strength, and CrossFit work capacity (P > 0.05). Females looking to reduce their body fat percentage, markers of health including resting heart rate, and increase their body strength should consider CrossFit training, which supports positive changes in exercise adherence.

C14 - Periodisation for Triple Jump: current approaches to Triple Jump training in the UK.

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The purpose of this study was to identify (a) the different methods coaches use to train Triple Jump and (b) their understanding of periodisation in Track & Field athletics. Research within periodisation for Triple Jump is very limited and lacks specificity in this field – most studies have looked at general Track and Field practices, without the specificity to triple jump. The objective was to use qualitative and quantitative survey questions allowing coaches to express different methodologies used for the area of their expertise. Inclusion criteria for the participants – coaching Triple Jump at least 2 times per week. Twenty UK-based coaches were recruited via snowball sampling. Survey questions included a question about coaches' experience in years and the level of athletes they coach to give a better insight to the methodologies used to train. Open questions about their approach with prompts were used to support coaches with their answers, and a question about periodisation involved to see the understanding. Results (expected). Some coaches use periodisation in their practice without the knowledge of different literature and resources available online. Most of the coaches that train athletes in higher levels of performance have a good understanding of periodisation and different application methods. Overall knowledge about the periodisation in Triple Jump is lacking and should be looked at for further investigation. A lot of coaches use their knowledge from their experiences in sport and previous coaches that they have come across, without considering literature and other evidence-based approaches. Athletics coach education programmes and higher education institutions could be prompted to add greater emphasis to periodisation within the field.

C15 - From the Boat Race to the Boat Races: the Oxford-Cambridge University Women's Boat Race and Media Framing.

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The Oxford-Cambridge University Women's boat race was held on the Thames in London in 2015, alongside the men's race, marking the first time in its 78-year history that "the boat race" became "the boat races." However, there is limited documentation of the Women's University Boat Race's evolution, and no research has been conducted on media coverage of the event, including messages, framing, and representations of female athletes. Media framing emphasises certain aspects of an event to help the audience make sense of it, and this study aims to examine how the media framed the events surrounding the creation of the boat races from 2011 to 2015. News frame analysis is a research method that examines how news media portrays certain events or issues. In this study, news frame analysis (Linstrom & Marais, 2012) was applied to a data set of 177 newspaper articles covering the creation of the Women's University Boat Races from 2011 to 2015. The method involved several stages, including the systematic selection of articles, coding the data for themes related to how the media framed the athletes and events, analysing the coded data to identify frames, and interpreting the results. Five frames were identified: "progress," "human-interest," "powerlessness," "economic impact," and "history." The results of the study suggest that media reporting aimed to educate the public about institutional change and the importance of women's participation in rowing. The study found that the creation of the Women's University Boat Races and the entrance of female rowers onto the same course as the men in 2015 received increased media attention. While it is encouraging to hear about the legacy of the boat races and the history of the women's boat race, the study also identified areas where the media could improve its coverage of women's sports. By promoting and supporting female athletes during significant institutional changes and accurately representing women's participation in sports, the media can help increase the visibility of women's sports and create a more inclusive sporting culture. This study highlights the need for better reporting practices to ensure accurate representation of women's participation in sports and advocates for enhanced promotion and support of female athletes during momentous sporting events.

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C16 - Can an isometric mid-thigh pull induce a post-activation potentiation in the power clean?

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The practice of utilising near maximal efforts (>80%) in concentric exercises such as the squat and deadlift has been shown to increase the force of subsequent muscular contractions, this phenomenon is known as post-activation potentiation (PAP). Some studies have shown that maximal isometric exercises may also produce a PAP effect (Rixon, Lamont, & Bemben. 2007). In many sports such as athletics, coaches may aim to use PAP to improve performance in events such as sprinting or jumping by coaching their athletes to complete a heavy squat or deadlift a few minutes prior to a competition event (Haff & Triplett, 2015). In the sport of weightlifting, athletes take three attempts to lift the heaviest weight possible in the snatch and clean & jerk, coaches in this sport may often prescribe derivative movements such as pulls between attempts to keep athletes warm. It may therefore be possible to use the principles of PAP, to use a derivative of the weightlifting movements such as an isometric mid-thigh pull (IMTP) an exercise whereby an athlete attempts to lift a barbell that is fixed in position at the mid-point of the thigh, such that it is immovable, even when maximal force is applied by an athlete, to improve competition performance, whilst maintaining an athlete's readiness between attempts. Accordingly, the aims of this study were: 1) to determine if an IMTP preceding a power clean increases impulse, and 2) to determine if an IMTP preceding a power clean increases peak force, either of these measures may imply that a PAP has taken place. After receiving ethical approval from the Faculty of Science & Engineering ethics panel, six recreationally competitive athletes (N=3 Male, N=3 Female), completed two testing sessions. During the first session athletes were required to perform three power cleans at 90% 1RM on an in-ground force plate, with five minutes of rest between attempts. During the second session, athletes were required to perform three power cleans at 90% 1RM, before each attempt athletes performed an IMTP against a fixed barbell, then athletes were given five minutes rest before completing their attempt in the power clean. No significant ($P > 0.05$) increases in impulse were observed. No significant ($P > 0.05$) increases in peak force were observed, although some individual responses showed increases in all three variables. The results of this study support the ideas from previous research, that responses to PAP are individualised, and that fatigue resulting from maximal effort isometric exercises may offset any benefits of PAP.

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C17 - Post-Activation Performance Enhancement on Rear-Hand Punching Performance.

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Post-activation Performance Enhancement (PAPE) has been extensively explored and shown to transiently enhance muscular maximal voluntary strength, power, and speed following a conditioning activity (CA), such as heavy resistance exercise (HRE) and/or plyometric exercise (PLYO). Whilst its application has been explored in numerous sporting activities, there is a paucity of literature which utilises PAPE in Martial Arts, especially in straight punching performance. This investigation aims to determine whether Counter-Movement Jump Height (CMJH) and Landmine Punch Throw Test (LPTT) Punching Velocity (PV) can be enhanced if preceded by HRE or PLYO and if there are discrepancies in this effect between a stronger and a weaker population. Seven males and one female (age 24 ± 4.9 years, height 177.9 ± 6.8 cm, weight 82.7 ± 15.6 kg) volunteered to participate in this study. Participants visited the gym on four separate days (minimum of 48-hours apart). The initial session involved fitness testing (3RM Back Squat, Individual Drop-Jump Height Determination, Anthropometric Data) and familiarisation with testing procedures. Participants were then randomly assigned and crossed over between a Control (CON), HRE and PLYO group for the following sessions. CAs included are as follows; CON: No CAs, HRE: 3 repetitions of 95% 3-RM Squat, PLYO: 2 sets of 5 Drop-Jumps from an individualised height with 90 seconds of rest between sets. CMJH and LPTT PV for the rear hand were collected 4, 8, and 12 minutes following the CA intervention. Prior to data analysis, participants were then divided into stronger (SG; N=4; 3-RM >1.33 kg/BW) and weaker (WG; N=4; <1.32 kg/BW) groups based off the average of 3-RM Squat results of the entire cohort. Three separated repeated measures Three-Way ANOVA's with Bonferroni Corrected Pairwise Post-Hoc Tests will then be performed to determine main effects and interactions between group (SG and WG) x condition (CON, HRE, and PLYO) x time (Post 4, 8, and 12 minutes). It's predicted that both CMJH and LPTT PV will be increased across all time intervals in the HRE and PLYO groups compared to the CON. Additionally, a more pronounced increase is expected in SG compared to WG.

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C18 - The effects of concurrent mixed-modality strength training on running economy in master club-level marathon runners.

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Master endurance runners represent a unique athletic population, who must contend with numerous age-related maladaptation's including architectural and morphological muscle declines, that negatively affect their strength-generating capabilities. Inevitably, any loss in power-generating capacity results in an elevated metabolic cost during sustained running performance reducing an athlete's running economy (RE). To date, research demonstrates RE to be a highly trainable parameter, particularly following short-duration concurrent strength training interventions in elite and younger populations. However, an observable gap with respect to the efficacy of concurrent strength training in master endurance athletes remains (Blagrove, Howatson, and Hayes, 2018). Accordingly, the aim of this study was to assess the effects of an 8-week concurrent mix-modality strength training intervention on the RE of club-level master marathoners. With institutional ethics approval, 7 females and 5 males (46.3 ± 6.3 years, height; 1.7 ± 0.1 m, body mass; 65.5 ± 6.2 kg, maximal oxygen consumption [$\dot{V}O_{2max}$]; 4.96 ± 6.2 L·min^{-1}), currently competing in marathon running events, were randomly allocated to a strength (STG n = 7) or control group (CG n = 5). STG performed a concurrent supervised mixed-mode strength training intervention, 3·wk-1 for 8 weeks, whilst CG maintained normal run training only. Pre- and post-measurements of oxygen consumption, jump performance and leg stiffness (kleg) were measured to assess RE, $\dot{V}O_{2max}$, neuromuscular lower-limb strength, and stiffness values, respectively. Test protocols measured RE on a treadmill, at 3 separate running speeds, denoted participant's marathon pace (MP), and ± 1 km^{-1} above (ABMP) and below (BWMP) MP. Blood lactate measures confirmed submaximal work rates on completion of each 5-minute stage, with oxygen uptake values continuously measured via metabolic analysis. Participants' $\dot{V}O_{2max}$ values were obtained via treadmill running at participants' MP with incline increases (1%) every minute until volition. Neuromuscular strength parameters were obtained from countermovement (CMJ) and stiffness (STIF) jumps utilising an optoelectronic system (OptoJump System) with kleg values calculated utilising the Sine-Wave method (Morin et al., 2005). The 8-week training intervention induced significant ($P < 0.037$) decreases in RE for STG at MP (−10.4 ± 5.9%, ES: 0.9) and ABMP (−15.6 ± 6.8%, ES: 0.6) running speeds. Furthermore, significant ($P = 0.012$, ES: 0.4) increases in CMJ (+9.8 ± 0.2%) and STIF (+14.9 ± 6.3%) performance were found for STG. These results suggest that mixed-modality strength training can attenuate age-related neuromuscular strength declines in Master marathoners, eliciting subsequent improvements in RE.

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C19 - The effect of cooling strategies on intermittent and team-sport exercise in the heat: a systematic review and meta-analysis.

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Team-sports encompass an intermittent exercise pattern, meaning that high intensity efforts are interspersed between periods of sub-maximal exercise. During intermittent exercise, fatigue is accelerated within hot/humid environments compared to temperate conditions, due to increases in both body temperatures and perceived thermal strain. A practical strategy to combat this thermal strain is cooling prior to (e.g. pre-cooling) and or during a break (e.g. per-cooling) in exercise. The aim was to examine the previous literature that focused upon the effect of different modalities and timings of cooling during intermittent exercise in the heat, upon physical performance, physiological and perceptual responses. The current study was approved (2021ISPAR005) by the ethical committee at the University of Bedfordshire. The study search of 42 search terms found 30 studies that met the inclusion criteria. These studies included 50 different cooling trials in a randomised control trial design within a hot environment (>25°C), during a laboratory or field-based intermittent/team-sport protocol. Physical performance outcomes, core and skin temperature and thermal sensation responses were extracted. Cooling strategies were categorised as external (n = 20), internal (n = 8), or mixed method (n = 22). Mixed method cooling was further categorised as two or more external cooling modalities (n = 13) or external and internal cooling combined (n = 9). Also grouped into pre- (n = 14) and per-cooling (n = 15) or the combination of the two (n = 21). Weighted-mean effect sizes (Hedges' g), and significance ($P < 0.05$) between subgroups were calculated. The overall cooling effect of all trials improved physical performance outcomes by a small effect ($g = 0.25$, $P < 0.01$), coinciding with a significant moderate decrease in thermal sensation and skin temperature ($g = 0.57$ and 0.72, $P < 0.01$). Mixed-method (external only) cooling ($g = 0.37$-0.45, $P < 0.05$) saw the largest significant improvements in physical performance as a result of a moderate to large significant decrease in both core and skin temperature ($g = 0.51$ and $g = 1.17$, $P < 0.01$), and thermal sensation ($g = 1.14$, $P < 0.01$). The singular use of pre-cooling ($g = 0.09$-0.27) or per-cooling ($g = 0.11$-0.14) had similar trivial to small effects upon physical performance, but the combination of the two caused significant improvements ($g = 0.31$-0.43, $P < 0.01$). To conclude, a mixed-method (external only) strategy applied both prior and during exercise augmented physical performance and reduced thermal strain by the largest effect, compared to other modalities and timings. As such, it is recommended that multiple external cooling strategies covering a large surface-area of the skin should be prescribed during the opportunities practitioners have with team-sport players during competition in the heat (e.g., players downtime, team talk, half-time).

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C20 - Coach and athlete perceptions of periodized strength and conditioning for short-sprinters.

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Athletes' training plans are periodized by coaches in order to develop the various conditioning components required for the sport (Kamandulis et al., 2012). Little research has been conducted on the perceptions of coaches and athletes associated with these programmes, causing a gap in the literature. Therefore, this study aimed to assess coach and athlete perceptions of a periodized strength and conditioning (PSC) programme for track and field short-sprint athletes during a 24-week periodized training programme. With institutional approval, ten short-sprint athletes and six of their coaches, who participated in PSC training, answered the longitudinal questionnaires on five separate occasions at the beginning and the end of each training phase (mesocycle). Both the athletes' and coaches' questionnaires were considered reliable since Cronbach's alpha coefficient for all the variables was above the cutoff value of 0.7. PCA revealed 2 and 4-component models for athletes' and coaches' perceptions with eigenvalues over 1, explaining 44% and 15% of the total variance, respectively. Statistical differences between the pre and all other time points were noted for athletes' perceptions of the PSC programme's influence on overall performance, skill, strength, speed, power, and understanding of the PSC monitoring protocols. Coaches' perceptions were statistically different from pre to post-mesocycles for all variables. The questionnaire revealed that perceptions of overall performance are influenced by perceptions of strength, skill, power, and speed. The second showed that aerobic and anaerobic endurance and speed are all highly correlated. Finally, the third revealed that athletes' understanding of the PSC programme increased with the return of data. Overall, perceptions of the PSC programme's ability to influence the components assessed by the questionnaire were positive, ranging from no different to much better for coaches and athletes. This study indicates that the PSC programme is a fully applicable method for short-sprint athletes. In conclusion, the PSC programme for short-sprint athletes seems to be a beneficial model for enhancing athletes' and coaches' perceptions of certain aspects of performance.

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C21 - A comparison of football substitutes performance effort and perception of their effort.

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Substitutes are used in football for a range of reasons. It is acceptable to assume that coaches may want their players to have the greatest impact possible when they enter the pitch. However, football players have often been found to experience a range of negative emotions when selected as a substitute. These negative emotions have been found to have a significant effect on players performance. However, when research has looked at the effect of substitutes performance in comparison to players who start the match they have found mixed responses, both positive and negative for the effect on running statistics. With the statistics investigated (high intensity running [HIR] and total distance [TD]) being often used to indicate a player's effort. Effort being a key factor in a good performance. Therefore, this study compared substitutes performance effort and perception of effort. A team of 31 players within a football and education team were asked their rate of perceived exertion (RPE) as well as having their TD and HIR recorded using FIFA accredited OHCOACH software for a full match. The results were recorded over 5 matches (4 league games, 1 cup game). The players were then split into 3 categories (Full match, substituted off and substituted on). The results are pending.

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C22 - Player Load: the impact of opposition quality at the 2022 Commonwealth Games on external workload in Netball.

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The purpose was to investigate the relationship between standard of opposition and measures of external workload in an international female netball team. Twelve international female netball athletes had their external workload measured at the Commonwealth Games 2022, in Birmingham. The twelve international players competed in six matches across the 2022 Commonwealth Games in Birmingham. PlayerLoad (which encapsulate velocity, acceleration, and change of direction experienced by the players) was recorded for each player during the competition. Measures of absolute PlayerLoad were then calculated and analysed to provide absolute PlayerLoad against each opposition and absolute PlayerLoad for each positional group (midcourters, defenders, and goalers) for the entirety of the competition. Relationships between external workload and oppositional standard and positional grouping were established. ANOVA revealed no absolute PlayerLoad differences, likely due to changes in the standard of opposition. External workload measures were as follows; Jamaica (128.7 ± 31.4 a.u.), Australia (127.2 ± 28.6 a.u.), South Africa (126.2 ± 23.1 a.u.), Barbados (120.3 ± 29.0) and Malawi (114.5 ± 22.4 a.u.) ($p = 0.962$). On the other hand, differences in absolute PlayerLoad (a.u.) were seen across positional groups, defenders (126.9 ± 7.5 a.u.), midcourters (148.3 ± 8.0 a.u.) and goalers (95.0 ± 5.0 a.u.). External workload measures of absolute PlayerLoad (a.u.) remain consistent despite changes in opposition within international netball, as highlighted through analysis from the 2022 Commonwealth Games. Absolute PlayerLoad measures vary across positional groups, highlighting differences in netball-based demands for each position. Taken with the existing literature this study concluded that, PlayerLoad is a good tool to monitor overall external workload volumes across positions and during competition. Physical preparation considerations before all matches can be approached similarly, however positional considerations on load management before competition must be considered. Therefore, the results provide further support for specificity in recovery and training considerations for each position.

Section D - Biomechanics & Motor Control

D01 - Effects of exercise on electroencephalography-recorded neural oscillations: a systematic review.

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Research into the effects of exercise on cortical activity has proliferated in recent years, with a predominant focus on the technique of electroencephalography (EEG). This technique has been deemed suitable for studies that explore human movement due to recent technological advancements. There is a clear gap in the literature that pertains to how EEG-recorded cortical oscillatory activity is affected by exercise. Accordingly, this review aimed to summarise studies that used EEG to investigate the effects of exercise on brain activity. This was a systematic review of 47 studies that was prepared in accord with PRISMA guidelines. Articles were searched using Google Scholar, Medline, PsycINFO, PubMed, and SPORTDiscus for the period 1 January 1986–31 March 2022 using the search terms: 'EEG OR Electroencephalogram OR Electroencephalography' AND 'exercise OR physical activity' AND 'oscillation'. A manual search of the references sections of the initially retrieved articles (n = 50) was also conducted, resulting in an additional 31 studies (n = 81). Of the 81 studies, five were duplicates, leading to the screening of titles and abstracts of 76 studies, of which 29 were removed for not meeting the inclusion criteria. The remaining 47 studies were included in the review. A MicrosoftTM Excel spreadsheet was used to extract the following informational elements from the retrieved studies: published year, number of participants, sex of participants, mean age, study design, intervention type (physical exercise type, intensity, duration), EEG paradigm (data processing and analysis method, number of electrodes used, artefact correction method), and main results. The studies were then categorised as follows: (a) pre- vs. post-exercise condition (n = 37); (b) pre-/post- vs. during-exercise condition (n = 15); (c) comparisons among different exercise intensities (n = 43); (d) exercise vs. control group (n = 6). Overall, the results were equivocal in nature, with the exception that activity in the alpha and beta frequency bands increased both during and after exercise across the frontal, central, and limbic regions. The reported increases could be attributed to a variety of neural processes, such as neuro-connectivity, cortical inhibition, and sensory feedback loops. Future researchers need to afford careful consideration to exercise parameters (e.g. mode of exercise, intensity, and duration) to assist their interpretation of experimental data. The existing findings support the notion that exercise alters alpha and beta neural oscillations; nonetheless, further work is needed to advance the understanding of the brain processes that occur during exercise.

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D02 - The effects of simulated vision loss on futsal penalty kick performance.

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Vision is a crucial contributor to optimal sporting performance as it allows the identification and processing of critical visual cues, enabling an individual to plan and action appropriate motor responses. Research is yet to examine performance determinants and how they influence the performance footballers with visual impairment (VI). Current VI classifications do not comply with the paralympic committee's classification code, as these are not sport-specific or evidence-based. The aim of the study was to gain an understanding of the impairment-performance relationship between penalty kick (PK) performance and VI. 25 recreational footballers (aged 22 ± 3 years) with normal or corrected to normal vision gave written informed consent following ethical approval from the research ethics panel at Anglia Ruskin University. Visual acuity (VA) and contrast sensitivity (CS) were recorded for habitual vision, impairment level 1-6 (reduced VA/CS). Level 7 simulated reduced visual field (VF), 3 penalties were taken per condition. Repeated measure ANOVAs with Partial Eta squared (η^2) effects sizes were calculated to compare PK outcome, initial ball velocity and end ball location. Post hoc analysis consisted of Bonferroni corrected p-value and Cohen's d effect size were used. PK outcome reported a main effect ($P = 0.006$, $\eta^2 = 0.110$), post hoc analysis revealed that fewer goals were scored at level 6 ($P = 0.026$, $d = -0.693$) and level 7 ($P = 0.015$, $d = -0.729$) compared to habitual vision. Initial ball velocity was lower at level 5 ($P < 0.001$, $d = 1.016$), 6 ($P < 0.001$, $d = 1.030$) and 7 ($P = 0.035$, $d = 0.656$) compared to habitual vision. This difference accounted for a 12% reduction at level 5/6 and a 6% reduction at level 7. Ball placement analysis indicated that participants shot significantly closer to the centre of the goal within level 6 (42%, $P = 0.004$, $d = 0.784$) and 7 (34%, $P = 0.048$, $d = 0.637$) compared to level 1. These findings indicate that despite simulated binocular VI, PK performance could be maintained at lower levels of impairment; this consistent with previous sporting literature (golf/cricket/basketball). Thus, indicating that participants were able to neuro-perceptually adapt and extract sufficient visual information to preserve outcome. PK performance was maintained past the point of the current minimum impairment criteria implemented for VI football classifications. However, enhanced binocular blur significantly reduced PK outcome, ball velocity and ball placement. Larger levels of binocular blur caused participants to employ a cautious strategy resulting in a reduction of goals scored, participants performed 45% worse when comparing level 6 and 7 to habitual vision.

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D03 - Interrater and intra-rater reliability of the Trendelenburg test.

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The Trendelenburg test (TT) is a clinical special test used to identify hip dysfunction (Hardcastle & Nade, 1985). When used in a battery of tests the TT can facilitate diagnosis of several forms of hip dysfunction, however, the reliability of the TT is still unknown. The purpose of this study was to investigate the interrater and intra-rater reliability of the TT. Twelve raters (BSc Sports Rehabilitation and Conditioning students) varying between 0 and 55 hours of Sports Injury and Rehabilitation Clinic (BASRaT accredited) experience were used to review digital photographs of 40 participants performing the TT. Digital photographs were allocated in a randomised order and raters were asked to score TT either 0 (positive) or 1 (negative). Each rater reviewed each photograph on two separate testing sessions, two weeks apart. Interrater reliability was computed between the twelve raters during each test session (TS) whilst intra-rater reliability was computed across the two sessions between each rater as an individual. The University of Northampton ethics committee granted approval for this study prior to data collection. For intra-rater reliability Cronbach's alpha (C) values for TT ranged from 0.77 to 0.93, demonstrating good to very good interrater reliability within the raters. Fleiss kappa (Fκ) statistics for TS one and two revealed a fair level of reliability between the twelve raters (TS1, Fκ = 0.31, P = 0.001; TS2, Fκ = 0.38, P = 0.001) (95% Confidence Intervals). This is the first study to investigate the reliability of the TT. Findings from this study indicate high intra and fair interrater reliability of the TT. Implications owing to this study is the chance to provide clinical practitioners with another reliable test they can confidently incorporate into a battery of tests when attempting to diagnose hip dysfunctions. Further replication studies in experienced clinicians are warranted to confirm the reliability.

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D04 - Understanding sport climbing biomechanics.

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Biomechanical research plays a vital role in both performance enhancement and injury reduction perspective. Despite rock climbing's recent increase in popularity there has been very little research into quantifying full body rock climbing movements with a recent focus on finger/hand and foot biomechanics leading to uncertainty in the biomechanical demands and therefore a lack of literature-based full-body training and injury prevention methods. This study aims to provide an insight into the kinematic demands of sport climbing derived movements in a lab-based setting through the use of inertial measurement units (IMU's). IMU's have been widely used to quantify movement in previously hard to measure sports/ action such as winter and water sports with a high degree of reliability (Camomilla et al., 2018) Twelve experienced climbers of varying climbing ability levels and discipline preference performed a series of climbing specific tests. Each participant performed the tests with 10 Vicon Blue trident IMU's to capture full body kinematics focussing on joint peak angles and ranges of motion (ROM). IMUs were placed on the torso, pelvis upper and lower arms and upper and lower legs. Participants were given two minutes rest between attempts and 10 minutes between tests in order to ensure that fatigue didn't affect their movement characteristics. The tests performed included a two-minute lattice traverse, a double dyno and a power slap, these tests were selected due to their specificity to modern sport climbing and its dynamic nature which provides a different demand on the athlete. The scores or success rate in these tests will be analysed alongside the IMU data in to find kinematic determinants of success and kinematic demands in sport climbing. Following data analysis this research will provide an in-depth analysis of the kinematic demands of rock climbing creating a foundation from which further research can be carried out on a greater population size to optimise climbing training, performance and injury prevention.

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D05 - Mechanical power in an ITF taekwondo side kick: an inter-joint analysis.

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Previous biomechanical studies on taekwondo kicks have investigated force, velocity and energy; however, joint power has not been investigated yet. The aim of this study was to investigate if there is a particular sequence of joint powers in a taekwondo side kick. To the authors' knowledge, this is the first study on joint kinetics in taekwondo, therefore an exploratory, descriptive research design was used. Ethical approval was granted by Cardiff Metropolitan University Research Ethics Committee before data collection commenced. Six participants with 15 to 40 years of experience performed three successful sidekicks. A joint power analysis was conducted on the standing and kicking ankle, knee and hip using force plates and marker-based motion capture. Regarding the standing leg, the ankle peaked first at −1.26 W/kg, then the knee (−1.78 W/kg), followed by the hip (−1.21 W/kg). It has previously been demonstrated that the role of supporting leg is to transfer power from the ground to the supporting hip, to then transfer to the pelvis, resulting in a distal to proximal sequence of negative joint powers. Based on this, instructors could look to see if practitioners' standing knee is flexing sufficiently in other areas of training, such as sparring drills and line work when performing sidekicks as flexing the knee of the standing leg allows its joints to absorb power. Regarding the kicking leg, the hip flexors generated power initially (2.11 W/ kg) whilst the knee extensor moment stayed around zero, then whilst raising from the ground, the knee flexors generated power (4.04 W/kg) whilst the hip extensor moment stayed around zero. The alternating pattern could be due to biarticular muscles which can generate power at one joint and absorb power at the other joint which it crosses. Furthermore, biarticular muscles are responsible for the redistribution of external forces by regulating the distribution of the joint moment. This can be visualised as alternating between the joints which the biarticular muscle crosses. To the authors' knowledge no research has been conducted on the biarticular muscles in martial arts kicks. Therefore, further research is needed to confirm, which could include using EMG's, the role and behaviour of biarticular muscles in martial arts kicks. Instructors should aim to develop capacity to absorb to transfer power distal to proximal in the standing leg, and to develop the hip and knee flexors ability to generate power within the specific movement in the kicking leg.

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D06 - Evaluating smartphone accelerometery data as a valid and reliable alternative to Actigraph technology in measuring human movement.

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Tracking physical activity is an important aspect in many sport science studies that measure health related outcomes, monitoring adherence or management of chronic conditions. Within research contexts this is often measured via motion capture technology or inertial measurement units (IMUs) which are considered the 'gold standard' in capturing biomechanical data. However, this technology is often expensive and limited to a laboratory-based setting, which may limit possible participation as well as reducing ecological validity. As technology develops and smart devices become more ubiquitous, as we move towards a fully connected society via the Internet of Things, this provides interesting and novel approaches to gathering data in different and more accessible ways. This also increases the possibility of research adopting a citizen science approach where the general public can contribute their own data to further research, and to develop 'big data' solutions to creating normative data sets and analysing gait patterns. Previous research studies have evaluated validity and reliability of smartphone accelerometery compared with Vicon motion capture, but the device position (where located on the person) has been fixed within this study. Using smartphone technology to capture data may create issues in terms of phone locations (pocket, bag) causing unreliable data, and this study aims to evaluate the importance of device location when capturing accelerometery data. Following institutional ethical approval, walking data were captured using two different smartphones (iPhone SE 2020, iOS 16.3.1; Samsung Galaxy A51, Android 13) and an Actigraph IMU. The devices were affixed to each other so they all maintained the same orientation and were placed in different body locations (for example, outer thigh pocket, back pocket, front pocket, handbag) to replicate data that may be collected in real world research settings. These data were compared via coefficient of variation to establish whether smartphone based accelerometery may provide a low cost, reliable method to capture large data sets outside of a laboratory setting. Gait related data are often analysed using linear measures, such as mean/ median, which may overlook the temporal nature of movement variability, which requires a non-linear approach to evaluate mathematical chaos in human walking patterns. Therefore, we additionally calculated the sample entropy of each time series to also evaluate the use of smartphones to measure non-linear phenomena within gait. This study will provide evidence to support the use of smartphone technology as an accessible, cheap method to access large datasets in a real-world context.

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D07 - In search of the best barbell hip thrust variation for hip extensor recruitment: an EMG amplitude comparison.

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The barbell hip thrust (BHT) has received popularity for targeting the hip extensor musculature. In addition to being essential for sports performance, developing the gluteals and hamstrings, preferentially in isolation from the quadriceps, is desirable for injury prevention and aesthetic sports (Baratta et al. 1988; Rowe et al. 2007). Coaches often use variations of an exercise to selectively train specific muscles. The Smith Machine is commonly utilised to execute the BHT and is yet to be investigated in terms of hip extensor surface electromyography (sEMG) amplitude. Moreover, to our knowledge, performing the BHT from different bench heights, compared with the barbell bridge (Bridge), is scarcely researched. Therefore, this study aimed to determine which hip thrust variations produce the highest sEMG amplitude in the lower gluteus maximus (LGMax) and gluteus medius (GMed), in combination with the semitendinosus (ST) and biceps femoris (BF), or, in greater isolation from the vastus lateralis (VL). Ten healthy women (mean ± SD age 33.3 ± 6.6 years, body mass 59.9 ± 8.1 kg, stature 164 ± 6 cm), familiar with resistance training, performed the BHT, Smith Machine hip thrust (Smith), and Bridge at three load intensities, one-repetition maximum (1RM), 10RM and 20RM, in a randomised order. sEMG amplitudes were reported as Root Mean Squares and were normalised relative to maximal voluntary isometric contractions, using an isokinetic dynamometer, ~6 days before the exercise protocols. It has been proposed that an sEMG amplitude threshold of ≥60% is required to obtain a muscle-strengthening stimulus (Andersen et al. 2006). All nine exercise protocols elicited LGMax, GMed and BF sEMG amplitudes ≥60% and the Smith additionally produced >60% ST sEMG amplitudes for all three load intensities. The ST sEMG amplitude was higher for the Smith compared to the BHT (Δ12%, $P < 0.01$) during the 10 RM protocol only. The VL sEMG amplitude was higher in the BHT compared with the Smith and Bridge at 20RM (Δ36% and Δ48%, $P < 0.01$), 10RM (Δ30% and Δ50%, $P = 0.01$), and 1RM (Δ27% and Δ53%, $P < 0.05$), respectively. All three hip thrust variations and intensities effectively train the hip extensors. It would be advisable for individuals seeking exercises to optimise gluteal and hamstring recruitment over their quadriceps to choose the Smith and Bridge instead of the BHT. These findings may be applicable within sports performance, aesthetics, and rehabilitation for selective muscle recruitment.

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D08 - Biomechanical Determinants of Blitz Performance in Male Amateur Point-Fighting Kickboxers.

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Point-fighting is high-intensity intermittent tatami kickboxing sub-discipline, where two point-fighters deliver 'forceful' strikes to score points across three two-minute rounds. During the World Association of Kickboxing Organizations (WAKO) World Championships 2015, 21% of points scored by winners were attributed to offensive hand techniques, yet most previous combat sports literature investigates kicking. The blitz is an explosive sprint start like motion where a point-fighter simultaneously strikes with both hands towards an opponent. No previous research has investigated the blitz; therefore, the aim of this study was to identify biomechanical determinants of blitz performance in point-fighting kickboxers. Male amateur point-fighters (n = 13), ranked at WAKO 1st Degree Black Belt or higher, performed three blitzes from a portable force platform whilst being recorded by two high-speed cameras in the sagittal plane. Movement time, from initiation to rear-foot ground contact, was considered the primary performance measure due to the requirement for a point-fighter to perform high-intensity fighting actions before an opponent delivers a counterattack. Pearson correlations assessed the relationships between blitz movement time and kinetic and kinematic variables. Blitz movement time had a strong positive correlation with push-off time ($R = 0.80$, $P < 0.01$), strongly positively related with vertical impulse ($R = 0.70$, $P < 0.01$), moderately positively related with propulsive impulse ($R = 0.61$, $P = 0.03$), but moderately inversely related with vertical rate of force development ($R = -0.58$, $P = 0.04$). Despite non-significant relationships for all other factors ($P > 0.05$), there were moderate positive relationships between blitz movement time and front-ankle peak plantarflexion ($R = 0.36$), front-knee range of motion ($R = 0.42$), rear-hip peak extension ($R = 0.52$), and rear-hip range of motion ($R = 0.36$). These findings suggest that successful blitz performance is determined by the ability of a kickboxer to produce propulsive and vertical impulse in the shortest possible push-off time, which is underpinned by front-ankle plantarflexion, front-knee extension, and rear-hip extension. Consequently, kickboxing coaches should include triple extension exercises that target the hip, knee and ankle extensors, with the focus on producing maximal force in short push-off times (e.g., countermovement jumps). Future research should aim to investigate blitz biomechanics in elite kickboxers, upper limb kinetics and kinematics of the blitz, and the effect of jump training on blitz performance.

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D09 - Neuromuscular responses to unanticipated vs anticipated cutting tasks for ACL risk determination.

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The majority of anterior cruciate ligament (ACL) injuries occur in noncontact settings, such as trying to escape defenders or keep up with attackers by performing cutting manoeuvres. When attempting to mimic these situations in a lab-based settings it has been shown that providing the athletes with an external cue they have to react to adds uncertainty (better reflects real situations) and changes their biomechanics as opposed to a pre-determined movement in a specific location. Females have a higher risk of obtaining an ACL injury and they have shown to have a lower hamstring activation compared to their quadriceps, specifically at pre-contact (50 m/s) before a cutting task. The hamstrings provide antagonistic support, and an imbalance in activation levels increases the shear anterior force through excessive anterior pull of the quadriceps. Therefore, the aim of this study is to investigate differences in precontact muscle activation of the quadriceps and hamstrings during an unanticipated vs anticipated cutting task. A cross-sectional study was conducted on 4 female athletes (data collection is still ongoing) who take part in dynamic sports, with no current or previous knee injuries, ethics was granted by Liverpool John Moore's ethics committee. EMG activity of the vastus lateralis (VL), vastus medialis (VM), biceps femoris (BF) and semitendinosus (ST) of the dominant leg was collected during an unanticipated (presented via visual cue on TV, delay = 0 m/s) and anticipated cutting task. Participants completed 5 successful unanticipated and 5 anticipated trials. Averaged EMG data was normalised to individuals' maximum voluntary contraction at 48 ms pre-touchdown of both conditions a hamstring/quadricep (H/Q) ratio was also calculated by dividing the sum of the BF and ST by the sum of the VL and VM. The results so far show that the BF has significantly lower EMG activation 48 m/s pre-contact during the unanticipated task compared to the anticipated ($P = 0.033$) and so did the ST ($P = 0.01$). No significance has yet been seen in the VL, VM or H/Q ratio at 48 m/s pre-contact between conditions. So far, most of the data is following trends of that found in previous literature. Clearly showing that the un-anticipation of a task has a negative effect on hamstring pre-activation before a task meaning that going into these movements females are less prepared to meet neuromuscular demands and stabilise the knee correctly, increasing risk of an ACL injury.

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D10 - Kinematic and kinetic analysis of a korfball penalty shot.

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In 2022, the International Korfball Federation changed the rules of korfball to state that whichever attacker lost the free scoring opportunity is required to take the penalty shot. This requires every player to have good penalty shooting technique rather than just one player in each section and so is becoming a bigger focus of coaches and players. There is limited research around the penalty shot technique and how it should be adapted for different categories of players (male/female, more experienced/less experienced, shorter/taller). This study aimed to fill the gap in research by comparing the kinematic and kinetic variables of successful korfball penalty shots of players in different categories to help the production of clear successful technique guidelines and kinematic and kinetic parameters to be used to influence training. With institutional ethics approval, Quintic motion capture software (500 fps) and Kistler force platform (1,000 Hz) was used to record data for 10 korfball players (five female, five male) of differing experience levels (4.81 ± 5.12 years). Subjects performed penalty shots using the underarm technique until three successful shots were achieved (range 3 - 14 shots). Kinetic data was normalised to body weight and kinematic data was normalised to height. Statistical analysis (independent samples t-tests) of the different categories of players showed that taller players displayed a significantly lower ball release angle (23.9 ± 2.8°, P = 0.02) than shorter players (36.6 ± 7.8°) and that more experienced players displayed a significantly lower minimum hip height during the counter movement phase (0.57 ± 0.02 m, P = 0.02) than less experienced players (0.65 ± 0.39 m). There were no significant differences found for any variables between sex. Pearson's product correlation showed that maximum hip height before ball release (R = 0.869, P = 0.01) was strongly related to the number of shots taken to score three goals. This could be due to force generation of the lower limbs but pending kinetic results are required to confirm. The results of this study can be used by coaches and athletes during the learning process to recognise and cater for characteristics of the technique which change across player groups.

D11 - The Gender Differences in Range of Motion and Injury Risk in Basketball Players: at the hip, knee, and ankle.

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Limited range of motion (ROM) increases the risk of injury because certain movement patterns put increased stress on joints and the surrounding muscles and ligaments, especially with increase force. Analysis of athletes' flexibility profiles can reveal differences in ROM and identify those players who are at higher risk for sports injuries (Fousekis et al., 2011) The current study investigated the sex differences in ROM and associated injury risk in basketball players. Nine males and six females (age M: 20 ± 2 years, F: 21 ± 1 years, height M: 189 ± 10 cm F: 170 ± 9 cm and weight M: 83 ± 9 kg, F: 80 ± 9 kg) from a competitive premiership basketball team were recruited. ROM was determined in the lower extremities by undertaking eight passive movements in accordance with (Cejudo et al., 2020). Females had a significantly greater ROM compared to males during hip abduction (males 22.8 ± 7.8° vs. females 38.3 ± 7.2°, $P = 0.03$) hip flexion for monoarticular adductors (males 36.3 ± 6.2° vs. females 83.7 ± 3.2°, $P < 0.001$), hip flexion for the use of hamstrings (males 62.3 ± 16.5° vs. females 97.4 ± 4.9°, $P < 0.001$), gastrocnemius (males 34.6 ± 6.1° vs. females 45.8 ± 5.6°, $P = 0.006$). There were no significant differences between males and females for hip extension, gluteus maximus, quadricep, and soleus ($P > 0.05$). Results suggest that males may have an increased risk of sustaining a knee or ankle injury due to less ROM compared to females, which increases the strain on the muscles and ligaments during functional movements.

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D12 - Understanding how common hypermobility is in individuals who identify as having autism.

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Currently, very few studies have investigated the incidence of individuals having both autism and hypermobility. These few studies have investigated hypermobility and identified a higher incidence rate of participants with autism than expected. The purpose of this study is to establish if there is a higher prevalence of joint hypermobility in the autistic population compared to the neurotypical population with the hypothesis that there would be a higher rate of individuals with hypermobility in the autistic population group compared to the neurotypical control group. In addition, this study also aims to establish the reliability of the Beighton score, which is the internationally accepted test for assessing hypermobility. The hypothesis is that the Beighton score would be reliable in both interrater and intra-rater reliability. With institutional ethical approval, 10 neurotypical and 10 self-identifying autistic participants were asked to attend 2 separate testing days 1 week apart. Participants were asked to self-assess their hypermobility against the Beighton score and were then assessed by 2 different therapists against this same score. Statistical analysis will be completed to determine if there is a significant difference in hypermobility prevalence between the autistic population and the neurotypical population. Statistical analysis will also be completed to determine the interrater and intra-rater reliability of the Beighton score. Preliminary results show that there is a higher prevalence of hypermobility in the autistic population when compared to the neurotypical population. However, the hypermobility scores collected so far have shown that the Beighton hypermobility score is not reliable in interrater reliability and interrater. These findings question the reliability of the Beighton hypermobility score and questions if this is an assessment of 'gold standard' quality. With the Beighton score results shown to be unreliable this also brings into question if the conclusion that 'there is a higher incidence rate of joint hypermobility within an autistic population when compared to a neurotypical population' is truly correct.

D13 - Protocol for a cross-over trial to investigate the impact of barefoot running on performance.

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Due to its supposed benefits for runners of all abilities, barefoot running has seen a resurgence of popularity in recent years due to claims of improved running performance and injury prevention as individuals continue to explore alternative strategies to improve performance. The review part of the study provides an overview of the practice of barefoot running and the potential benefits to performance as well as highlighting the role of barefoot running in the prevention of running related injuries. The purpose of the true experimental crossover trial is to investigate if running barefoot compared to minimalist footwear, improves 1,500 m time trial performance in recreational runners. Twenty healthy recreational runners will be recruited through Durham University's Athletics and Cross-Country Club and from advertisements at other local universities and running clubs. Participants will be randomised to either the experimental study arm (barefoot condition) or the control study arm (minimalist condition) which they will be required to perform a 1,500 m time trial in each condition. All participants will be provided with a four-week washout period between running trials as well as ten-day barefoot familiarisation session. Outcomes measures include the comparison of individual participants to the experimental condition to the control condition. If considered effective, the study findings may help identify and enhance barefoot running as an optimal performance-based modality that recreational runners may choose to employ to lead to an increase in running performance.

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D14 - Bottom line: do resistance bands increase gluteal EMG amplitudes during barbell hip thrust variations?

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The barbell hip thrust (BHT) has received popularity for targeting the hip extensor musculature. In addition to being essential for sports performance, developing the gluteals and hamstrings, preferentially in isolation from the quadriceps, is desirable for injury prevention and aesthetic sports (Baratta et al. 1988; Rowe et al. 2007). Coaches often use variations of an exercise to selectively train specific muscles. The Smith Machine is popular for executing the BHT and is yet to be investigated in terms of hip extensor surface electromyography (sEMG) amplitude. Moreover, performing variations of the BHT, such as the barbell bridge (Bridge), with additional, mini resistance bands are prevalent yet, to our knowledge, scarcely researched. Therefore, this study aimed to determine which hip thrust variations produce the highest sEMG amplitude in the lower gluteus maximus (LGMax) and gluteus medius (GMed), in combination with the semitendinosus (ST) and biceps femoris (BF), or in greater isolation from the vastus lateralis (VL). Ten healthy women (mean ± SD age 33.3 ± 6.6 years, body mass 59.9 ± 8.1 kg, stature 164 ± 6.1 cm), familiar with resistance training, performed the BHT, Smith Machine hip thrust (Smith), and Bridge at 20-repetitions maximum (20RM) and 20RM with an additional resistance band (+BAND), in a randomised order. sEMG amplitudes were reported as Root-Mean Squares and were normalised relative to maximal voluntary isometric contractions, using an isokinetic dynamometer, ~6 days before the exercise protocols. It has been proposed that an sEMG amplitude threshold of ≥60% is required to obtain a muscle-strengthening stimulus (Andersen et al. 2006). All six exercise protocols elicited LGMax, GMed and BF sEMG amplitudes ≥60%. The VL sEMG amplitude was higher for the BHT than the Smith and Bridge at 20RM (Δ36% and Δ48%, $P < 0.01$), and 20RM+BAND (Δ34% and Δ44%, $P < 0.05$), respectively. The GMed sEMG amplitude increased in the BHT+BAND (Δ21%, $P < 0.01$), Smith+BAND (Δ14%, $P < 0.05$), and Bridge+BAND (Δ22%, $P < 0.01$), compared with the respective non-banded exercises. The BHT, Smith and Bridge effectively train the hip extensors at 20RM and 20RM+BAND. The +BAND augmented the GMed sEMG amplitude. It would be advisable for individuals seeking exercises to optimise gluteal and hamstring recruitment over their quadriceps to use an +BAND and choose the Smith and Bridge over the BHT. These findings may be applicable within sports performance, aesthetics and rehabilitation for selective muscle recruitment.

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D15 - The Cutting Movement Assessment Score: The ability of a field-based screening tool to estimate ACL injury risk during anticipated and unanticipated 90° cutting manoeuvres.

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Unanticipated side-step cutting is frequently performed in multi-directional field sports and can elicit postural deficits associated with increased knee joint loading and anterior cruciate ligament (ACL) injury risk. Practitioners are constantly seeking portable and inexpensive systems that offer accuracy levels similar to "gold standard" threedimensional motion capture. The cutting movement assessment score (CMAS) is a field-based qualitative screening tool used to evaluate a performer's movement quality during a cutting manoeuvre. The CMAS aims to identify high-risk kinematics related to non-contact ACL injury risk. Performers are awarded a score if high-risk postures are displayed, with greater scores signifying potentially greater peak knee abductor moments (pKAMs) and suboptimal cutting technique. This study aimed to assess the validity of the CMAS for estimating the risk of pKAMs against three-dimensional motion capture during anticipated and unanticipated 90-degree cutting manoeuvres. After gaining institutional ethical approval, six multi-directional field sport athletes completed four anticipated and four unanticipated dominant limb 90-degree cutting manoeuvres. The VICON motion capture system (250 Hz) and Kistler force plates (1,000 Hz) collected full body kinematic and kinetic data during the penultimate (PFC) and final foot contact (FFC). Five iPad Pros (120 Hz) collected video footage simultaneously. The nine item CMAS criteria and Kinovea software, assessed video data for movement deficits in the frontal and sagittal planes, culminating in an overall CMAS for each performer. Participants were distributed into low and mid CMAS categories, where biomechanical data was analysed using VICON Nexus. A Spearman's rank correlation was used to determine relationships between CMASs and pKAMs. An independent t-test compared three-dimensional kinetics and kinematics between the low and mid CMAS groups for both conditions, alongside Hedges' g effect sizes. Both anticipated and unanticipated conditions displayed low positive correlations between CMAS and pKAMs ($R = 0.23$ and $R = 0.19$, respectively). Athletes with lower CMASs demonstrated significantly lower FFC knee flexion angles and larger pKAMs during the unanticipated condition compared to the anticipated ($P \leq 0.049$, $g \geq 0.53$). Athletes with medium CMASs in the unanticipated condition demonstrated significantly higher PFC trunk inclination angles and lower FFC trunk abduction angles at initial contact compared to the anticipated condition ($P \leq 0.011$, $g \geq 0.79$). These findings confirm that the unanticipated cutting task showed higher risk mechanics compared to the anticipated task. However, the correlations suggest that the ability of the CMAS tool to predict the risk of pKAMs during cutting conditions needs further investigation. Future research involving larger cohorts and more ecologically valid conditions is warranted.

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D16 - An investigation into the acute effects of percussive therapy frequencies on hip range of motion.

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Percussive therapy (PT) interventions have developed and become more popular over recent years in therapeutic exercise and rehabilitation with early research proposing beneficial effects for users (Konrad et al., 2020). Limited research has directly compared the influences of the varied frequencies and attachment heads on range of motion (ROM). The purpose of this study was to directly compare the acute effects of different PT frequencies and attachments (via Theragun Elite) on hip ROM. Ethical approval was granted by the University of Northampton. Twenty recreationally active participants (age, 25.05 ± 6.29 years) completed a single-blind independent-subject design trial during which baseline Passive Straight Leg Raise ROM (°) (PSLR) and Thomas Test (°; TT) via digital goniometry pre and post intervention. Participants were randomly allocated to either percussive therapy (TG1, 1750rpm [29Hz] via dampener; TG2, 1750rpm [29Hz] via wedge; TG3, 2400rpm [40Hz] via dampener; TG4, 2400rpm [40Hz] via wedge) or passive control (CON) conditions. All PT interventions were applied for 2 × 60-seconds per muscle at pressure bar two. A two-way mixed-model ANOVA with Bonferroni adjusted post-hoc and pairwise comparison analyses were conducted for within and between-group differences. Significant within-group increases were reported for PSLR in ROM ($F_{1,20}$ = 98, $P < 0.001$ and $\eta^2 = 0.736$) and with group interaction effect ($F_{4,20}$ = 4.01, $P < 0.009$ and $\eta^2 = 0.314$). Pairwise comparisons revealed a significant difference from pre to post in all PT conditions (all $p < 0.001$, $\eta^2 = 0.736$) but no change in the CON and with no between group differences reported post interventions ($P > 0.05$). TT analysis revealed significant within-group increases in ROM ($F_{1, 20}$ = 35, $p < 0.001$, $\eta^2 = 0.502$), pairwise comparison analysis showed TG1 ($P < 0.001$), TG3 ($P < 0.006$), and TG4 ($P < 0.009$), however no between group differences were noted ($P > 0.05$). PT can provide a significant moderate to large effect size changes in acute hip ROM, however neither frequency or attachment appear to make any significant difference.

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D17 - The effects of blur on anticipation of penalty kicks in football.

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To increase their chances of successfully saving a penalty kick in football, the goalkeeper is required to start their dive before the penalty taker makes contact with the ball. This means the goalkeeper must anticipate the kick direction based on visual information presented during the taker's approach to the ball. Research in other sporting tasks (e.g., cricket, basketball, boxing) has shown that the pick-up of visual cues that facilitate effective anticipation, and subsequent decision making, is not dependent on high acuity vision. The purpose of this study was to investigate whether artificially blurring vision of the penalty taker, but not the ball, affected participants' ability to anticipate direction of a penalty kick. Following institutional ethics approval, footballers (n = 10) and non-footballers (n = 10) completed a video-based task in which they anticipated shot direction from a series of penalty kicks displayed from the perspective of a goalkeeper. A low or high level of artificial blur was applied to the video clips using Adobe Pro software. The ball was always visible with high acuity but the visual field in the near, mid, and far periphery was blurred. Results are pending.

Section E - Physical Activity

E01 - Reflections on co-creating Pilates-based exercise interventions with people with visual impairment – a collaborative autoethnography.

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On average, adults with a visual impairment engage in less physical activity than the general population (Holbrook et al., 2009). Physical activity is a significant predictor of health-related quality of life and is significantly correlated with life satisfaction in this population (Łabudzki & Tasiemski, 2013). Concerningly, the COVID-19 pandemic has further compounded low levels of participation in sport and exercise by adults with visual impairment, which may have significant health-related implications (Strongman et al., 2022). This research aims to explore the experiences of setting up an intervention for people with visual impairment and to reflect on challenges faced and lessons learned. Autoethnography is a process of self-reflection that examines personal experience in the context of a wider cultural and social perspective. This research is based on a collaborative autoethnography and discusses the experiences of two researchers setting up Pilates classes for people with visual impairment, as the instructor and as a volunteer. Following institutional ethical approval, both researchers documented their thoughts and experiences using reflexive journals and regular discussions, acting as critical friends over a period of 10 months. The findings were organised into key themes, in which the researchers consider their own positionality and relate themes to theories of inclusivity in sport, self-determination, and the social model of disability. The themes included: ableist narratives, researcher vulnerability, inclusivity, and barriers to participation when designing exercise interventions with this population. We discuss how the research could help inform future physical activity groups for people with visual impairment and develop best-practice guidelines co-created with the participant group to ensure future interventions are effective.

E02 - Exploring the Psychosocial Determinants of Gym-Based Exercise Participation Among Undergraduate Female Students: a Qualitative Investigation.

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Literature has repeatedly confirmed physical activity as a fundamental component in enhancing student wellbeing. Despite these well documented benefits, various personal, social, and environmental barriers have been identified as inhibiting an individual from participating in gym-based exercise. The purpose of this study was to investigate perceptions of barriers and facilitators to gym-based exercise participation among undergraduate female students. Bandura's social cognitive theory (SCT) was adopted as a theoretical framework to explore the psychosocial determinants of exercise behaviours. Three undergraduate female students aged between 20-28 years (age 23.3 ± 4.2 years) participated in the study. Semi-structured qualitative interviews were conducted. Responses were organised and systematically coded into meaningful units of data to create meaningful sub-themes using inductive thematic analysis. The investigation's findings align with Bandura's SCT, highlighting the complex interplay between cognitive, and environmental factors in influencing behaviour. Self-efficacy beliefs and self-perception were identified as predominant determinants of gym-based exercise participation among students. Negative social comparison and an impaired exercise competence were identified as salient barriers, consequently reinforcing feelings of inferiority, intimidation, reduced self-esteem, thus discouraging gym attendance. Conversely, social interaction, enhanced perception of social support, positive exercise related outcomes, and recognition of performance accomplishments enhanced perception of ability and belonging among participants. This encouraged positive self-evaluation, enhanced self-esteem, and heightened self-efficacy, thus facilitating the maintenance of gym-based PA behaviours. Recommended interventions to be introduced by fitness facilities are discussed. Strategies which enhance self-efficacy beliefs, feelings of competence, and perceptions of social support are particularly salient to offset perceived barriers and encourage gym attendance among female students.

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E03 - A qualitative investigation into students' experiences and perceptions of compulsory school-based physical education.

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Physical activity is widely understood as a vital component of health and wellbeing globally and is considered essential to be maintained throughout the life course. However, national and global statistics show a continual rise in physical inactivity across age groups. In response to this, governments attempt to produce effective intervention methods to address these health trends. Physical Education (PE) within schools is considered a key intervention to encourage childhood physical activity and the adoption of healthy lifestyles. However, rates of childhood inactivity and obesity continue to rise in the UK, initiating claims of an ineffective PE curriculum/experience. Previous research has investigated PE through the perspective of PE teachers and practitioners to seek positive change to the subject, but limited research has been conducted in which the student perspective and experience is considered. Therefore, the aims of this study were to understand the student experience of compulsory PE and their perceptions of its delivery. A qualitative approach was taken using semi-structured focus groups with students from one secondary school in the Midlands, England. Once ethical approval was granted, a total of 195 students from Years 7, 8, and 9 completed a self-report survey indicating their interest to participate as well as a measure which ascertained student self-reported ability, motivation, and enjoyment. From this sample, a purposeful sampling approach was taken whereby 18 students (six from each year group) were selected that represented a mix of genders, self-reported ability, motivation, and enjoyment. Due to some dropouts, a total of 14 students participated in the focus groups (Year 7 n = 5, Year 8 n = 5, Year 9 n = 4), which lasted approximately 20-30 min. Each focus group was recorded and transcribed verbatim, with thematic analysis used to analyse the data. Findings suggested gender influenced student access to sporting opportunities, reinforcing harmful gender-stereotypes. A lack of student choice influenced enjoyment and motivation in lessons creating generic experiences. A sport focused curriculum was identified which failed to holistically educate students regarding physical/mental health and wellbeing. Student's understanding of PE and the general PE environment were both identified as areas for concern where students' knowledge was not in line with curriculum definitions, with students highlighting areas for improvement within their PE experiences. To conclude, there is a need to provide students with increased influence over PE and for the subject to provide a more holistic and well-rounded physical and mental education to students.

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E04 - What predicts archery participation in England: an analysis of the Active Lives survey data.

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Physical activity is a modifiable predictor for a host of non-communicable diseases, and overall mortality rate. Currently, more than one-third of the population of England is inactive. One solution to address this challenge is through the provision of modes of club-sport which are social supportive, adaptive to skill and ability, inclusive, and hold the capacity to reach the population. There is evidence which suggests Archery can be a successful, acceptable and feasible club-sport. Participation in this sport may contribute towards meeting physical activity guidelines. However, less is known about what predicts participation, how participation differs across regions, and the extent to which participation in Archery can meet national physical activity guidelines. To address this challenge we conducted an analysis of the 2021 (latest) Active Lives Dataset. Active Lives is commissioned by Sport England and conducted by IPSOS Mori, and is the only population representative survey of participation in sport, exercise and physical activity within England. All the data is available and was sourced from the UKDA. Data was extracted from the November 2020-2021 (Year 6) Active Lives Survey. Here a sample of 177,273 participants were used. Of these participants, 223 were included in the main analysis (i.e., participants had reported taking part in archery to some capacity within the span of a year). To address our research questions, a linear multiple-regression model was constructed whereby minutes per-week of Archery was inputted as an outcome, and the following predicters were included. More specifically, age, health status, highest qualification level, physically limiting disability, motivation, capability, happiness, loneliness, anxiety, individual development, life satisfaction, index of multiple deprivation, opportunity to participate, and club membership status were inputted as predictors of archery participation. Unadjusted analysis indicates participants engaged in 106 ± 198 minutes of archery within a typical week. Which equates to 70% of the recommended physical activity guidelines. Multiple regression analysis indicates models significantly fitted the data (R^2 = 0.754, P = 0.002). This model indicates archery participation is significantly predicted by age (P = 0.008), general health (P = 0.003), highest qualification level (P < 0.001), anxiety levels (P < 0.001), individual development (P = 0.008), and opportunity (P = 0.025). The data provides some evidence that archery is an inclusive sport regardless of age and challenges to health and anxiety. However, opportunity to participation remains an importance consideration for policymakers and stakeholders. Future research may consider examining the experiences of individuals who participate and the changes in participation over the long-term.

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E05 - Direct Parent Engagement to Improve Fundamental Movement Skills in Early Years Children: a Systematic Review.

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Fundamental movement skills (FMS) are basic movements in children that represent the building blocks for more complex motor skill development, and act as a prerequisite for lasting sport and physical activity (PA) engagement and positive health-related behaviours (Seefeldt, 1980). However, motor proficiency in children in the UK and around the world is vastly inadequate (Lawson et al., 2021). Consequently, there are currently alarming levels of inactivity and overweight or obese children (Stevenson et al., 2022). The data within the literature is disturbing and interventions are urgently required to improve children's FMS. To date, interventions have primarily been delivered within early childhood educational settings by instructors and teachers (Ali et al., 2021). Yet, despite children spending half of their time at home where sedentary behaviours are more likely, there is currently little research attention in family FMS programmes (Johnstone et al., 2018). Parents are role models to their children and can be considered as "gate keepers" as they possess the power to influence their child's behaviour and PA opportunities (Horodyska et al., 2019). Direct parent involvement is considered a valuable approach to improve children's FMS (Stevenson et al. 2022). Therefore, the aims of this review were to investigate if PA interventions that directly involved the parent could improve children's FMS, and to evaluate which method of parent engagement was most effective. Keyword searches were conducted in SPORTDiscus, PubMed, Science Direct, and Google Scholar. Studies that directly and explicitly involved the parent or guardian within the intervention were included and explored via a narrative analysis. Only nine articles worldwide met the criteria, none of which originated from the UK. Of the nine studies, FMS improved significantly in seven of the interventions ($P < 0.05$). Studies that involve joint parent-child participation and provide parents with clear structure and guidance for FMS practice at home may be the most influential method of parent engagement. Smartphone apps have emerged as a potential vehicle to directly engage parents and children in FMS practice in the home environment and may be integral to future motor skill programmes. Further research into parent-focused FMS interventions is clearly warranted.

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E06 - The recreational marathon runner: a scoping review.

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Every year over one million runners compete globally in the marathon (42.195 km) with most of these runners considered recreational. Consequently, the past decade has seen a growth in research of the recreational marathon runner. Despite this, the term recreational is often poorly or not defined by these studies. Therefore, due to the recent increase of research, a scoping review has been conducted with the aim of mapping the current literature and to provide a definition of the recreational marathon runner for future research. This review was developed using the Jonna Briggs Institute (JBI) protocol and PRISMA-ScR guidelines and followed the JBI framework: Population, Concept, Context (PPC). Studies that exclusively used elite runners, did not compare the measured variables to marathon time and examined race distances other than the marathon were excluded. The search yielded a total of 2,095 recorded from four databases (PubMed, Scopus, Sport Discuss and Web of Science), after non-English and duplicates records were removed, 1,128 records remained. Post title and abstract screening, 64 records remained plus five records were included from reference searching, resulting in a total of 69 records. It was observed 78% of the research had been conducted since the year 2012. The medium sample size was 97 (IQR 31; 283), while males constituted 74% of runners researched (26% female), and the most common study design was cross-sectional (82%). Furthermore, most research was conducted in Europe and North America (n = 43 and 11 respectively), with little research from other continents. Thirteen themes were identified with physiological measures (25%), training characteristics (21%) and anthropometrics (20%) as the most common. Moreover, only 22 studies included a definition or inclusion/exclusion criteria when describing the desired population. Furthermore, 48 studies used the term recreational to describe the sample, however, only 18 of those 48 studies provided a definition or inclusion/exclusion for the population. The range in marathon time from the runners in those 18 studies was 3:00 to 4:40 (hrs:min), had this range in time been an inclusion criteria three additional studies would have been excluded from the review. This scoping review proposes a recreational runner is someone with an active lifestyle, runs mainly for personal benefit and have a marathon time between 3:00 and 4:40 (hrs:min). Further, more research should be conducted in female populations and a wider range of countries. Future studies should use this definition to guide their research.

Section F - Physiology

F01 - Strength and Neuromuscular Adaptations following a 4-week Isokinetic Strength Training program with Blood Flow Restricted Recovery in a Physically Active Population.

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Blood flow restriction (BFR) training can increase rates of muscular adaptations at equal, and lower training intensities than traditional strength training. BFR induces hypoxia in the working muscles which induces greater fatigue, promoting adaptations such as angiogenesis. There is currently limited knowledge as to the effects of blood flow restricted recovery on morphological and neuromuscular adaptations. Therefore, the aim of this study was to investigate whether blood flow restricted recovery can elicit superior strength and neuromuscular adaptations over a 4-week isokinetic strength training program. Following local institutional ethical approval 20 physically active participants (n = 12 male, n = 8 female) volunteered to participate (mean ± SD: age = 21.0 ± 2.3 years, height = 174.5 ± 9.2 cm, mass = 75.2 ± 14.0 kg). A single-blinded repeated measures matched pairs design was implemented with 3 training conditions: (1) 20 mmHg [SHAM], (2) 40% limb occlusion pressure (LOP), and (3) 80% LOP. Participants completed baseline and post testing ankle-brachial index (ABI), 60 cm drop jumps, 6 s Wingate cycle test, and knee flexion-extension measured using an isokinetic dynamometer. During dynamometer testing, electromyography (EMG) and near infrared spectroscopy (NIRS) responses were recorded. Participants completed 12 training sessions (3 times per week for 4 weeks) on the dynamometer at 60°/s with blood flow restricted recovery. Training weeks 1 & 2: 3 sets of 5 reps per leg with 120 s recovery between sets; week 3: 3 sets of 5 reps per leg with 90 s recovery between sets; week 4: 2 x 2 sets with 120 s recovery between sets 1-2 & 3-4, and 180 s unrestricted recovery between sets 2-3. A significant pre to post increase (P = 0.004) in peak torque was observed in Group 2 left leg (Pre: 147.0 ± 50.7 Nm, Post: 207.6 ± 78.9 Nm). Large effect sizes were observed for Group 2 (d = 1.080) and moderate effect in Group 3 (d = 0.662). Only a trivial effect seen in Group 1 (d = 0.092). Non-significant changes observed in right leg for any group. Small effects seen in Groups 1 & 3 (d = 0.462 & 0.380) respectively. Moderate effect in Group 2 (d = 0.635). Blood flow restricted recovery promotes strength adaptations at a faster rate than traditional strength training, however, the optimal occlusion pressure and training modality to achieve the fastest gains in strength, need further investigation.

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F02 - The effects of cold-water immersion and active recovery on muscle soreness and performance following high-intensity exercise.

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Repeated exposure to high intensity exercise on consecutive days during demanding training and competitive schedules, places physiological demands on the musculoskeletal, nervous, immune, and metabolic systems which impair subsequent sporting performance (Getto & Golden, 2013). Athletes and coaches adopt a range of recovery interventions to return the body to a pre-fatigue state and optimise subsequent performance. To date there is limited information on the benefits of recovery interventions in a female population. The current study compared cold-water immersion (CWI; 10°C 2 × 5 min separated by 2.5 min) and active recovery (steady state cycling 10 min) using a randomised cross over design, in female recreationally active team sport players (age 21 ± 1 years; body mass 73 ± 12 kg). The recovery interventions were conducted immediately following an exercise circuit designed to mimic the duration and performance demands of a netball game. Measures of vertical jump height, sprint speed, and muscle soreness were recorded before and after the recovery intervention. Results indicate a main effect of time (pre vs. post; $F_{1,7}$ = 8, P = 0.028) and an interaction effect (recovery method × time; $F_{1,7}$ = 49, P < 0.001) for ratings of muscle soreness. The rate of muscle soreness increased in the active recovery group (pre 2.3 ± 1.9; post 5.1 ± 1.7, P = 0.001) but remained unchanged in the CWI group (pre 2.4 ± 2.0; post 2.0 ± 1.3; P = 0.836). There were no pre to post differences in 20 m sprint time or vertical jump following active recovery or CWI (P > 0.05). CWI appears to be an effective strategy in reducing perceptions of muscle soreness and is likely due to the reduction in skin temperature (P < 0.001) during CWI causing an analgesic effect (Moore et al., 2023). As such, it should be considered as a viable recovery option for athletes looking to optimise recovery between demanding training blocks and competitive schedules.

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F03 - Liquid cooling suit use during Explosive Ordnance Disposal in hot conditions: Body versus Head and Body circuits.

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Undertaking activities whilst wearing fully encapsulating Personal Protective Equipment (PPE) increases thermoregulatory strain and can lead to uncompensable heat stress (UHS). Methods of mitigating UHS in PPE are often precooling based (e.g. conductive and convective), for example liquid cooling suits (LCS). These generally comprise of a tubing network, ranging in coverage for the wearer, with a pump circulating a coolant (often water). Head and neck as well as body coverage could have beneficial effects for effort perception (RPE) and thermal strain. Therefore, the purpose of this study was to evaluate the use of a LCS body circuit (limbs and torso, B) compared to a body circuit with integrated head and neck cooling (limbs, torso and head/neck, BH). With institutional ethical approval and following a randomised crossover design, participants (N = 5, of a projected 8; height: 1.85 ± 0.04 m; mass: 86.8 ± 16.1 kg) walked at 2.5 $km \cdot h^{-1}$ for 60 min in an explosive ordnance disposal suit, in hot conditions (40.9 ± 0.3°C; 25.1 ± 0 .9% relative humidity), on two occasions separated by seven days. In both B and BH, the LCS continuously delivered water via tubing circuits. The LCS reservoir contained 1 kg of ice and 0. 5 kg of room temperature water immediately prior to entering the environmental chamber. Physiological measures (heart rate, skin temperature, and rectal temperature) were recorded, and block averaged into 5 min intervals. Perceptual measures (thermal sensation and RPE) were recorded at 10 min intervals. Body heat storage (BHS), physiological strain and perceptual strain were calculated. Total LCS heat absorption was calculated using LCS circuit inlet and outlet water temperatures. More heat was absorbed in BH compared to B (133 ±12 vs. 147 ± 17 W; d = 0.95), however, BHS increased at trial completion when BH is worn (4.45 ± 0.47 vs. 4.67 ± 0.57 $J \cdot g^{-1}$; d = 0.42). Physiological strain was elevated in BH (4.8 5± 1.03 vs. 5.30 ± 1.33 a.u.; d = 0.37), however perceptual strain did not vary (d = −0.02) between conditions (B: 6.49 ± 1.39, BH: 6.46 ± 1.74 a.u.). Although LCS heat absorption increased in BH, this did not translate to a reduced BHS. The elevated BHS in BH is indicative of a greater insulative effect of the LCS BH configuration, compared to the B circuit. The fit of the LCS garment and tubing characteristics, e.g size, shape and density are likely implicated and are important considerations for future design.

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F04 - The acute effect of two different concentrations of ammonia inhalants on force production and rate of force development.

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Smelling salts, also known as ammonia inhalants (AI), date back to the 13th century and are used as a restorative stimulant. AIs have become popular among barbell athletes due to the theorised belief that such a supplement has ergogenic properties. Conflicting evidence within published literature of the ergogenic properties of AI, may be due to the concentration of NH_3 within the ammonia inhalant. It has been suggested that AIs elevate psychological arousal, thus impacting neural activation, muscle activation, responsiveness, and synchronisation of motor units. This study aimed to investigate the effect of two concentrations of NH_3 in ammonia inhalants on force production and peak rate of force development (pRFD) in barbell sports athletes. Six male barbell sport athletes (mean ± SD age, 22 ± 1 years; height, 177 ± 5 cm; body mass, 82 ± 8 kg) volunteered to partake in this study. Two familiarisation trials were performed on the Isometric Midthigh pull (IMTP) device which used dual Kistler force plates to measure peak force (PF) and pRFD using a 20 $m \cdot s^{-1}$ time window. Subjects underwent three experimental trials (separated by 72 hours) each consisting of 3 attempts, separated by 4 minutes, with the best scores being reported for analysis. The three experimental conditions A: 1.7 ml of ethanol and 2.3 ml of ammonia, B: 2.85 ml ethanol and 1.15 ml of ammonia, and C (PL): contained 4 ml of liquidised Vicks VapoRub following a Latin square design and involved the subjects inhaling a supplement approximately 30 seconds prior to performing maximal voluntary contractions for 5 seconds on the IMTP. The one-way repeated measures ANOVA test of within-subjects effects found no significant difference between the three experimental conditions for either PF ($P = 0.215$) A (2835 ± 885 N), B (2778 ± 808 N) and C (2882 ± 889 N) or pRFD ($P = 0.836$) A (7371 ± 2588 $N \cdot s^{-1}$), B (7374 ± 2702 $N \cdot s^{-1}$) and C (7191 N.s-1 ± 2480 $N \cdot s^{-1}$). This study is the first to the authors knowledge that has investigated differing concentrations of NH_3 and its effect on force production. Neither concentration of NH_3 had a significant impact on the performance measures of PF and pRFD. Statistical insignificance could be due to limited sample size resulting in low statistical power. However, greater concentrations of NH_3 may elicit a greater psychological arousal and neutral activation leading to a significant effect on force production.

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F05 - Assessing habitual dietary nitrate intake on vascular structure and function.

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Cardiovascular disease (CVD) remains a global burden and is the greatest cause of non-communicable disease deaths worldwide (McAloon et al., 2016). Following a reduction in CVD mortality rates during the late 20th century, this rate of decline has slowed or plateaued in many high-income countries (O'Flaherty et al., 2013). Therefore, in a society which promotes sedentary behaviour, it's imperative to investigate non-pharmacological strategies that may mitigate CVD risk. Limited work has been done to assess the effects of habitual dietary nitrate intake on cardiovascular health. To our knowledge, no one has directly explored how habitual nitrate intake may influence flow-mediated dilation (FMD) and carotid intima-media thickness (CIMT) in the general population. The aim of this cross-sectional study was to investigate whether habitual dietary nitrate intake from foods may be positively associated with markers of vascular structure (CIMT) and function (FMD) in the general population. Following ethical approval, participants (n = 39; mean ± SD: age, 38 ± 15 years; BMI: 24.9 ± 4.6 kg/m^2) were recruited in conjunction with the OMNIPLaNT study currently ongoing at Swansea University. Dietary information was obtained through a 3-day weighed food diary. Participants recorded their habitual diet over two weekdays and one weekend day. Dietary nitrate intake was estimated from a comprehensive nitrate database, which assigned each food product with a nitrate content value (Zhong et al., 2022; Zhong et al., 2021). Participants with an average nitrate consumption <95 mg·day^{-1} were assigned to a "low" group, whilst those who consumed >95 mg·day^{-1} were assigned to a "high" group. FMD of the brachial artery was performed using B-mode ultrasonography (MyLab9, Esaote, Genoa, Italy) in accordance with previously published guidelines (Thijssen et al., 2019). CIMT of the right carotid artery was measured 1 cm proximal to the carotid bulb at anterior, lateral, and posterior angles. There was a difference in nitrate intake between the high (260 ± 169 mg·day^{-1}) and low (45 ± 25 mg·day^{-1}; P< 0.001). There was no difference in FMD between the high (6.24 ± 3.10%) or low (6.58 ± 2.50%) groups (P = 0.718) and no difference was observed in CIMT between the high (0.52 ± 0.12 mm) and low (0.47 ± 0.06mm) group (P = 0.123). These findings suggest that chronic ingestion of a nitrate-rich diet does not influence markers of vascular function and structure in the general population.

F06 - Investigating whether a loading phase for Vistula cherry supplementation is necessary for increasing recovery from exercise induced muscle damage.

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Actions such as running, jumping and resistance training have been shown to cause exercise-induced muscle damage (EIMD). As these are all activities undertaken by the majority of athletes improving recovery from EIMD is of high importance to sport researchers. Tart cherries (TC) have been the focus of many investigations exploring their recovery increasing effects from EIMD. However, all of these studies have a loading phase, whereby the participants take the tart cherry supplement from anywhere between four to nine days prior to the exercise bout. Studies investigating the of uptake of anthocyanins (the active ingredient in the TC) into the blood plasma found by the eight-hour mark there are only trace detectable amounts left. These findings cast doubt on the necessity of including a loading phase in studies researching EIMD. This study aims to subvert the traditional inclusion of a loading phase by measuring recovery from EIMD when TC supplementation is started post muscle damage. In this study, seven participants were split into either a, TC or placebo (PLC) group. They came into the lab for four visits over four consecutive days following a familiarisation session. Visual Analogue scale (VAS), upper arm limb girth, pain pressure threshold (PPT), range of motion (ROM) and maximal voluntary isometric contraction (MVC), were the tests used to assess the level of muscle damage and subsequent recovery. These were done immediately before the damage protocol, which consisted of five sets of eight repetitions of eccentric contractions at 30°/s on a Biodex isokinetic dynamometer. The tests were then used for visits at the 24,48, and 72 h marks post damage. Due to the small sample size the area under the curve was used to calculate the 95% confidence intervals (CI) and Cohen's d for effect size. Line graphs were plotted to visual any trends. There were no statistically significant results due to all 95% CI crossing through zero. However, there were meaningful effect sizes (0.3 to 1.43) and the line graphs showed that the TC group trended better at VAS and limb girth. But PLC group are depicted as better in PPT and ROM. Finally, there was no trend in the MVC data. To conclude, despite having no loading phase, this study indicated an increase in recovery and lower inflammation from EIMD. To improve on future findings, a larger sample size and additional group using a loading phase should be used in future research.

Section G - Physiology & Sex

G01 - Sex differences in the physiological response and thermal perception to passive heat exposure.

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The passive elevation of body temperature can lead to an acute inflammatory response that may be beneficial for health. However, heat therapy interventions can be accompanied by negative perceptions and discomfort as a result of hyperthermia. Additionally, women are less heat tolerant compared to men. Accordingly, the aims of the present study were 1) to assess the effect of facial cooling on thermal comfort and inflammation during dry heat exposure, and 2) to explore the differences in physiological responses and perceptions between men and women. Participants were 22 healthy young adults (10 females, 12 males; age: 24.4 ± 3.3 years; height: 174.5 ± 8.7 cm; weight: 70.2 ± 9.7 kg). Three trials were performed in random order with institutional ethics approval, using a dry sauna device (Cocoon POD) which exposed the entire body, except the head, to heat. 1) Exposure to hyperthermia (71.1 ± 1.9°C; HEAT); 2) exposure to hyperthermia including facial cooling using fans (71.1 ± 3.0°C; FAN) and 3) exposure to a thermoneutral temperature (27.0 ± 0.9°C; CON). Blood samples to determine IL-6 plasma concentration were collected; basic affect and thermal comfort, rectal and skin temperature were assessed throughout the intervention. Rectal temperature following HEAT (38.0 ± 0.3°C) and FAN (37.8 ± 0.3°C) did not differ between men and women (P = 0.57) but was higher after HEAT when compared with FAN (P = 0.01). The skin temperature of the forehead in women (35.3 ± 1.3°C) was higher than in men (34.0 ± 1.8°C) (P = 0.019). The increase in IL-6 plasma concentration in HEAT (0.6 ± 0.8 pg/ml) and FAN (0.5 ± 0.4 pg/ml) did not differ (P = 1.00) and was greater than in CON (0.1 ± 0.2 pg/ml; P = 0.02), there were no sex differences for IL-6 plasma concentration (P = 0.69). Thermal discomfort was reduced in FAN compared to HEAT (P = 0.002). Women felt more thermal discomfort than men in HEAT (P = 0.03), but not in FAN (P = 0.28). This study showed that facial cooling did not impact the inflammatory response during whole-body heat exposure. Women were more uncomfortable during HEAT, possibly related to their higher forehead skin temperature. Facial cooling relieves thermal discomfort during dry heat exposure and may particularly benefit women. By promoting a more positive perceptual response, facial cooling may make passive heat therapy more tolerable.

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G02 - The Effect of Gender on in Vivo Muscle Protein Response to Exercise.

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In the field of muscle proteomics, it is apparent that both gender and exercise have a significant affect, on the proteomic make-up and its function. The idea of using proteomic profiling to provide in depth, quantifiable data on the muscle proteome has been perfected and used in a wide range of contexts throughout the literature (Malik et al., 2013). We aimed to build upon the previous work in the field but with a more specific aim. The aim of the study was to quantify the response to exercise and how it differed between male and female rat samples. The study contains two experiments which used LC-MS analysis following a process of trypsin digestion providing an in-depth profile of the muscle proteome for each sample. Statistical analysis, including t-tests, were used to show significant differences. The first part was a pilot study which used both soluble and myofibrillar fractions of a muscle sample to provide reference on the reproducibility and reliability of the methods. The second part of the study was to assess the aforementioned aim of the study, it required muscle samples to be electronically stimulated over a twenty-day period. Throughout the stimulation process, weight and protein abundance data were recorded for comparison between genders. The most abundant proteins shown in the pilot study were as expected in both the myofibrillar and soluble fractions, whilst the electrical stimulus showed to significantly alter the muscle proteome. Males had a significantly larger weight gain than the female samples as a result of stimulation and both genders reacted differently to the stimulus provided. Our study showed the most abundant proteins in the pilot study was m-type creatine kinase whilst in the stimulated sample it was alpha actin 1 out of the 513 unique proteins shown in LC-MS analysis. The aforementioned data was created to act as a reference point for future research due to the innovative nature of its aims. It shows quantifiable data alongside statistical analysis in relation to the muscle proteome and how exercise can alter the make-up and structure of it.

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G03 - The impact of the menstrual cycle on strength and power: both perceived and measurable.

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Despite the ever-growing success of women's sport and a subsequent increased demand for female-specific sports performance knowledge, just 4% of Sports Science studies exclusively feature women as participants. Through the study of the hormonal fluctuations of the menstrual cycle and their potential effect on sports performance, reluctance to adapt research protocols to include both sexes may be reduced. After obtaining institutional ethical approval, 16 participants were invited to participate in 4 testing visits, as part of an observational, repeated measures design assessing strength and power across 3 phases of the menstrual cycle. A familiarisation session was first completed, followed by 3 identical testing visits. Key performance outcomes included 1 repetition maximum (1RM) Single Leg Press, 1RM Bench Press and maximum jump height from Countermovement Jumps. Participants were also asked to complete a testing questionnaire at each visit, to obtain an overview of the participant's perceived fatigue, mood and other common menstrual cycle related symptoms at each phase. Visit scheduling coincided with early-follicular, ovulatory, and mid-luteal phases, to sufficiently encapsulate all hormonal milieus within one complete cycle, including peaks and troughs of oestrogen and progesterone. Participants were allocated to 2 different groups – hormonal contraception (n = 8), and non-hormonal contraception (n = 8). The study aimed to examine the presence of any potential fluctuations in strength and power between the 3 key phases of the menstrual cycle, and whether these fluctuations differed between groups. It was hypothesised that the hormonal contraception group would not display significant performance changes across different phases, due to the consistent downregulation of sex hormones. However, the non-hormonal contraception group were expected to display significantly greater strength and power performances during the early-follicular phase ($P < 0.05$), when oestrogen is at its highest and progesterone at its lowest. Perceived effects of the menstrual cycle were hypothesised to be significantly affected by menstrual cycle phase, with symptoms such as mental fatigue and mood disturbance peaking during the luteal phase. With data collection in its final stages, it is expected that the above hypothesis will be found across the dataset. In the event that the hormonal contraception group displays no significant performance fluctuations across the menstrual cycle, this would suggest that future study methodologies would not require adaptation in order to include both sexes. Knowledge of the effects of the menstrual cycle on strength and power outcomes in non-hormonal contraceptive groups will enable the tailoring of training around performers' cycles to produce optimal sports performance.

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G04 - Sex differences in the physiological responses to high-intensity interval exercise.

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Muscle fatigue is a topic that has been researched in various ways and for multiple purposes by many researchers. This is a particularly saturated area when it comes to male participants, in which, conclusions vary between studies. Whilst it has been established that there are differing levels of muscle fatiguability between sexes, this has not been explored during and after interval exercise (Goodall et al., 2015). Additionally, it appears that most of the studies investigating sex differences in fatiguability focus solely on the fatigue based on pre- and post-exercise measurements and not constant measurements throughout. This study aimed to investigate sex differences in fatiguability during a high-intensity interval training protocol. Twenty recreationally active participants, 10 male and 10 female were recruited to participate. The first visit consisted of an incremental exercise test, followed by familiarisation with neuromuscular measures. The second visit was made up of a protocol of 4 × 3 min intervals, with 90 s rest periods between each interval. The intervals were performed at 90% of velocity at $\dot{V}O_{2max}$. Neuromuscular stimulation techniques were used to assess fatigue of the knee-extensors. Before exercise, and in each rest period, MVC, potentiated twitch force, and voluntary activation (VA) were assessed, blood lactate sampling was performed, and heart rate and rating of perceived exertion were recorded. Following exercise, the neuromuscular assessments were repeated at 10, 20, and 30 minutes. Breath-by-breath data was collected throughout the testing protocol. The interval protocol did not highlight significant differences between males and females when measuring the decline in knee extensor MVC, resting twitch amplitude and VA ($P = 0.671$, $P = 0.544$, and $P = 0.612$, respectively). Furthermore, there was no significance between males and females when considering heart rate, RPE and percentage of $\dot{V}O_{2max}$. Both males and females fatigued to the same level after the first interval ($P < 0.001$) and then did not significantly fatigue further throughout the protocol. Both males and females did fatigue over the protocol, however, this was at a similar rate. This contradicts the outcomes from previous studies and further research is needed to fully understand why this may have happened.

Section H - Vascular & Respiratory

H01 - Enhanced sub-maximal oxygen uptake after 4 weeks of high intensity training with blood flow restriction.

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Blood Flow Restriction (BFR) training consists of exercising with inflated pressure cuffs to limit oxygen delivery to the muscle. Improvements in central and peripheral adaptations have been evidenced following high-intensity interval training (HIIT) combined with BFR. However, cardiorespiratory adaptations during submaximal exercise following HIIT+BFR are poorly documented. Thus, this study aimed to determine if HIIT+BFR is effective in enhancing sub-maximal cycling efficiency. With institutional ethics approval, 25 participants (11 females, 14 males; 19 ± 7 years old; 67 ± 8 kg) were trained 3 times a week for 4 weeks with BFR at different levels of occlusion (G1 = 20 mmHg [SHAM]; G2 = 40% Limb Occlusion Pressure [LOP]; G3 = 60% LOP). Training consisted of 4 to 7 cycling bouts of 90s HIIT+BFR performed at 90% of $\dot{V}O_{2max}$, interspersed with 2 min recovery bouts, with deflated cuffs. Pre-and post-training $\dot{V}O_{2max}$, Gas Exchange Threshold (GET) and Respiratory Compensation Point (RCP) were assessed. Pre-and post-submaximal responses were assessed during 10 min at baseline (BL; i.e. 50 W for females, 100 W for men), 6 min at moderate (MOD; i.e. BL+50% [GET – BL]), 10 min at BL, and 6 min at heavy (HEV; i.e. GET + 20% [RCP – GET]) intensities. Filtered and averaged last 2 min of each bout were compared using mixed ANOVA and post hoc analysis. Despite having no effect on $\dot{V}O_{2max}$, HIIT+BFR had an effect on submaximal respiratory data only for G3, with a significant decrease of $\dot{V}O_2$/kg during the first BL (G3: 20.3 ± 2.3 vs. 17.3 ± 2.8 mL·min·kg, $P < 0.01$), and the second BL bout of the sub-maximal test (G3: 20.2 ± 2.9 vs. 17.9 ± 2.9 mL·min·kg, $P < 0.05$). Training also decreased $\dot{V}CO_2$ for G3 on the first (G3: 1.3 ± 0.2 vs. 1.1 ± 0.2 L·min, $P < 0.01$) and the second BL bouts (G3: 1.2 ± 0.3 vs 1.1 ± 0.2 L·min, $P < 0.05$), but increased $\dot{V}CO_2$ for HEV bout (G3: 2.7 ± 0.6 vs 2.9 ± 0.6 L·min, $P < 0.05$). Four weeks of HIIT+BFR was sufficient to increase the sub-maximal cycling efficiency only for G3 by reducing $\dot{V}O_2$ and $\dot{V}CO_2$ at baseline intensity. The application of greater pressure probably increased the blood pooling in the muscles and the metabolites accumulation (Jessee et al., 2018). These findings highlight the utility of using higher pressures for BFR, when training is performed at high intensity.

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H02 - Effect of Post-Exercise Ischemic Conditioning on Recovery from Exercise-Induced Muscle Damage in University Standard Athletes.

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Team sports are characterised as high-intensity intermittent sports, and players are at risk of exercise-induced muscle damage due to high forces associated with acceleration, deceleration and physical contact. Determinants of high performance, such as strength and rate of force development, may not recover fully until 72 hours post-match, which can be detrimental to match performance. Bluetooth-controlled occlusion devices are portable, easy to use and inflate to pressures required to induce limb ischemia. Post-exercise ischemic conditioning has been demonstrated to alleviate markers of exercise-induced muscle damage and improve performance in soccer players and cyclists. The evolution of the high intensity activity of team sport athletes combined with congested match periods throughout the season, has resulted in increased observations of exercise-induced muscle damage markers after competitions. Therefore, research should continue to explore blood flow restriction's ability to enhance recovery. Research Design: Randomised controlled trial, single-blind within-subject design. Fourteen university-standard team sport athletes (7 male and 7 female) lower limbs will be randomly assigned to either a post-exercise ischemic conditioning (3 × 5 min at 50 mmHg above systolic blood pressure) or SHAM group (3 × 5 min at 20 mmHg). Occlusion will be completed using the rapid inflation system (E20, Hokanson, Bellevue, WA, USA). The experimental protocol will include 10 sets of 10 maximal voluntary eccentric contractions of the hamstrings using an Humac NORM isokinetic dynamometer (CSMi, Stoughton, MA, 2009). To assess indices of muscle damage, subjective measures including muscle soreness (DOMS) will be measured via a handheld pressure algometer (Algometer II, Sbmedic Electronics, Solna, Sweden) and physical tests such as thigh circumference (TC), unilateral countermovement jumps (CMJ) and unilateral drop jumps (DJ) will be assessed using Optojump (Microgate, Bolzano, Italy) and a floor integrated force plate (type 9281CA, Kistler Instrumentation, UK, operating at 1,000Hz) and finally, maximal voluntary isometric testing will be assessed on the Humac NORM isokinetic dynamometer (CSMi, Stoughton, MA, 2009. Following baseline assessments, perceptual and performance testing will be completed 0, 24, 48, and 72 h post-fatiguing protocol. All data will be presented as means ± standard deviation (SD). Shapiro-Wilk tests will be used to assess the normal distribution of all dependent variables. A two-way repeated measures ANOVA will be used to assess the effect of time and condition on the dependent variables. Where main effects are indicated post-hoc comparisons will be made using a Bonferroni correction. Statistical analysis will be completed using JASP (v0.16.4 Apple Silicon), with an alpha level of $P < 0.05$. Pending data analysis.

H03 - An observational study of microvascular and macrovascular endothelial function in individuals with cystic fibrosis established on Elexacaftor-Tezacaftor-Ivacaftor cystic fibrosis transmembrane conductance regulator modulator therapy compared to healthy controls.

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Cardiovascular manifestations are on the rise in people with cystic fibrosis (pwCF)as the Elexacaftor-Tezacaftor-Ivacaftor transmembrane conductance regulator (CFTR) therapy changes the profile of the disease. Given the new CFTR therapy there is an increased need to understand the wider consequences of cardiovascular manifestations. Vascular endothelial dysfunction is one cardiovascular manifestation of serious concern amongst pwCF affecting quality of life, time spent in hospital with pulmonary exacerbations, mortality rates, and exercise capacity. To date little research has been conducted to assess the impact of the CFTR modulator therapy on the vascular endothelial dysfunction experienced by pwCF.Iontophoresis and flow-mediated dilation (FMD) provide an effective assessment of micro-and macrovascular endothelial function in pwCF. Accordingly, the aims of the present study are: 1) to assess the microvascular function of individuals with cystic fibrosis (CF)on the Elexacaftor-Tezacaftor-Ivacaftor modulator therapy compared to healthy controls using iontophoresis, and 2) to assess the macrovascular function of individuals with CF on the Elexacaftor-Tezacaftor-Ivacaftor modulator therapy compared to healthy controls using flow-mediated dilation. Fifty adults and 50 children took part in the study, each comprised of 25 patients with CF and 25 age-and sex-matched controls. The data presented within this project is based upon of an interim analysis of a subset of this data. Laying in a supine position microvascular function is assessed by iontophoresis whereby an anode containing acetylcholine and a cathode containing insulin are attached to the volar aspect of the forearm. Following acclimatisation, a sequence of electrical pulses are administered and the vascular response is measured using a laser doppler system. To measure macrovascular function by flow-mediated dilation an occlusion cuff is applied distal to the medial epicondyle while lying in a supine position. An ultrasound probe is placed 2-10cm above the antecubital fossa and held in position. Blood pressure and blood vessel diameter measurements are collected throughout the pre-occlusion minute, during the 5 minute occlusion, and for 3 minutes after occlusion, and analysed upon completion. To analyse the results, mean values, standard deviations, and significant differences will be calculated and compared between pwCF and healthy controls for both iontophoresis and FMD results. Results will be presented through graphs and tables alongside corresponding text. It is believed that micro-and macrovascular endothelial function will be significantly worse in pwCF on Elexacaftor-Tezacaftor-Ivacaftor compared to healthy controls. Future research should assess other mechanistic impairments possessed by pwCF and establish whether the CFTR modulator therapy has an impact.

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H04 - The effect of Elexacaftor/Tezacaftor/Ivacaftor cystic fibrosis transmembrane conductance regulator modulator therapy on indices of cardiopulmonary fitness in UK-based children and adults with cystic fibrosis compared to healthy controls.

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Cardiopulmonary exercise testing (CPET) with supramaximal verification produces a safe and valid assessment of aerobic fitness in children and adults with cystic fibrosis (CF). Aerobic fitness is associated with improved prognosis in people with cystic fibrosis (pwCF). Elexacaftor/Tezacaftor/Ivacaftor (ETI) is a CF transmembrane conductance regulator (CFTR) modulator, which has shown to improve mechanisms that limit exercise function in pwCF, quality of life and reduces hospitalisation risk and increases mortality risk. However, little is known on the benefits of ETI on fitness and aerobic (dys)function. Therefore, the aim of this study is to investigate the aerobic fitness and mechanisms underlying this in pwCF on ETI and compared to healthy age- and sex-matched controls. The data presented within this study is based upon an interim analysis of a subset of this data. Within institutional ethics approval, 50 adults and 50 children participated in the study, each compromised of 25 pwCF on ETI and 25 healthy age- and sex-matched controls. Participants completed a ramp-incremental cycling test in which resistance increased at a predetermined rate to determine peak oxygen uptake and obtain ~8-12 min test. Maximal oxygen uptake was confirmed by supramaximal verification at 110% of the peak power achieved during the incremental ramp test. Resting anthropometric measurements and pulmonary function was recorded. Thoracic impedance cardiography to assess haemodynamics, changes in heart rate, gas exchange and ventilation were measured. Arterial oxygen saturation and blood pressure data in addition to, breath-bybreath pulmonary gas exchange and ventilation variables were measured, followed 1-s interpolation and averaged to 15-s time bins. Ratings of dyspnoea and perceived exertion for adults and the Pictorial Children's Effort Rating Table for children were obtained throughout the experiment. To analyse the results, mean values, standard deviations and independent t-tests will be calculated and presented to compare between pwCF and healthy age- and sex-matched controls. It is hypothesised that from these results, aerobic fitness, peak power output, time to exhaustion, oxygen transport, peak oxygen uptake and utilisation assessed during aerobic exercise will be significantly impaired in pwCF on ETI, as well as impacting haemodynamic variables compared to healthy age- and sex-matched controls.

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H05 - Reactive strength index and neuromuscular adaptations after 4-weeks of isokinetic strength training with blood flow restricted recovery in a physically active population.

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Blood flow restriction training (BFR-t) results in increased muscular growth and strength leading to improved performance whilst training at a lower intensity across a shorter timeframe in relation to conventional resistance training. The hypoxic conditions that are induced by BFR-t induce greater fatigue thus allowing for heightened adaptations such as a promotion of angiogenesis. However, to date no evidence has been provided to assess its effectiveness when applied during the recovery periods (BFR-r). Therefore, the aim of this study was to investigate the impact of BFR-r on the reactive strength index (RSI) and neuromuscular adaptations following a 4-week training period using an isokinetic strength programme. Following local institutional ethical approval (Anglia Ruskin University), 20 healthy and physically active adults (12 males; 8 females) volunteered to participate (mean ± SD: age, 21 ± 2.3 years; mass, 75.2 ± 14 kg; height, 174.5 ± 9.2 cm). Adopting a single-blinded, repeated measures matched pairs design of 3 different limb occlusion pressures (LOP) for training. (1) 20 mmHg [SHAM], (2) 40% LOP, (3) 80% LOP. Pre and post testing sessions consisted of ankle-brachial index (ABI), drop jumps at 60 cm, 6 s Sprint cycles and Isokinetic strength (2 × 2 sets at both 60 and 180°/s) with EMG and NIRS recorded at the rectus femoris muscle. Training comprised of 12 training sessions (3 sessions per week over 4 weeks) with BFR-r on the isokinetic dynamometer at 60°/s. Weeks 1 and 2: 3 × 5 per leg with 120 s rest; week 3: 3 × 5 per leg with 90 s rest; Week 4 2 × 2 per leg with 120 s rest between sets which was repeated after a further 180 s of rest. Blood flow restriction was applied for 60 s per recovery. Non-significant changes in RSI were observed for all 3 groups ($P > 0.05$). Trivial effects seen in Group 1 ($d = 0.014$) and a small effect seen in group 3 ($d = 0.323$), with a trivial negative effect witnessed in group 2 ($d = -0.004$). The data suggests that blood flow restricted recovery does not promote neuromuscular adaptations such as reactive strength index at any occlusion pressure, however further research needs to be undertaken utilising longer time frames and with training modalities that are specific to reactive strength index and neuromuscular changes.