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D1.S3.1 Expert Statements

D1.S3.1(1) The use of cooling therapies for post-exercise recovery

*Produced on behalf of the British Association of Sport and Exercise Sciences by **Dr ADAM GRAINGER FBASES**, Dr James Malone, Dr Joe Costello, Dr Chris Bleakley & Dr Robert Allan*

Introduction: Cooling therapies are commonly used for post-exercise recovery by recreational and professional athletes. These interventions include (but are not limited to): cold water immersion, ice packs, whole/partial body cryotherapy and phase change material. However, confusion remains within the sports science community around their effectiveness, benefits and risks. The purpose of this expert statement will be to provide evidence-based guidance for athletes, coaches and practitioners on the optimal use of cooling therapies for recovery post exercise.

Background and Evidence: We will formulate the expert statement in the following order:

(1) Prioritise high-quality empirical evidence on cooling therapies, focusing on subjective and objective markers of recovery.
(2) Quantify the benefits and risks associated with commonly used cooling therapies in sport for recovery.

Conclusions and Recommendations: This statement will provide BASES members, and the wider scientific community, with clear guidance on the safe and effective use of cooling therapies for post-exercise recovery. We will summarise our findings using an evidence-based decision tree, to facilitate application and tailoring of cold therapy across key sporting populations and end users.

D1.S3.1(2) Optimising protein intake recommendations for skeletal muscle mass in older adults to support healthy ageing

*Produced on behalf of the British Association of Sport and Exercise by Dr Tom Maden-Wilkinson, Dr David Church, Dr Marlou Dirks, Dr Oliver Witard, Professor Benjamin Wall, Professor Leigh Breen and **Dr PAUL MORGAN**.*

Please note that the following two talks are intimately linked and will therefore be delivered as one elongated talk. The maintenance (and adaptation) of skeletal muscle mass across the lifespan is important for several health-related outcomes (e.g., cardio-metabolic health, functional capacity, fall risk) and represents an important prognostic marker in many clinical conditions. An area of particular relevance for clinical nutrition is the importance of dietary protein to maintain muscle mass. A blunted muscle protein synthesis ([MPS] the main regulator of muscle mass) response to each meal (termed 'anabolic resistance') as we age is a primary determinant of age-related muscle loss (termed 'sarcopenia'). Therefore, in this expert statement/talk we will discuss how current dietary protein recommendations could be optimised in an effort to combat anabolic resistance and therefore support healthy (muscle) ageing. We will focus on providing practically relevant and concise dietary protein intake recommendations across the lifespan.

D1.S3.1(3) Protein recommendations for athletes: Amount, type and timing

*Produced on behalf of the British Association of Sport and Exercise Sciences by **Dr PAUL MORGAN**, Dr Sophie Killer, Dr Lindsay Macnaughton, Dr Marlou Dirks, Dr Oliver Witard, Professor Benjamin Wall and Professor Leigh Breen*

The topic of protein nutrition is continually evolving, with much interest focussed on recommendations for athletic populations. From an applied perspective, each of the 4000+ meals consumed across an Olympic cycle (assuming 3 meals/day) provides an opportunity for dietary protein to support recovery, adaptation and/or athletic performance. This expert statement/talk presents concise, evidence-based, and practically relevant protein recommendations for athletes and physical active individuals. The primary nutritional role of dietary protein is the provision of amino acids (AA) for the synthesis of new, functional proteins, including skeletal muscle (termed muscle protein synthesis [MPS]). While a sufficient quantity of non-essential amino acids can be supplied endogenously, an exogenous (e.g., dietary) supply of essential amino acids (EAA) is necessary for the stimulation of MPS. Muscle proteins are constantly turning over (~1–2%·day-1), with the degradation of old, damaged proteins and synthesis of new, functional proteins. Hence, refining protein recommendations beyond simply total daily intakes to encompass the nuances of each postprandial MPS response, is warranted. These expert statements are dedicated to the late Professor Kevin Tipton who made a significant contribution to the field of protein nutrition and muscle hypertrophy.

D1.S3.1(4) Creating inclusive and empowering environments for disabled people

*Produced on behalf of the British Association of Sport and Exercise Sciences by **Dr TABO HUNTLEY**, Professor Brett Smith, Dr Tori Sprung, Dr Toni Williams & Lydia Bone*

Introduction: Equity, diversity and inclusion (EDI) has now become as key focus for intuitions (e.g., Universities and Sport Governing Bodies), including BASES, who have a remit to widen participation in all aspects of sport and physical activity (PA). With reference to BASES, the widening participation agenda is central to the 'Strategic Plan 2021–2025", where the core values of "Equity, Diversity and Inclusion" is evident within the Strategic objectives of "Value proposition for membership" and "Professional standards". This means that EDI must influence scientific research, education, practice, and the workplace environment. In other words, BASES has responsibility to ensure that a suitably trained and qualified sport and exercise workforce can deliver and experience equitable, inclusive and empowering environments, so that everyone is able to fulfil their potential. However, it is commonly recognised that the disabled population – people with impairment disabled by society – face disproportionate barriers to all aspects of sport and PA. There is a paucity of research regarding how best to support the needs of people with disabilities and educational support for workforce development, but further work is warranted to aid understanding. Consequently, the disabled population remains excluded and under-supported in sport and PA. Given the important role BASES plays in the learning, education and development of sport and exercise scientists and practitioners, an expert statement on disability is required to guide workshop curriculum design, mentor development and individual reflexivity so that people with a disability can flourish in sport and PA. Here, the authorship team provides a unique mix of expertise and experiences that span disability research, co-production approaches, creation of influential guideline documents and EDI reports, and experience in delivering training to support workforce development. As such, the statement will offer:

(1) Critical insight into the way disability is understood in society and sport and the implications this has for the field of sport and exercise scientists and practitioners.
(2) Detail core subject areas and topics that should be embedded within, the learning and developmental experiences of BASES trainees, mentors and workshops.
(3) Provide recommendations for future collaborative research and evaluation within the field including empirical studies exploring the effectiveness of disability-related interventions and the impact on practice.

D1.S3.1(5) Masters dissertation award: Prevalence of disordered eating, exercise dependency, mood disorders, and low energy availability in non-elite competitive endurance athletes

GREGORY WRIGHT, IFIGENEIA GIANNOPOULOU, MARIA KOTOPOULEA-NIKOLAIDI

University of Brighton, Eastbourne, UK

Endurance athletes are a high-risk population for low energy availability (LEA) and relative energy deficiency in sport (RED-S) due to high levels of EEE, increased prevalence of disordered eating (DE) and their desire to maintain a low body mass (Mountjoy et al., 2018, Nutrition and Exercise Metabolism, 28(4), 316–331). However, research has typically focused on elite- and high-level athletes. The study aimed to assess a) the prevalence of DE, exercise dependency (EXD), depression, and LEA in non-elite competitive endurance athletes compared to non-athletes and b) to compare DE, EXD, depression, and LEA prevalence in male and female athletes. With institutional ethics approval, 175 participants completed: Eating Disorders Examination Questionnaire 6 (EDE-Q 6.0), Profile of Mood State Questionnaire (POMS), ORTO-15, Exercise Dependence Scale-21 Manual (EXDS-21), Socio-cultural Attitudes Towards Appearance Questionnaire 4 (SATAQ-4), and Athletic Identity Measurement Scale (AIMS). Fifty athletes and 20 non-athletes completed 4-day self-reported nutritional and exercise diaries. Ten athletes and ten non-athletes undertook resting metabolic rate (RMR) measurements via indirect calorimetry and body composition and bone mineral density measurements via dual-energy X-ray absorptiometry. Athletes produced significantly greater scores for depression, all EXDS-21 measures, and had a significantly greater prevalence of orthorexia than non-athletes ($P < 0.05$). Athletes had significantly greater scores for the eating concern subscale of the EDE-Q ($P < 0.05$), produced larger average scores for all other EDE-Q measures, and presented with a greater prevalence of pathologic DE and EXD behaviours than non-athletes (51% vs 8%). Athletes presented with a 35% larger prevalence of LEA, significantly lower energy balance and energy availability, and significantly greater EEE than non-athletes ($P < 0.05$). About 70% of athletes presented with RMR suppression, compared to 0% of non-athletes. Female athletes had a larger prevalence of LEA than male athletes (46% vs 32%). Body mass, SATAQ-4 internalisation factors, and ORTO-15 and EXDS-21 scores significantly predicted EDE-Q score ($F(5,44) = 20.031$, $P < 0.001$, $R2 = 0.70$). Additionally, body mass and ORTO-15, EXDS-21, and EDE-Q scores were significant predictors of athletic EA ($F(4,45) = 15.718$, $P < 0.001$, $R2 = 0.58$). Finally, body mass and EXDS-21 and EDE-Q scores significantly predicted depression ($F(3,127) = 41.496$, $P < 0.01$, $R2 = 0.39$). Non-elite endurance athletes are at greater risk of DE, EXD, depression, and LEA than non-athletes, with female athletes at greater risk than male athletes. The reported prevalence of DE, EXD, and LEA matches studies in elite athletes.

D1.S3.2 Free Communications - Physical Activity for Health

D1.S3.2(1) Responsiveness of functional assessments to monitor change in balance, walking speed and strength of older adults: A systematic review of the minimal detectable change

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Age-related change in physical health can negatively impact the performance of functional activities, which can affect quality of life and well-being (Kojima et al., 2016, Journal of Epidemiology and Community Health, 70, 716–721). Physical activity interventions have been used to counter the effects of ageing on functional movement (de Labra et al., 2015, BMC Geriatrics, 15, 154; Richardson et al., 2019, European Journal of Sport Science, 19, 234–246). However, the ability to observe change is influenced by the size of error within observed outcome values (Hopkins, 2000, Sports Medicine, 30, 1–15). This can be indicated via the Minimal Detectable Change (MDC) statistic (Haley & Fragala-Pinkham, 2006, Physical Therapy, 86, 735–743), providing a quantifiable value defining the responsiveness of the functional assessment; a lower MDC suggests a better ability to detect a small improvement or deterioration in functional ability (Haley & Fragala-Pinkham, 2006, Physical Therapy, 86, 735–743). The objective of this study was to systematically review and evaluate the responsiveness of different functional tests via the MDC across different older adult population cohorts. The systematic review protocol was published in PROSPERO (CRD42019147527) and involved searching ISI Web of Knowledge and PubMed databases from inception to 26 September 2020. Studies were included if the older adults were on average over the age of 60 and recruited from community dwellings, hospital and residential home settings or had musculoskeletal conditions (health subgroup). The MDC values were extracted for gait speed, grip strength, balance, timed up and go, and repeated chair stand tests and were analysed based on health subgroup. Comparisons of MDC were also made between the functional test, study design (between- and within-rater designs) and MDC calculation methodology. Regression analysis was performed to explore the impact of these factors on the MDC ($p < 0.05$). A detailed overview of the results can be found in a full paper available in an open-access repository (https://medrxiv.org/cgi/content/short/2022.06.06.22276029v1). In summary, 39 studies met the inclusion criteria and MDC values were not available for all assessments across all population cohorts. The MDC was affected by the functional test used, population and MDC calculation methodology. Thus, the MDC should be assessment and population specific, and this should be considered when using the MDC in the evaluation of interventions such as physical activity used to counter changes due to ageing.

D1.S3.2(2) The physiological and perceptual responses of post exercise hot water immersion in physically inactive middle-aged adults

CHARLES STEWARD[1], MATHEW HILL[1], CAMPBELL MENZIES[1], CHRISTOPHER PUGH[2], DOUGLAS THAKE[1], MUSHIDUR RAHMAN[1], AND TOM CULLEN[1]

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Hot water immersion (HWI) replicates some of the acute vascular responses of moderate-intensity aerobic exercise that underpin improvements in vascular health. Therefore, HWI as an adjunct to exercise may enhance the physiological responses from shorter and less intense bouts of exercise. The aim of this study was to determine whether post-exercise HWI can augment shear rate responses when compared to exercise and HWI alone. After ethical approval, sixteen physically inactive middle-aged adults (9 males and 7 females; age 54 ± 6 years; BMI 29 ± 4 kg · m^2; VO2max 24 ± 6 ml· kg^{-1}· min-1) completed a randomised repeated measures study consisting of three conditions; 1) Cycling + HWI 2) Cycling + REST and 3) HWI + HWI. Each condition had two 30 minutes bouts separated by 10 minutes of rest. Cycling was performed at a power output equivalent to 50% VO2max. HWI was at 40°C up to the mid sternum with arms not submerged. Room temperature was 20 ± 1°C for all conditions. Ultrasound scans of the brachial and superficial femoral arteries were assessed at baseline, 30, 70, and 100 minutes. In addition, perceptual and thermo-physiological measures were assessed at 5- or 10-min intervals. Post hoc pairwise comparisons showed a higher total shear rate area under the curve for Cycling + HWI (brachial: $P < 0.001$, $d = 0.84$, CI 298 to 473 s^{-1} and femoral: $P < 0.001$, $d = 0.81$, CI 112 to 216 s^{-1}) and HWI+HWI (brachial: $P < 0.001$, $d = 1.02$, CI 364 to 614 s^{-1} and femoral: $P < 0.001$, $d = 0.96$ CI 148 to 297 s^{-1}) compared with Cycling + REST. There was no difference in total shear rate between Cycling + HWI and HWI + HWI (brachial: $P = 0.06$ and femoral: $P = 0.11$). In the Cycling + HWI condition mean thermal comfort was "slightly comfortable to comfortable" ($P = 0.16$) and basic affect was "good" ($P = 0.18$) with no differences between conditions. Cycling + HWI was more pleasurable ($P = 0.02$, median difference 1), pleasant ($P = 0.03$, median difference 1) and gratifying ($P = 0.04$, median difference 1) than Cycling + REST. These findings suggest that HWI after moderate-intensity aerobic exercise is enjoyable and can augment total shear rate responses. Therefore, post-exercise HWI may offer a practical strategy to further improve vascular health for physically inactive individuals.

D1.S3.2(3) The effects of prescribed exercise on the physical and cognitive health of adults with down syndrome

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Down syndrome is the result of the presence of either the whole or part of an additional duplication of chromosome-21. The countenance of this additional chromosome can be linked to chronotropic and respiratory incompetence, neuromuscular conditions, immunological suppression alongside impaired decision-making, verbal reasoning, processing, and executive function. Recent works showed that adults with Down syndrome engaged in just 10.1 ± 13.5 min of moderate-intensity activity per day and the financial health care costs to the community were 4.2 times greater than those for the general population. Therefore, the aim of this study was to examine the effects of 8-weeks of prescribed exercise and/or cognitive training on the physical and cognitive health of adults with Down syndrome. Following institutional ethics approval 41 participants (age 26.3 ± 6.0) from 4 countries volunteered and agreed to participate. Measures of physical fitness and cognitive function were obtained using a modified version of the 6-min walk test, completed twice as well as a modified version of the talk test, while cognitive and executive function were assessed using the Wisconsin Card Sorting task, Corsi block test, Stroop task, and the Sustained-Attention-To-Response Task (SART) test. All tests were completed pre- and post-intervention. Based upon distance completed across the 6-min walk test, participants were assigned to 8-weeks of either 3 × 30 min of walking (EXC), 6 × 20 min of cognitive training (COG), combined group of EXC and COG (COM) or no intervention (CON). Data are expressed as mean ± SD. Repeated measures ANOVA showed a significant increase ($P < 0.05$) in 6-min walk distance for both EXC (67.3 ± 79.3 m) effect size (ES) ± 95% CI's (ES = 0.67; −1.47–0.17) and COM (86.0 ± 74.4 m) (ES = 0.89; −1.73 to −0.05). SART mean response time decreased by 43.9 ± 128.5 ms, ES = 0.54 (−0.42–1.45) COM, while the number of correct responses increased by 3.4 ± 4.0%; ES = 0.51 (−1.37–0.41) for EXC and 9.9 ± 14.6%; ES = 0.69 (−1.69–0.32) COM. COM, EXC and COG all exhibited significant increases in their percentile ranking for overall cognitive performance using BrainHQ metrics ($P < 0.05$). These preliminary findings show that prescribed exercise can have a profound effect on both the physical and cognitive health of adults with Down syndrome. Additionally, these results offer insight into how exercise can be a potent tool in the societal development of the Down syndrome community.

D1.S3.2(4) Reliability of the Physical Literacy in Children Questionnaire (PL-C Quest) in English Primary School Children

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The Physical Literacy in Children Questionnaire (PL-C Quest) is a novel holistic measure of children's self-reported Physical Literacy (PL) developed in Australian children (Barnett et al., 2020, Physical Education and Sport Pedagogy, 1–26; Barnett et al., 2022, Psychology of Sport and Exercise, 60, 1–12). The PL-C Quest provides a time-efficient measure of the core domains of PL. However, it has not been tested outside Australia, and therefore, it is unclear whether the psychometric properties are consistent when applied to a sample of children in the UK. Thus, the study aimed to evaluate the test–retest reliability and internal consistency of the PL-C Quest in English School Children. Following institutional ethical approval, and written parent and participant consent/assent, data were collected from 264 primary school children (46.6% boys; aged 10.0 ± 0.9 years; 95% white British). From these a convenience sub-sample of 66 children (45.5% boys; aged 10.13 ± 0.91 years) completed the PL-C Quest, which consists of 30 pictorial items relating to PL elements under four PL sub-domains (physical, psychological, social, and cognitive) twice within 10-days. Test–retest reliability was calculated using intraclass correlations (ICC) with two-way random single measures for absolute agreement (ICC, 2,1) with 95% confidence intervals (95% CI), for all participants (n = 66) and stratified by sex. Cronbach's alpha (α) was used as a measure of internal consistency on the full sample (n = 264). All data were analysed in SPSS, v28. The PLC-Q total score showed excellent test–retest reliability across the 10-day interval (ICC, 0.94; 95% CI, 0.90–0.96). Subdomain values were excellent for physical domain (ICC, 0.93; 95% CI, 0.88–0.95) and good for social (ICC, 0.82; 95% CI, 0.71–0.89), psychological (ICC, 0.88; 95% CI, 0.80–0.92), and cognitive (ICC, 0.77; 95% CI, 0.62–0.86) domains. Stratified by sex, both boys and girls total scores showed excellent test–retest reliability (ICC, 0.95; 95% CI, 0.90–0.9; ICC, 0.93; 95% CI, 0.86–0.96). Boys had lower ICC values than girls for the social (0.75 vs 0.86) and psychological (0.86 vs 0.90) domains, but higher for the cognitive domain (0.82 vs 0.70). ICC values were the same for the physical domain (0.93). Overall, a high level of internal consistency was found for the PLC-Q ($\alpha = 0.83$). Results suggest that the PL-C Quest demonstrates reliability and consistency in our sample, supporting its use in children in England.

D1.S3.2(5) A systematic review using the socio-ecological model for physical activity interventions aiming to prevent type 2 diabetes after gestational diabetes

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Gestational Diabetes Mellitus (GDM) is a common pregnancy complication that increases subsequent risk of Type II diabetes mellitus (T2DM). Lifestyle changes, including increased physical activity, can reduce T2DM onset, even after GDM. However, a wide range of barriers exist which are not always addressed in interventions aiming to increase physical activity after GDM. A socio-ecological approach highlights the need to include these multi-level factors when trying to change behaviour. Therefore, the aim of the review was to investigate the extent that interventions to prevent T2DM after GDM have integrated a socio-ecological approach and the impact on physical activity outcomes. A computer-based systematic literature search was conducted in five databases: MEDLINE (via EBSCO), Cochrane Library, Web of Science (via Clarivate Analytics), CINAHL Complete (via EBSCO), and Scopus. Studies had to be conducted in women who experienced GDM in the past 5 years and target physical activity in some way. All study types were included. Published protocol papers were also included and grouped with results papers. An adapted socio-ecological model was used as an a priori framework to classify intervention components. Physical activity results were categorised as "U" if no outcomes were available, "N" if there were no changes in physical activity, "Y" if physical activity outcomes increased, and "Y*" if these were significant. Forty-two studies met the inclusion criteria (comprising 35 different interventions). There was no distinct pattern between study type and methodological quality, with eight studies "limited", thirty-three "adequate" and one "good" quality. The greater the number of levels of the socio-ecological model included, the more "Y*" and "Y" physical activity results seen. Mixed physical activity outcomes were observed across components used at the intrapersonal level, the first level of the socio-ecological model, with components across other, wider levels showing greater variation and more definitive patterns. Physical activity outcomes are likely constrained by intervention components used across wider levels of the socio-ecological model, rather than just intrapersonal level components. Specifically, intervention components within the interpersonal and organisational levels, like childcare provision, including group-based sessions and offering remote delivery, were identified as important intervention components, more often present in interventions seeing physical activity increases. Future interventions targeting physical activity in women after GDM should therefore aim to include these components in their intervention design.

D1.S3.2(6) "I was having my midlife fat crisis": exploring the experiences and preferences of home-based exercise programmes for adults living with overweight and obesity

SOFIE POWER, NIKITA ROWLEY, MICHAEL DUNCAN AND DAVID BROOM FBASES

Coventry University, UK

The involvement of people with lived experience in the design of exercise programmes may lead to a more needs sensitive and population-specific intervention (Morgan et al., 2016, Research Involvement and Engagement, 2). However, the integration of people living with overweight and obesity when designing home-based exercise programmes has primarily been ignored, despite this being a population that would significantly benefit from a suitably tailored programme. Therefore, key information, relevant to the design of these population-specific programmes, may have been missed. This study qualitatively explored the experiences of home-based exercise programmes for adults living with overweight and obesity and aimed to identify preferences for the design of future home-based exercise programmes. Following institutional ethics approval, a semi-structured interview guide was developed and piloted with four individuals, to test understanding, flow, feasibility of questioning and approximate interview length. Twenty adults (aged ≥18 years, 12 females) either living with or previously lived with overweight (BMI ≥ 25 kg/m^2) or obesity (BMI ≥ 30 kg/m^2) or having used exercise as a weight management mechanism, undertook virtually conducted semi-structured interviews, with a mean interview time of 25 ± 11 min. Interviews were transcribed verbatim by the lead researcher and distributed to participants for member checking to ensure that they were representative of the conversation. Taking an experiential approach, reflexive thematic analysis was used to analyse the transcripts and give voice to participant's experiences of and preferences for home-based exercise. Twenty generated codes highlighted considerations in programme design and engagement moving forward. These included comfort within a home-based environment, a desire for social connection and the integration of technology. Four corresponding themes were generated, encapsulating 1) participant's choice reasoning for home-based exercise, 2) difficulties of engaging in home-based exercise, 3) undertaking and adhering to home-based exercise, and 4) factors that constitute the perfect programme. These findings have informed the design and development of a home-based exercise programme for adults living with overweight and obesity, which will be further tailored through Patient and Public Involvement events. Results suggest that the home is an appropriate setting for exercise programmes for adults living with overweight and obesity wishing to be active. However, they should be designed in collaboration with people with lived experience of overweight and obesity to potentially increase programme adherence, engagement and enjoyment.

D1.S3.3 Sport and Performance

D1.S3.3(1) Changes in mental fatigue, physical fatigue and mood state during a two-day orienteering competition

HUI KWAN NICHOLAS LAM, JOHN SPROULE, ANTHONY P. TURNER AND SHAUN M. PHILLIPS

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Mental fatigue (MF) caused by prolonged cognitively demanding tasks has been shown to have a negative impact on athletes' mood state and performance (Van Cutsem et al., 2017, Sports Medicine, 47(8), 1569–1588). MF also has a deleterious effect on sport-specific reaction time and decision-making accuracy, regardless of the type of sport (Habay et al., 2021, Sports Medicine, 51(7), 1527–1548). Experimentally inducing MF before an orienteering race has been shown to increase the completion time of the race (Batista et al., 2021, The Journal of Sports Medicine and Physical Fitness, 61(5), 673–9). However, no research has investigated whether MF develops organically during orienteering competition. The aim of this study was to measure self-reported MF, physical fatigue and mood states during a two-day orienteering competition. Following institutional ethical approval, 14 national-level orienteers (age: 20.4 ± 5.2, height: 1.76 ± 0.1 m, body mass: 63.3 ± 7.2 kg, competitive experience: 11.1 ± 5.6 years) provided informed consent and completed an online survey, before and immediately after race one and two (PRE1/PRE2 and POST1/POST2), and 24- and 48-h post-race two (24POST and 48POST). Race one and two were separated by at least 20 hours depending on the racing schedule. A 0–100 visual analogue scale and the vigour, subscale of The Brunel Mood Scale assessed the MF, PF and mood state, respectively. There was a moderate increase in MF (d = 0.9, 95% CI 0.16 to 1.61) and a large increase in PF (d = 2.02 , 95% CI 1.09 to 2.93) from PRE1 to POST1. MF was moderately decreased from POST1 to PRE2 (d = -0.73, 95% CI -1.42 to 0.02). There was also a moderate increase from PRE2 to POST2 (d = 0.85, 95% CI 0.08 to 1.59). The MF ratings showed a moderate increase at PRE1 vs. 24POST (d = 1.14, 95% CI 0.31 to 1.93) and PRE1 vs. 48POST (d = 0.62, 95% CI -0.07 to 1.29). Trivial to moderate decreases in vigour scores and a large decrease in vigour scores presented at PRE1 vs. 24POST (d = -1.25, 95% CI -2.05 to -0.42). PF demonstrated a similar change as MF where these two variables reported a noticeable change immediately after the competition and the ratings remain elevated two days after the competition. To optimise orienteering performance, practitioners should monitor MF daily, especially if the competition schedule is longer than 2 days.

D1.S3.3(2) Association between whole body phase angle and anaerobic performance in CrossFit® athletes

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The use of bioelectrical impedance analysis (BIA) has been extended for body composition analysis. Additionally, recently, both segmental and whole-body phase angle (WBPA) at 50 kHz, has gained special attention due to its ability to determine nutritional and functional status. Norman et al. ([2012]. Clinical Nutrition, 31, 854–861) found WBPA to be associated with muscle strength and aerobic fitness in people suffering from different conditions, and Di Vincenzo et al. ([2019]. Journal of the International Society of Sports Nutrition, 16, 1) showed WBPA to be higher in athletes with higher levels of performance and athletes compared to controls. However, to our knowledge, there is no study conducted to assess its relationship with the physical abilities of CrossFit® (CF) athletes. Therefore, the main purpose of this study was to correlate the phase angle, specifically WBPA, with the anaerobic performance in CF athletes. Fifty CF athletes (25 males and 25 females) were recruited to participate in the study (age 33.3 ± 6.81 years; height 169.61 ± 8.76 cm; bodyweight 72.78 ± 12.18 kg). All participants had been practicing CF for at least 1 year and a minimum of 3 h per week. They were tested in two separate sessions, one for BIA (Inbody 770) and one for the all-out test. For the BIA session, they were asked to come to the laboratory without having eaten or drunk anything for at least 4 h. To assess anaerobic performance, the Wingate test was performed. This test consists of 30 s at maximum effort on a cycle ergometer. For the all-out session, they were advised to refrain from high-intensity physical activity for 24 hours before testing. Peak (WGPP), mean (WGXP) and minimum power (WGMP) were determined. All procedures were approved by the ethics committee of the university of Malaga (CEUMA: 43–2018-H), according to the recommendations of the Declaration of Helsinki. WBPA showed significant correlation

with WGPP (r = 0.67, P < 0.01), WGXP (r = 0.69, P < 0.01) and WG MP (r = 0.52, P < 0.01). In conclusion, our results show that WBPA is directly associated with power values, which suggests that it might be considered as an indicator of anaerobic performance in CF athletes.

D1.S3.3(3) The effect of low frequency resistance training on estimates on jump performance in girls' soccer players: an applied case series

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Strength training is emphasised within the youth physical development model for girls (Lloyd and Oliver, 2012, Strength & Conditioning Journal, 34, 61–72) yet there are few studies that have quantified its effectiveness in a "real world" setting. Jump testing provides a time-efficient and reliable assessment of strength training as it estimates maximal vertical impulse and stretch-shortening cycle function with differing time constraints, important for sports such as soccer. Thus, the aim of this applied case series was to track changes in jump performance over an off-season strength training intervention in girls soccer players. Twenty-four girls soccer players from an FA Regional Talent Club (mean age: 15.0 ± 0.77 years; stature: 163 ± 5.9 cm; mass: 56.4 ± 6.2 kg age) were invited to attend one, 60-min, off-season, strength training session per week for 7 weeks. Sessions consisted of a fundamental movement skill warm-ups and resistance training movements: squats, inverted row, Romanian and trap bar deadlift and the Nordic hamstring exercise. The countermovement and 10 of 5 repeated-jump test were performed (Optojump, Microgate, Italy) each session after the warm-up. Week 1 players were habituated to testing and thereafter countermovement and repeated-jump height (cm) and contact time (s) were tracked (week 2 to week 7) in players who had a minimum of three data points (13 players; mean 4.8 ± 1.3 sessions). After institutional ethics release, data, which met the assumptions for normality, were analysed through mixed-linear modelling to evaluate the effect of training week (fixed factor) on jump performance, accounting for the random variation of each individual player. Repeated-jump height was adjusted for variance in ground contact time within the model. All statistics were performed in R-Studio ("lme4" package). Initial mean countermovement height was estimated at 27.2 (between-participant SD ± 4.96; within-participant SD 1.10) cm and training week had a significant positive effect (P = 0.018) with the greatest increase at week 6 (2.5, 95% CI 1.20 to 3.8 cm). The adjusted mean repeated-jump height was estimated as 22.92 (± 4.64; ± 1.93) cm and did not differ significantly across weeks (P = 0.06), although a decrement was observed in week 3 (−2.45, −4.59 to −0.30 cm), perhaps indicative of acute fatigue. Strength training appears viable for improving maximal vertical impulse in girls' football players in a "real world" setting, typified by low session frequency. Lack of improvement in repeated-jump performance may reflect the specificity of training prescription.

D1.S3.3(4) The dose-response relationship between training load measures and aerobic fitness in professional male academy soccer players during the in-season period

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The dose–response relationship between training and fitness adaptation is fundamental to the training process (Impellizzeri, Marcora & Coutts, 2019, International journal of sports physiology and performance,14,270–273). Most research examining this relationship between training load (TL) measures and changes in aerobic fitness has reported linear findings in soccer. Still, non-linear relationships have been evidenced in Rugby Union (Taylor, Sanders, Myers, T., et al.,2018, International journal of sports physiology and performance,13,163–169). Thus, this study aims to assess the linear and non-linear relationships between TL measures and changes in aerobic fitness during the in-season period. Nineteen (176 ± 8.1 cm, 71 ± 4.4 kg, 18 ± 2 yr) professional academy soccer players from two different teams (U18 = 10, U23 = 9) completed a lactate threshold test to identify changes in treadmill speed at 2 mmol · L^{-1} (S2) and 4 mmol · L^{-1} (S4) before and after 6 weeks of in-season soccer training. The internal TL measures monitored were training impulses (TRIMP) and session rating of perceived exertion multiplied by duration (sRPE-TL) on a 0–10 scale. The TRIMPs included the individual TRIMP (iTRIMP), Banister TRIMP, Lucia TRIMP and Edwards TRIMP. To monitor external TL, the U18 team used a Catapult S5 (Catapult Innovations, Melbourne, Australia), whereas the U23 used STATsports Apex (STATsports, Co Down, N. Ireland) with both global position systems sampling at 10 Hz. Written informed consent was given by each player, with the study being approved by the university ethics committee. Different Bayesian regression models were run with different likelihood functions. The best-fitting models with the lowest out-of-sample prediction error and the highest variance explained (R2) were used. iTRIMP demonstrates the strongest linear relationships with aerobic fitness with R2 ranging from 0.30 to 0.70 (95% CI: 0.05–0.79) across both teams. However, sRPE-TL shows a strong relationship with changes at S2 (R2 = 0.75, 95% CI: 0.41–0.85) and S4 (R2 = 0.54, 95% CI: 0.11 to 0.72) for the U23 team using a polynomial fit, but this is not reciprocated in the U18 group. For both teams, the total distance, very high-speed running (19.8–25.2) and sprint distance (>25.2) displayed an R2 of 0.05 to 0.16 (95% CI: 0–0.38) across all changes in fitness measures. The results of this study suggest that iTRIMP generally demonstrates the strongest relationships with changes in aerobic fitness, but sRPE-TL exhibits a non-linear response to the U23 squad. Consequently, during the competitive stage of the season, where increasing aerobic fitness is not the primary aim, there is an increased range of individual responses to changes in aerobic fitness.

D1.S3.3(5) Front crawl body roll characteristics of highly trained swimmers with central motor and neuromuscular impairments

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Rotation of the body about its long axis, commonly referred to as body roll, is an essential feature of front crawl swimming. Body roll may facilitate the breathing action, aid over-water recovery of the arm, increase propulsion, decrease drag, and reduce shoulder injury risk. Body roll involves rotation of the entire trunk combined with a twist of the trunk such that the hips and shoulders may achieve different amplitudes, possibly at different times in the stroke cycle (Yanai, 2001, Journal of Applied Biomechanics, 17, 28–42). Swimmers with central motor and neuromuscular impairments (CMNI), such as cerebral palsy, typically find it challenging to perform the rhythmic and coordinated movements required in front crawl. It is hypothesised that front crawl swimmers with CMNI will present atypical body roll characteristics. This study aims to: (i) compare body roll kinematics between non-disabled swimmers and those with CMNI and (ii) examine the effect of impairment severity (S class) on body roll. With approval from the Manchester Metropolitan University Ethics Committee, 27 Para swimmers (S1–S9) with an eligible CMNI were recorded by six synchronised cameras while performing front crawl. 3D shoulder and hip coordinates were obtained for a full stroke cycle at 50 Hz. Shoulder and hip roll angles were defined by projecting the vectors linking each joint pair onto the plane perpendicular to the swimming direction. CMNI swimmers' shoulder roll range (88 ± 21°) was well below values (107 ± 8°) reported for skilled non-disabled swimmers (Psycharakis and Sanders, 2008, Medicine & Science in Sports & Exercise, 40, 2129–2136), whilst their mean hip roll range (75 ± 29°) was notably greater than values reported (50 ± 12°) for the same non-disabled group. Shoulder and hip roll asymmetries were higher in CMNI swimmers (10 ± 7° and 10 ± 8°, respectively) than in the non-disabled group (8 ± 5° and 6 ± 4°, respectively). No association was found between impairment severity (S class) and any body roll metric. CMNI swimmers with a strong leg kick exhibited greater hip roll range (88 ± 37°) and mean hip roll angular speed (129 ± 31°·s^{-1}) than those with a weak or absent leg kick (74 ± 29° and 96 ± 38°·s^{-1}, respectively). CMNI swimmers displayed differences in shoulder and hip roll range and asymmetries, compared to non-disabled swimmers. These differences may hinder their ability to generate propulsion and minimise drag, and consequently limit swimming speed.

D1.S3.3(6) A loss of control: Locomotor activities and subjective load differences between professional youth soccer players and professional development loans

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Weekly training and match locomotor activity and subjective load between elite and development loan youth soccer players registered to a primary club were quantified and compared. Development loans involve players being loaned to a lower-league club for training and matches with the loan club whilst being available for development fixtures and training with the primary club. Data were collected in 16 squad players and 4 development loan players at host clubs across a 41 week competitive phase of the 2018/19 season. Analysis was completed on total distance (m), PlayerLoadTM (au), low intensity running (<14.4 km.h^{-1}, m), running (19.8-24.98 km h^{-1}, m), sprinting (>24.98 km h^{-1}, m), accelerations (>2 m s^{-2} count), decelerations (<-2 m s^{-2}, count) and subjective load (sRPE). The study was awarded institutional ethical approval by The Robert Gordon University (SHS20/30). Point estimates for the development loan players consistently showed lower weekly values than squad players for all variables ranging from 5.2% (weekly sRPE) to 16.8% (weekly sprint distance covered). Differences, however, were not found to be statistically significant ($p \geq 0.07$). Variance ranged from 23.6% (weekly distance) to 37.7% (weekly high-intensity accelerations). Development loans may not be beneficial for physical development with the primary club's loss of control being a potential factor in the lower weekly values. Scheduling considerations for training and match play do not take advantage of the hybrid nature of the development loan system and as such the opportunity is not being optimised. The integration of B squads into the Scottish professional game warrants further analysis as a positive alternative to the development loan system.

D2.S1 – 5 slides in 5 minutes free communication sessions

D2.S1.1 Sport and Performance

D2.S1.1(1) The effect of maturity on periods of slow and fast stretch-shortening cycle development in girls aged 7–17 years

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Many explosive sporting actions such as sprinting and jumping inherently involve the stretch-shortening cycle (SSC). Slow (>250 ms) and fast (<250 ms) SSC function improves with increasing maturity in boys, due to the development of several morphological, structural, and neurological factors, but the magnitude of any improvements in girls is not as well understood. The aim of this study, therefore, was to compare SSC function between girls of different maturation phases, as determined by years from peak height velocity (PHV). The study was conducted in accordance with the latest version of the Declaration of Helsinki (World Medical Association, 2013), and all procedures were approved by the Manchester Metropolitan University ethical committee for the use of human participants. After receiving a verbal and written explanation of the experiment protocol and its protentional benefits and risks, parents/guardians gave written consent for their daughters to participate. Following a pre-activity readiness questionnaire (PARQ), 130 non-elite schoolgirls aged 7–17 years (mean age: 12.8 ± 2.4 years; height: 1.56 ± 0.13 m; body mass 47.8 ± 12.8 kg) were grouped as pre-PHV (n = 30), mid-PHV (n = 31) or post-PHV (n = 69). Using an Optojump Next system, participants completed three trials of squat jumps (SJ) and countermovement jumps (CMJ) to assess slow SSC, three trials of five maximal bilateral hops (5max) and one trial of 20 submaximal bilateral hops (20submax) to assess fast SSC via measurement of the reactive strength index (RSI) and leg stiffness, respectively. The peak value from each trial was included in subsequent analyses. SJ height (14.6%; $p = 0.005$), CMJ height (14.5%; $p = 0.004$), RSI (27.6%; $p < 0.001$), and relative leg stiffness (15.0%; $p = 0.002$) were significantly higher in the post-PHV group compared to the pre-PHV group, whereas SJ, CMJ, and RSI between the pre-PHV and mid-PHV groups were not ($p > 0.058$). Absolute stiffness was significantly higher in the mid-PHV and post-PHV groups (67% and 76%, respectively; $p < 0.001$) compared to the pre-PHV group. Relative leg stiffness was significantly higher in mid-PHV compared to pre-PHV (35%; $p = 0.001$) and post-PHV groups (17.2%; $p > 0.002$). In conclusion, slow SSC (SJ and CMJ) does not increase significantly in girls between consecutive maturity groups, whereas fast SSC may, as indicated by increases in absolute leg stiffness. A lack of RSI development between consecutive maturity groups, however, suggests increases in fast SSC are task-dependent.

D2.S1.1(2) The effect of competitive Gaelic games match play on 10–5 repeated jumps, countermovement jump and maximal voluntary contraction

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Gaelic Games are amateur sports played throughout Ireland, with most adult players having full-time jobs or study commitments whilst playing. Following competitive match play, Gaelic game players experience transient fatigue due to the physical demands of the game, which involve sprinting, jumping, accelerating and changing direction, causing major disruptions to numerous physiological systems (De Hoyo et al., 2016, Journal of Sports Sciences, 34, 1363–1370). The aim of this study was to examine the post-match changes in neuromuscular function following competitive Gaelic Games. Participants performed countermovement jumps (CMJ), 10–5 repeated jumps tests, and performed maximal isometric voluntary contractions (MVC) through both knee extension (KE) and knee flexion (KF) paired with electromyographic activity (EMG) pre-match, immediately post-, 12 h, 36 h and 60 h post-match. With institutional ethics approval, 12 male Gaelic football players (mean age: 23.2 ± 1.5 years; stature: 183.7 ± 7.5 cm; body mass: 85.8 ± 10.7 kg) (mean ± s) completed the above protocol up to 60 h. During knee extension, a significant effect across time ($P = 0.009$) was noted for knee extension MVC along with a small effect ($d = 0.258$), with no significant difference across time for Vastus Lateralis (VL) EMG ($P = 0.323$, $d \leq 0.228$). Bicep Femoris (BF) EMG did not significantly differ across time ($P = 0.603$) with a moderate effect ($d = 0.383$) for pre-post-match, amongst small to trivial effects ($d \leq 0.318$). During knee flexion, no significant difference across time ($P = 0.215$) was noted for MVC with a moderate effect for pre-post ($d = 0.401$) and post-12 h ($d = 0.417$) post-match, amongst small to trivial effect ($d \leq 0.162$). VL EMG was not significantly different across time ($P = 0.654$); however, moderate effect sizes were determined for pre-post ($d = 0.631$), pre-12 h ($d = 0.618$), pre-36 h ($d = 0.619$), and pre-60 h ($d = 0.624$) post-match ($d \leq 0.170$ for all remaining pairwise comparisons). Similarly, no significant difference ($P = 0.547$) was observed for BF EMG, with moderate effect for pre-post ($d = 0.408$) and post-12 h ($d = 0.408$) post-match

(d ≤ 0.178 for all remaining pairwise comparisons). A significant effect for time was noted for CMJ peak force (P = 0.004) with significant pairwise comparisons for pre-12 h (P = 0.016, d = 0.190) and post-12 h (P = 0.009, d = 0.281) post-match. CMJ jump height, CMJ peak velocity and RSI were not significantly different across time, with some moderate effect sizes, but mostly small to trivial pairwise comparisons noted. The results suggest that Gaelic football match-play induces moderate effects on knee flexor and extensor force production, with concomitant decreases in CMJ peak force post-match.

D2.S1.1(3) The effects of sodium bicarbonate ingestion on swimming interval performance in trained competitive swimmers

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Sodium bicarbonate ($NaHCO_3$) supplementation has been shown to improve repeated high-intensity performance, however most swimming performance studies examine time trial efforts rather than repeated swims indicative of training sessions. The aim of this study therefore was to investigate the effects of NaHCO3 supplementation on sprint interval swimming reflective of a typical training session. Fourteen trained competitive swimmers (body mass: 73 ± 8 kg) volunteered for this double-blind, randomised, crossover-designed study that received institutional ethical approval. Each participant was asked to swim 50 m (front crawl), from a competitive diving block, at their maximum effort 8 times (interspersed with a 50 m active recovery swim). Each exercise bout was runoff a 5 min base, which left participants with approximately 3 min passive recovery. After one familiarisation trial, this was repeated on two separate occasions whereby participants ingested either 0.3 $g.kg^{-1}$ BM $NaHCO_3$ or 0.05 $g.kg^{-1}$ BM sodium chloride (placebo), 60 minutes prior to exercise. Time to complete each 50 m interval was recorded, along with blood measures for pH and bicarbonate (HCO3-) using a Radiometer (ABL9, Copenhagen, Denmark) and lactate (Lactate Pro 2, Arkray, Japan) at rest, at 60 min (post-supplementation), and post-exercise. Aggregated gastrointestinal (GI) discomfort symptoms were measured using Visual Analogue Scales (VAS) throughout each trial. Two-way repeated measures ANOVA was used to assess performance and blood measures (using SPSS V28, IBM, Chicago, IL, USA). Hedges' g effect size (ES) was also calculated for pairwise comparisons between treatments and interpreted using Cohen's D thresholds. Performance was improved by $NaHCO_3$ ingestion prior to the interval swimming (p = 0.005, Pη2 = 0.301). Whilst there were no differences between sprints 1 to 4 (p > 0.05), improvements were observed in sprint 5 (p = 0.011; ES = 0.26), 6 (p = 0.014; ES = 0.39), 7 (p = 0.005; ES = 0.6), and 8 (p = 0.004; ES = 0.79). Following $NaHCO_3$ supplementation, pH was greater at 60 min (p < 0.001; ES = 3.09), as was HCO3− at 60 min (p < 0.001; ES = 3.23) and post-exercise (p = 0.016; ES = 0.53), compared to placebo. Lactate was greater following $NaHCO_3$ supplementation post-exercise compared to placebo (17.6 ± 4.9 vs. 14.7 ± 3.8 $mmol \cdot l^{-1}$; p < 0.001; ES = 0.64). Aggregated GI discomfort was higher for $NaHCO_3$ compared to placebo (21 ± 12 vs. 3 ± 1; p = 0.021; ES = 2.05). These findings suggest that $NaHCO_3$ supplementation can improve the latter stages of sprint interval swimming performance, which is likely due to the increase in buffering capacity (increased pH and HCO3−). Further research is warranted to investigate $NaHCO_3$ and training responses as greater individual session performance might improve overall adaptation.

D2.S1.1(4) Attitudes towards and perception of reproducibility and replicability in sports and exercise science

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There are some formal calls for increased reproducibility and replicability in sports and exercise science, yet, there is minimal information on the overall knowledge of these concepts at a field-wide level. A survey was conducted to explore the attitudes and perceptions of active researchers towards reproducibility and replicability in the field of sports and exercise science, adapted from the established Nature survey (Baker & Penny, 2016, Nature, 533 (7604), 452–454). Sports and exercise science researchers were recruited via the Web of Science mailing list of published authors to complete the survey on Microsoft Forms. Responses were analysed using descriptive statistics (for multiple choice responses) in R statistical software and thematic analysis (for open text box responses). Of the 511 participants who responded to the survey, 42% (n = 217) of respondents believe there is a significant crisis of reproducibility or replicability in the field of sports and exercise science, while 36% (n = 182) believe there is a slight crisis. Three per cent (n = 15) of respondents believe there is no crisis, while 19% (n = 95) did not know. Insufficient mentoring, low statistical power, selective reporting of results and pressure to publish were identified as the highest contributing factors to poor reproducibility and replicability. Four key themes emerged from the thematic analysis: the research and publishing culture, educational barriers to research integrity, research responsibility, and the current practices promoting reproducibility and replicability. Researchers believe that engaging in open science can be detrimental to career opportunities due to lack of incentives. They also feel that journals are a barrier to reproducible research due to high publication charges for open access and a focus on novel research. Researchers believe that journals appear to act as gatekeepers in science and have too much research responsibility. Statistical expertise was identified as a key factor for improving reproducibility and replicability in the future, particularly, a better understanding of study design and different statistical techniques. Statistical education should be prioritised early in a researcher's career, which could also positively affect peer review at a later stage. Finally, sports and exercise science researchers must accept increased responsibility for reproducibility and replicability through thorough project design, appropriate planning of analyses and transparent reporting practices.

D2.S1.1(5) Predictors of overuse shoulder injuries in male Kuwaiti volleyball players: A regression analysis

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Overuse shoulder injuries are common in overhead throwing athletes, with limited mobility, muscular weakness and scapular dysfunction all reported to be risk factors (Tooth et al. [2020]. Sports health, 12(5), 478–487). An understanding of modifiable risk factors is critical to providing optimal care for overuse injuries and may facilitate future efforts to prevent shoulder problems among volleyball athletes (Reeser et al. [2010]. Pm&r, 2(1), 27–36). This study aimed to identify predictors of overuse shoulder injuries in a group of male Kuwaiti volleyball players. Following institutional ethical approval, 48 Kuwaiti competitive male volleyball players (20 with overuse shoulder injuries and 28 with no injury) (aged 27 ± 8 years, mass 79 ± 27 Kg, height 178.5 ± 18.5 cm, years' experience in volleyball 15.5 ± 10.5) were examined clinically. After a warm-up procedure consisting of multiplanar shoulder movements, physical examinations were performed in a single session by the same examiner who was blinded to their injury status. A digital goniometer was used to examine bilateral shoulder flexion, external rotation (ER) and internal rotation (IR) range of motion (ROM). A handheld dynamometer measured bilateral shoulder ER eccentric strength and isometric strength of both IR and ER. Kibler and Sciascia classification system based on visual observation was used to evaluate dynamic scapular motions and identify scapular dyskinesis (Burn et al. [2016]. Orthopaedic journal of sports medicine, 4(2), 2,325,967,115,627,608). Discriminant analysis was used to predict injury status based on the physical measures. The results showed that only internal rotation (DIR) shoulder ROM of the throwing arm was a significant predictor of overuse injury incident ($r = 0.63$, Lambda = 0.6, $F\ 1,46 = 22.17$, $p < 0.01$). The overall sensitivity of this variable in classification of the participants into injured and non-injured was 73%. Players with overuse shoulder injury had a lower IR shoulder ROM in their throwing arm (mean = 37.8°, SD = 7) than players with no injury (mean = 44.6, SD = 2.7). The injury prediction of other variables was not significant ($p > 0.05$). Therefore, enhancing shoulder IR ROM of throwing arm is an important strategy to prevent or alleviate overuse shoulder injury consequences during volleyball sport competitions.

D2.S1.1(6) Nike Vaporfly ZoomX NEXT% shoes have running economy benefits over various inclines

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Distance-running performance can be predicted using running economy (RE); defined as the mass-specific submaximal rate of oxygen uptake (VO2 ml/kg/min) at a specified running velocity. Submaximal oxygen uptake (VO2submax) increases with running velocity, therefore, improved RE is demonstrated through a lower VO2submax uptake at a set speed or the same VO2submax at a faster speed. More economical runners will outperform those with similar maximal physiological capabilities by utilising less metabolic energy. As well as physiological training benefits, RE can be influenced using biomechanical interventions such as footwear. The Nike Vaporfly ZoomX NEXT% (VF) shoes improve RE by ~4% during level treadmill running and ~3% up to a 5% incline or decline when compared with other conventional running shoes. This improvement in RE is attributed to a curved carbon fibre plate embedded in the polyether block amide foam midsole. While the benefits of running in VF on an incline have been demonstrated, it is unknown whether there is an optimal incline at which improvements in RE are greatest. This study investigated the effects of different inclines (0%, 1%, 3% and 5%) on RE in the VF compared to a control shoe (Saucony Jazz ProGrid 12 (JAZ)). With faculty ethical approval, a sample of 18 participants completed a single session, randomised crossover study (6 females and 12 males; age 33.5 ± 11.6 years, body mass 70.3 ± 13.2 kg, height 176.9 ± 8.4 cm) (mean ± s). Each participant ran eight ~7 min trials at 12 km/h on a treadmill: two shoes (VF and JAZ) and four inclines (0%, 1%, 3% and 5%). VO2submax uptake and VCO2 production were measured using masked cardiopulmonary exercise testing (CPET), and RE was calculated for each trial using the average gross VO2submax uptake. A repeated-measures ANOVA with post hoc pairwise comparison and Bonferroni correction identified a significantly lower VO2submax uptake for the VF compared to the JAZ over inclines 0%, 1%, 3% and 5% whilst running at 12 km/h ($F(1,14) = 30.43$, $p=<0.01$). These results determined the RE improvement for the VF compared to the JAZ decreased exponentially with increasing incline, ranging from 4.4% on the level to 2.7% at a 5% incline. The RE improvement for the VF reached an asymptote of 2.3%, with 0.43 being attributed to the lower mass and the remaining 0.57 to the ZoomX foam midsole and carbon plate.

D2.S1.1(7) Investigating the reliability and usefulness of a field-based motion tracking system for movement screening in youth football players

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The assessment of fundamental movement competency is used in football academies to guide physical development programming to large squads (Newton et al. [2017]. Science and Medicine in Football, 1, 102–106). A newly developed motion tracking system (AMAT Performance) aims to enhance

movement assessment through more objective and sensitive scoring. The aim of this study was twofold, first to examine the reliability of AMAT's stride-for-distance test and secondly the longitudinal relationship between the stride and physical performance (short-sprint) in youth male footballers. Thirteen youth footballers from an English professional football academy (age = 16.8 ± 0.6 years [y]) performed 3 trials of stride testing in a between-week reliability study. Subsequently, 144 players from six English professional football academies (age = 14.8 ± 1.8 y) completed a linear sprint (20-m, s) and the stride (cm), on 3–7 occasions across 3 seasons (2017/18, 2018/19, 2019/20). Ethics release was obtained from Teesside University's School of Health and Life Sciences Research Ethics Committee to use anonymised data provided by Pro Sport Support Ltd. The study was conducted in accordance with the Declaration of Helsinki. Reliability was assessed using the intra-class correlation coefficient (ICC3,1) and typical error with uncertainty of estimates at 90% confidence intervals (CI). Within-player (repeated measures) and between-player (mean of the repeated measures) correlation coefficients were calculated to identify the relationships between stride distance and sprint times. Analyses were stratified by pre- and post-peak height velocity (PHV). The ICC for the stride was high (0.76; 0.46 to 0.90) and typical errors moderate (2.1%; 1.6 to 3.3). Very large, negative between-player correlation was found for stride length vs. sprint time (r = −0.77 [95% CI: −0.83 to −0.70]). This correlation was large for pre-PHV (−0.62 [−0.78 to −0.39]) and post-PHV (−0.54 [−0.68 to −0.36], respectively). Within-player correlations were small for the total sample of players (r = −0.24 [−0.34 to −0.16]) and for pre- and post-PHV subgroups (r < −0.30). These findings suggest that the stride-for-distance is a potentially reliable test in youth football players with the potential to identify quicker and slower players, but this relationship will be weaker when comparing within maturity groups. However, the stride should not be used for tracking within-player sprint changes in youth footballers, irrespective of maturation.

D2.S1.2 Physical Activity for Health

D2.S1.2(1) "We were locked away" The lived experiences of UK adult transplant athletes during COVID-19 in relationship to transplant sport and exercise

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Recipients of solid organ transplants face well-documented medical challenges. One challenge is medication-induced immunosuppression resulting in a reduced ability to fight infections and other diseases (Hames et al., 2022, BMJ Open Sport & Exercise Medicine, 8(1):e001248. doi: 10.1136/bmjsem-2021-001248). Prior to the first COVID-19 lockdown organ recipients were instructed to go into shielding, consequently experiencing longer periods of isolation than for the general public. Shielding may consequently have impacted upon their life and sporting routines to a greater extent. Therefore, the aim of this study was to explore the impact of the COVID-19 pandemic on the life and well-being of adult solid organ transplant athletes with a specific focus on their relationship with sport and exercise. An interpretative phenomenological analysis approach was adopted. After obtaining ethics approval a purposive sample of 17 participants underwent semi-structured online interviews. Data were analysed using the seven-step procedure of Smith et al. (2022) (Interpretative Phenomenological Analysis: Theory, Method and Research (2nd ed.), SAGE) providing Personal Experiential Themes (PETs) for each participant and subsequent Group Experiential Themes (GETs) for the whole participant group. Five GETS were generated regarding the experiences of transplant athletes during the pandemic; 1) The life-changing experience of receiving the gift of transplantation: A second chance in life ("I was basically reborn"), 2) Sport and exercise: A life-affirming activity that offers health, purpose, and happiness ("It just makes me happy"), 3) The transplant community: A safe and loving environment ("We're all like a family"), 4) Mental health impact: Extreme fear of COVID-19 and complete isolation of the shielding period ("We were locked away"), 5) Loss of sport during shielding: Impact on physical, mental, and social health and well-being ("I was basically vegetating"). During shielding, some athletes were able to continue training at home depending on the nature of the sport or access to facilities and/or equipment. For those athletes who were not able to practice their sport, even if sport training was replaced by different types of exercise, the sense of happiness and fulfilment was altered and inadequate. The results of the current study suggest that the COVID-19 pandemic during shielding had significant negative impact on the transplant athletes' health and well-being due to complete isolation and loss of meaningful sport and exercise activities. Further research is warranted to explore the athletes' relationship with their sport compared to other types of exercise undertaken.

D2.S1.2(3) Fundamental movement skill competence and physical activity of 4-5-year-old school children in central England, what next?

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Fundamental movement skills (FMS) and physical activity (PA) are pivotal to positive health behaviour development in the early years. The early years foundation stage (EYFS) of English primary schools provides an opportunity for children to receive purposeful tuition of FMS and increase levels of PA. Yet, our knowledge of the FMS and PA of 4–5-year-old children in England is limited, and this could be a possible barrier to the creation and implementation of sustainable intervention programmes. The primary aim of this study was to measure the FMS and PA levels of children in the EYFS in central England. With institutional ethics, ninety-two 4–5-year-old children (boys n = 51, mean age: 5.0 ± 0.4 years, height: 112.1 ± 4.3 cm, mass:

19.8 ± 3.0 kg, BMI centile: 48.2 ± 32.9) from 8 EYFS classes in central England participated in the Test of Gross Motor Development Two and a single-leg balance test to measure their FMS competency, after which they were fitted with a wrist-based ActiGraph accelerometer for 5 days over both week and weekend days. Fifty-four children provided valid PA data (9 hours wear time per day). Results revealed that all but one of the children providing PA data met the PA guidelines of 180 minutes per day, including 60 minutes of MVPA. Conversely, children demonstrated low total FMS competency (57.9 ± 10.6 marks out of 92), especially in object control skills. There was no correlation between higher PA levels and FMS competency within the cohort. To analyse in further detail, children were split into age tertiles; the oldest children (i.e., born in the first term of the school year) were significantly ($P < 0.05$) more proficient in their FMS skills than the children born within the next two terms (spring and summer). Analysis of PA when split by an index of multiple deprivation tertile showed the most deprived children engaged in the most sedentary time (423.2 ± 80.2 mins/day). These follow patterns of previous findings for this age group and establishes that there is a clear need for more tuition of FMS in the early years. The requirement of well-informed and adaptable teaching across a cohort to ensure that all children's needs are being met is needed; therefore, interventional approaches must consider this. This information will help to inform the theory and evidence-based methods of future interventions for this age group in England, including the use of intervention mapping (Bartholomew-Eldredge et al., 2016).

D2.S1.2(4) An investigation into the physical activity experiences of people living with and beyond cancer during the COVID-19 pandemic

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Physical inactivity continues to be a public health concern; especially in people with long-term conditions such as cancer. There has been an increase in the delivery of health improvement interventions offered through football community trusts, including those aimed at a range of long-term conditions and health enhancing behaviours (Pringle, Zwolinsky and Lozano-Sufrategui, 2021, Public Health in Practice, 2, 100,104). In the UK on 23 March 2020, unprecedented legal restrictions were imposed by the UK Government to prevent the spread of COVID-19. The restrictions in the sport and leisure sector led to a temporary cessation of "face-to-face" sport and recreation services delivered indoors, negatively impacting some people's physical activity (PA). People considered as "clinically extremely vulnerable" included people living with and beyond cancer (PLWBC) (Nekhlyudov et al., 2020, Journal of Cancer Survivorship, 14, 601–606). The outbreak of the pandemic accelerated the use of modern technology, using online digital platforms such as Microsoft Teams and Zoom for PA delivery (Nyenhuis, et al., 2020, The Journal of Allergy and Clinical Immunology: In Practice, 8, 2152–2155). The aim of this study was to investigate the PA experiences of PLWBC, and staff of PA interventions offered on the cancer and rehabilitation exercise (CARE) programme by Notts County Foundation, a Football Club Community Trust during the COVID-19 pandemic. With institutional ethics approval participants (n = 9; 7 females; 2 males) and Staff (n = 2; 2 males) who attended the CARE programme participated in semi-structured interviews investigating the PA participation and experiences of attending/delivering different modes of CARE, including exercise classes delivered outdoors and online. The data were analysed using thematic analysis. The key novel findings of this study show that the COVID-19 pandemic and government restrictions impacted on PA participation, yet exercise sessions provided via CARE offered participants an important opportunity to arrest their inactivity, keep active and maintain their fitness and functionality. Barriers to participation of CARE online included access to IT infrastructure, internet connectivity and comfort using IT. Regarding CARE outdoors, the weather, range of equipment, variety of exercises and the lack of toilets and seats were barriers. The results suggest that CARE helped PLWBC to keep physically active, the skills of delivery staff who were sensitive to the needs of participants, social support, and the need for participants to maintain good mental and social health were important facilitators for engagement and are considerations for future programme delivery.

D2.S1.2(5) A qualitative study of adults who switched to active commuting during the COVID-19 lockdowns

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During the COVID-19 lockdowns many UK adults switched away from their car or public transport commute to an active form of commuting, including cycling and walking (Whyte, et al., 2022, Active Travel Studies, 2). The aim of this study was to explore the views of adults who became new active commuters during one of the 2020 COVID-19 lockdowns and to identify ways active commuting could form part of the pandemic recovery. Ethics approval was granted by the University of Strathclyde School of Psychological Sciences ethics committee. Participants were recruited via social media and word of mouth. Participants were eligible if they were over 18 years old and self-identified as switching to active commuting during lockdown. Once consent was obtained online, participants (n = 9) reported their demographics and completed a 30-min Zoom interview following a semi-structured interview guide. Interviews were transcribed verbatim and thematic analysis of the interview transcripts produced key themes and sub-themes. From the analysis, four main themes were extracted to keep focus on the project's overarching aim and objectives. These themes were benefits of active commuting, the barriers to active commuting, effects on mental health and

well-being and maintenance of behaviour change post-COVID-19 lockdowns. Example sub-theme for each main theme included reduced stress and increased confidence, poor road conditions, economic and environmental benefits and flexibility. The quotes below represent the main themes:

"[the benefits of commuting to work by bicycle were] physical, emotional health, um the other one is it makes me feel I'm doing something for the environment." Andrew (35–44)

"There is one [road] section near me which does have a cycle lane, but the cycle lane is an absolute disgrace." Claire (55–64)

"I feel calmer, I get time on my own." Anna (55–64).

"I occasionally drive if I had a late shift finishing really late then an early shift starting the next day . . . There's not enough time to rest and recover from that." Roger (45–54).

Local and national governments are facing the grand global challenges of declining mental and physical health and climate change in the COVID-19 recovery. Switching to active commuting can be a strategy to help tackle these crises. This study provides much-needed qualitative data to understand how active commuting was used during lockdowns, which can be used in the early stages of intervention development. While barriers do exist, switching to an active commute should be prioritised as part of the COVID-19 recovery.

D2.S1.3 Multidisciplinary: Physiology and Nutrition, Psychology and Biomechanics and Motor Behaviour

D2.S1.3(1) Assessing the sports nutrition knowledge of amateur and elite level coaches in Trinidad and Tobago

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Many athletes rely on coaches as their primary source of nutritional advice and guidance (Wood et al., 2022, Performance Enhancement & Health, 10). Previous studies have reported that coaches' sport nutrition knowledge is suboptimal (Cockburn et al., 2014, Nutrients, 6, 1442–53). However, data relating to coaches' nutritional knowledge in developing countries are lacking. The aim of this study was to assess coaches' sport nutrition knowledge in the developing countries of Trinidad and Tobago. Following ethical approval from the institutional ethics committee, 61 (male n = 42, female n = 19) amateur (n = 38) and elite (n = 23) coaches from a wide range of sports completed the Abridged Nutrition for Sport Knowledge Questionnaire (A-NSKQ) (Trakman et al., 2018, Journal of the International Society of Sports Nutrition, 15, 17). The survey instrument consisted of 34 questions; demographic questions such as age, years of coaching experience, and coaching level, followed by questions relating to the provision of nutrition advice to their athletes, sources of nutrition information, and multiple-choice questionnaires to determine coaches' nutrition knowledge. A series of one-way ANOVAs were conducted to determine whether there were any statistically significant differences in nutrition knowledge scores based on whether coaches provided advice, from where nutrition advice was obtained, primary sport coached, level of athlete coached, and years of coaching experience. Only 5% of coaches were able to attain adequate nutrition knowledge scores (≥75% correct). No significant differences were found between A-NSKQ scores based on Education level ($F(4,60) = 0.478$, $P = 0.752$), Coaching experience ($F(3,60) = 0.794$, $P = 0.502$), Athlete level coached ($F(3,60) = 0.367$, $P = 0.777$), Whether advice was provided or not ($F(2,60) = 0.452$, $P = 0.639$), or the Source of nutrition information ($F(3,50) = 1.566$, $P = 0.210$). There was a statistically significant effect of the primary sport coached ($F(4,60) = 3.592$, $P = 0.026$), with those who coached team sport athletes achieving significantly lower total scores than those delivering personal training or fitness classes. Our findings suggest that sport nutrition knowledge deficits exist among sports coaches in Trinidad and Tobago. Governing bodies within Trinidad & Tobago may wish to consider sport nutrition education and training programmes, to further benefit coach education.

D2.S1.3(2) Effects of range of motion during resistance training on muscle size and performance adaptations: A meta-analysis & systematic review

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Range of motion is commonly manipulated during resistance training to elicit different adaptations such as muscle hypertrophy and jump height improvements. However, attempts at synthesising the data on range of motion during resistance training have primarily focused on muscle hypertrophy in the lower body. Therefore, the aim of this study was to meta-analyse and systematically review the effects of range of motion on a variety of muscle size and performance outcomes in the existing literature. No explicit ethical approval was required for this study. A systematic review of PubMed and SportsDISCUS was performed. Data were extracted, and a Bayesian multi-level meta-analysis was performed. A range of sub-group and moderator analyses were explored. The main model revealed a trivial SMD (0.13; 95% CI: −0.01, 0.27) in favour of full range of motion compared to partial range of motion. When grouped by outcome, SMDs were also all in favour of full range of motion, but SMDs were trivial to small at most (all between 0.05 and 0.2). Subgroup analyses suggested that there may be a muscle hypertrophy benefit to partial range of motion training at long muscle length compared to using a full range of motion (SMD = −0.28, 95% CI: −0.81, 0.16). Analysis also suggested the existence of a specificity aspect to range of motion, such that training in the range of motion being tested as an outcome resulted in greater adaptations. No clear differences were found between upper- and lower-body adaptations when range of motion was manipulated. Overall, the results suggest that using a full or long range of motion may enhance

results for most outcomes (including muscle size, strength, sport and power outcomes). That said, differences in adaptations are trivial to small, so partial ranges of motion may be beneficial in certain applications, when managing an injury or when personal preference enters the picture.

D2.S1.3(3) Developing a life skills coaching resource for Primary School physical education: A participatory action research study with community football coaches

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Life skill development is concerned with developing skills to manage demands in sporting contexts, before transferring and applying these skills to non-sporting contexts (Williams et al., 2020). To facilitate meaningful life skill development through sport and PE, coaches must explicitly teach life skills (Bean et al., 2018). The aim of this study was to use Participatory Action Research (PAR) to facilitate the development of a Life Skills Coaching Resource. The resource aims to enable coaches to explicitly embed life skills in primary school PE lessons. Participants and the primary researcher collaboratively engaged in a 20-month PAR study to develop a context-specific Life Skills Coaching Resource. PAR is a collaborative three-phase spiral of inquiry, action, and reflection (Kemmis et al., 2013), whereby the participants and researcher learn together. Following university ethical approval, ten adult male and one adult female primary school PE coaches (Mean ± SD for age = 32 ± 11 y) were recruited in two cohorts. Primary school PE coaches are specialist sport coaches who are employed by private organisations, whom schools contract to deliver curriculum PE. Cohort 1 contained six male coaches. Cohort 2 was recruited twelve months later and contained four male coaches and one female coach. Data were collected via reflexive diary entries, semi-structured interviews, observations, and field notes from informal conversations between the participants and the primary researcher. A modified form of thematic analysis was used to analyse the data. Resource development was divided into three components. During Component 1, "Original Checklist Development", the primary researcher reviewed life skills literature and relevant coaching resources to produce a life skills checklist tool, which was the original study aim. However, in response to the needs of participant coaches, and in line with PAR, the study aim was adapted to facilitate the development of a Life Skill Coaching Resource. Consequently, during Component 2, "Reaction Component", the first version of the resource was developed. During Component 3, "Action Component", the resource was collaboratively refined by the participants and the primary researcher. The result is the production of a Life Skills Coaching Resource that enables coaches to embed life skills in lessons. The resource includes instructions detailing how to explicitly teach life skills, and lists specific life skills coaches can teach (e.g., teamwork and responsibility). The research illustrates the importance of involving coaches in the development of applied coaching resources, as these coaches will ultimately utilise these resources in applied contexts.

D2.S1.3(4) The effect of footwear midsole thickness on postural stability in older adults aged 65 to 79

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Footwear is a major fall risk factor, with shoe midsole thickness shown to affect the postural stability of older adults (OA) (Aboutorabi et al. [2016], Prosthetics and Orthotics International, 40,170–181). Therefore, the aim of this study was to investigate the effect of footwear midsole thickness on OA postural stability during a bipedal static balance test. Following institutional ethics approval, 26 OA (age 71.0 ± 4.1 years; height 166.6 ± 7.1 cm; mass 69.2 ± 11.0 kg) completed a bipedal static balance test on a force plate (1000 Hz, Kistler 9281C). Sample size was determined with an a priori calculation using G*Power 3.1.9.7 ($d = 0.2$; $1\text{-}\beta = 0.80$; $\alpha = 0.05$). Participants were required to look at a 0.1 × 0.1 m diameter black mark on a white board placed at eye level 2.0 m away. Three 30 s trials with 1 min seated rest between trials were conducted in four footwear conditions differentiated by midsole thickness: 1) own (participants' most used outdoor footwear); 2) thick (27 mm); 3) moderate (21 mm); and 4) minimal (12 mm). In all conditions, the participants stood as still as possible, with feet hip width apart and arms hanging by their sides. Consistent foot placement was ensured between trials by tracing an outline of the feet on top of the force plate. A repeated measures one-way ANOVA (with Bonferroni post-hoc; $P < 0.05$) analysed the differences between footwear for centre of pressure (CoP) sway path (mm), mean speed ($mm \cdot s^{-1}$), anteroposterior and mediolateral mean velocity ($mm \cdot s^{-1}$). With minimal footwear, CoP sway path ($P = 0.002$, 95% CI: −86.2 to −15.4 mm, $d = 0.64$, 328.5 ± 79.4 mm), mean speed ($P = 0.002$, 95% CI: −2.9 to −0.5 $mm \cdot s^{-1}$, $d = 0.65$, 10.9 ± 2.6 $mm \cdot s^{-1}$) and anteroposterior mean velocity ($P = 0.007$, 95% CI: −2.5 to 0.3 $mm \cdot s^{-1}$, $d = 0.57$, 9.1 ± 2.5 $mm \cdot s^{-1}$) were significantly reduced by a medium magnitude and mediolateral mean velocity by a large magnitude ($P < 0.001$, 95% CI: −1 to −0.23 $mm \cdot s^{-1}$, $d = 0.91$, 4.1 ± 1.1 $mm \cdot s^{-1}$), when compared with the participant's own shoes (379.3 ± 97.0 mm; 12.6 ± 3.2 $mm \cdot s^{-1}$; 10.5 ± 3.1 $mm \cdot s^{-1}$; 5.1 ± 1.2 $mm \cdot s^{-1}$). The OA in this study exhibited significantly enhanced postural stability when wearing minimal footwear. Wearing footwear with thinner midsole thickness might improve OAs' balance and reduce fall risk.

D2.S1.3(5) Wearable sensors detect differences between the sexes in spatiotemporal characteristics during running

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Sex differences in spatiotemporal characteristics during running have been speculated to be a contributing factor to the lower extremity injury rate disparity between men and women (Ferber, Davis and Williams, 2003, Clinical biomechanics (Bristol, Avon), 18(4), 350–357). Running biomechanics has traditionally been analysed in laboratory settings using 3D motion capture, but this may not reflect natural running gait. Wearable sensors on the other hand allow for continuous analysis of movement in an unobtrusive manner and ecologically valid setting (Godfrey et al., 2018, Maturitas, 113, 40–47). The purpose of this study was to use wearable sensors to characterise sex differences in spatiotemporal outcomes during running as a function of speed. With institutional ethical approval (ref: 33,358), 30 healthy club runners (aged 18–55 years, 19 males, 11 females) wore the ViMove2 sensors, placed on the tibia. Participants performed a series of treadmill running at various speeds (8, 10, 12, 14 km/hr), completed in a standardised shoe. Spatiotemporal running gait outcomes included ground contact time (GCT) and step frequency (SF). GCT and SF were compared between sexes across each speed condition using a two-factor ANOVA with repeated measures. Results indicated significant differences in the magnitude of the spatiotemporal parameters as running velocity increased ($p < 0.001$) and between-sexes ($p < 0.001$). Statistically significant interactions between the effects of sex and speed were evident for GCT ($F (3, 430) = 3.976$, $p < 0.001$) but not for SF ($F (3, 211) = 0.222$, $p < 0.881$). Male runners demonstrated significantly faster GCT and higher SF at all speeds ($p < 0.05$). The present study demonstrates that differences in spatiotemporal characteristics during running exist between the sexes as measured by wearable sensors. Understanding the differences in running biomechanics between sexes may provide insight into the aetiology of injury, as well as performance benefits. Future research should further explore the use of wearable sensors to detect differences in more ecologically valid settings.

D2.S3 Free Communications

D2.S3.1 Multidisciplinary: Biomechanics and Motor Behaviour and Sport and Performance

D2.S3.1(1) Characterising movement complexity across the exercise intensity domains during treadmill running in male runners

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Movement variability and complexity may be mediated by physiological responses to exercise (Murray et al., 2017, International Journal of Sports Physiology and Performance, 12, 1119–1122). However, variability and complexity demonstrate little change fractionally above and below the critical speed during running (Hunter et al., 2021, European Journal of Applied Physiology, 121, 1297–1313). Therefore, physiologically mediated alterations to movement dynamics may be more pronounced further from physiological boundaries. This study aimed to characterise movement complexity and variability in the three main exercise intensity domains. Following institutional ethical approval, 10 male participants (Mean ± SD; Age: 28 ± 10 y, stature: 1.79 ± 0.07 m, mass: 72.6 ± 10.4 kg) ran in the moderate (80% GET; MOD), heavy (20% Δ; HVY), and severe (80% Δ; SEV) intensity domains on a treadmill for 20 min or to task failure (Tlim), whichever occurred sooner. Sagittal joint kinematics of the hip, knee, and ankle were sampled throughout using 3D motion analysis and separated into 30 sec epochs. Sample entropy (SampEn) and detrended fluctuation analysis-α scaling exponent (DFA-α) were used to estimate the regularity and fractal scaling, i.e., complexity. Standard deviation (SD) was used to quantify variability. Two-way repeated-measures ANOVA (intensity × time) tested differences in regularity, fractal scaling, and variability in the first and last epoch.

All participants were able to complete 20 min in MOD and HVY. Tlim occurred at 4.41 ± 1.18 min in SEV. Knee SampEn ($P = 0.009$) and SD ($P = 0.005$) increased over time in all intensity domains. Ankle demonstrated that increased SD increased over time ($P = 0.005$). Variability of hip, knee, and ankle movement was greater in SEV compared to MOD ($P < 0.05$). Variability was also greater at the knee and hip in SEV compared to HVY ($P < 0.001$) and HVY compared to MOD ($P < 0.001$). DFA-α was lower, demonstrating greater randomness, in SEV compared to MOD ($P < 0.001$) and HVY ($P < 0.05$), at the knee and hip. Similarly, smaller DFA-α was evident at the ankle in SEV compared to MOD ($P < 0.001$). Lower DFA-α was also shown in HVY when compared to MOD ($P < 0.05$) at the ankle and hip. SampEn values were higher, indicating greater unpredictability, in SEV compared to HVY ($P < 0.05$), at all joints, with greater SampEn also noted in SEV compared to MOD at the hip ($P = 0.001$). Greater movement variability, i.e., higher SD, and complexity, i.e., lower DFA-α and higher SampEn values, were noted in HVY and SEV domains. These findings suggest that changes to movement complexity and variability may be linked to the intensity domains in which exercise is performed.

D2.S3.1(2) A pooled analysis of fundamental motor skills self-organization of preschoolers from 9 countries

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Early childhood is a critical period for the development of fundamental motor skills (FMS). Facilitative environments promote the development and refinement of specific FMS in particular contexts; thereby how these skills vary and self-organise across different context should be considered. This study aimed to 1) examine to what extent preschoolers' FMS vary across different countries by age and 2) explore how FMS self-organise in these countries. Multiple sources were used to gather data from collaborators who had used the TGMD – second or third editions in preschoolers between 2010 and 2020, specifically: (i) international database search of the FMS literature in target population and (ii) contacts of international research networks. This study pools institutional ethics approved microdata of 21 collaborators from 9 countries, comprising 5360 3-to-5-year-old preschool-aged children. Bootstrap resampling, descriptive statistics, followed by non-linear comparisons of FMS scores by age were conducted using

Bayesian Analysis of Variance – ANOVA. The Network Analysis was used, and the sparsity, entropy (Von Neumann) and expected influence values of each country's network were calculated using the qgraph from the RStudio (version 1.3.1056). Independent of the sex, almost three-quarters of the assessed 3-year-old children did not comply with at least one of the criteria for dribble (74.8% in TGMD-2 and 71.2% in TGMD-3, respectively). For the 5-year-olds, 45.2% remains non-compliant with any of the dribble criteria. Almost half of the 3-year-old sample (54.4% and 56.3%) do not comply with any of the TGMD-2 and TGMD-3 criteria for hop. Moderate-to-high differences in FMS scores by country and age (Bayes Factor > 3) were observed. For the TGMD-2, the Chinese and US networks showed the highest (0.712) and lowest sparsity values (0.000), respectively. For the Brazilian, US and Iranian TGMD-3 samples, the running skill acts as a link between locomotor and object control skills. Similar entropy values were seen for all the emergent patterns. Hop emerged as the skill with the highest expected influence in 58% of the observed countries. The results suggested that FMS scores in preschoolers vary substantially according to country and age. Children from each country present a distinct pattern of skills self-organisation, though a common observation showed hopping as the most influential on other skills. Future research should longitudinally investigate the sustainability of the observed patterns and critical FMS for specific contexts to maximise the benefits of early programmes and interventions.

D2.S3.1(3) Expert Statement: Graduated Return to Play Following COVID-19 infection

Produced on behalf of the British Association of Sport and Exercise Sciences by Dr Anita Biswas, ***Dr NEIL HERON****, Dr Rhodri Martin, Dr Niall Elliott, Dan Grimstead,* ***Dr ADAM GRAINGER FBASES****, Joshua Wass*

COVID-19 is a significant threat to the health and performance of athletes and the general population. As a new illness, medical teams and scientists are challenged by a lack of knowledge and the resulting lack of evidence base around the care of affected athletes. Many will be required to support those athletes who have experienced symptoms of a disease about which very little is known. The complications and long-term impact of this disease may be varied and are not fully understood.

This Expert Statement seeks to summarise what is currently known about the potential impact of the SARS CoV-2 virus on an athlete and how this may affect their return to play after mild-to-moderate infection. It will advise on the safe return to play of athletes under medical supervision yet acknowledge that Sports Scientists and Strength and Conditioning Coaches have an important part to play in the support of athletes returning to full training and as such will benefit from understanding some of the risks and cautions to be considered.

This Expert Statement incorporates the learning from experts within and outside elite sporting environments in this rapidly changing situation. A previous BASES expert statement has addressed the area of exercising during the COVID-19 pandemic but to date no statements have addressed the return of a high-performance athlete to exercise following COVID-19 illness.

D2.S3.1(4) Body composition changes but no physiological adaptations following a mixed martial arts pre-competition training camp

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Preparation for mixed martial arts (MMA) competition commonly occurs during time periods colloquially known as "training camps". Camps may last up to 12 weeks, with 4–10 weeks being common (Uddin et al., 2020, The Journal of Sport and Exercise Science, 4, 90–99). The aim of these camps is to attain the required levels of physiological fitness for competition and the required body mass (BM) for the chosen "weight" category (Kasper et al., 2019, International Journal of Sport Nutrition and Exercise Metabolism, 29, 331–338). There is currently no data supporting these outcomes of MMA training camps without specific interventions, with an absence of periodisation suggesting such positive adaptations are unlikely (Kirk et al., 2021, PLoS One, 10.1371/journal.pone.0251266). This study aimed to determine the effects of a 6–8 week technical/tactical MMA training camp without intervention on physiological fitness and body composition. Following ethical approval n = 9 MMA athletes (age = 23.9 ± 4.3 years; BM = 76.6 ± 6.4 kg; stature = 177.3 ± 8.8 cm) completed the following testing battery 6–8 weeks before official bouts and again 1 week before. Body composition was measured via dual x-ray absorptiometry (DXA, Hologic, USA). Aerobic capacity (VO2max) was determined via treadmill based graded exercise test (Metalyser 3B, Cortex, Germany). Impulse was determined by proxy from squat jumps (SJ), countermovement jumps (CMJ) and drop jumps (DJ) (Optojump, Microgate, Italy). One repetition maximum (1RM) was determined for isometric midthigh pull (Takei, Japan), back squat, bench press and prone row (Olympic barbell and plates). Pre- and post-camp measures were compared via Bayesian paired sample tests (BF) and Cohen's d using JASP 16.2.0. Participants displayed statistically relevant reductions in body mass (BF10 = 29, d = 1.3), fat mass (BF10 = 10, d = 1.1) and fat-free mass (BF10 = 9, d = 1). No statistically relevant changes were found for squat, bench press, prone row or VO2max. Only isometric midthigh pull force was found to improve, though this was only moderately supported by the data (BF10 = 4, d = .83). Data supported the null hypothesis of no improvement in impulse as measured by squat jump, countermovement jump and reactive strength index (BF01 = 4–6). These results reflect Kirk et al. (2021) in suggesting MMA training may be sub-optimal for the preparation of MMA athletes for competitive performance. MMA technical/tactical training may be adjusted to provide periods of overload and restitution with the addition of supplementary strength and conditioning and nutritional strategies to maintain fat-free mass and provide stimuli for positive performance adaptations (Stone et al., 2000, Strength and Conditioning Journal, 22, 65–76).

D2.S3.1(5) Body composition analysis and development of asymmetries and sports injuries in female handball players

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Handball is a team sport subjected to asymmetric actions that require high physical capacity demands on athletes (Cavedon, V., 2018, PeerJ, 6, e5913). The development of large asymmetries could negatively affect sports performance and sports injury development (Barrera-Dominguez, F. J., 2021, International Journal of Environmental Research and Public Health, 18(4), 1866; Bishop, C., 2018, J Sports Science, 36(10), 1135–1144). However, few studies have analysed body composition asymmetries in elite female handball players. Therefore, the aim of this research was to assess whether the presence of asymmetries in body composition influences jumping performance and sports injury development. Fourteen elite handball players (27 ± 4,96 years, height = 170,11 ± 7.7 cm, body mass = 66,5 ± 8,7; kg, BMI = 22,9 ± 1,7 kg m^2) were assigned for convenience. Procedures followed the Declaration of Helsinki and its later amendments and were approved by the Research Ethics Committee of the University of Malaga (code: 38–2019-H). Dual X-ray Absorptiometry (DXA Hologic Horizon A) and bioimpedance (Inbody 770) were used to analyse body composition, including total body water. A jumping platform was used to evaluate jumping performance. Furthermore, an injury self-report questionnaire was used to determine the presence of pain induced by physical exercise (Castillo-Dominguez, A., 2022, Clinical Rehabilitation, 0(0), 02692155221088933; Olmedilla, A. G., C. Journal of Sports Psychology, 15, 37–52). Results show statistically significant differences in muscle mass between dominant and non-dominant upper (P = 0.004) and between lower limbs (P = 0.008; P = 0.006) in muscle and fat mass, respectively. No statistically significant relationship has been observed between body composition parameters and asymmetries in the Countermovement (CMJ) test. However, a statistically significant relationship was observed with the rest of the jumping performance parameters. No significant differences were observed between positions and a significant relationship was observed with the history of moderate injuries and jump performance (R = −0.573; P = 0.041 and R = −0.677; P = 0.011). The results suggest that the presence of asymmetries and the history of injuries influence jump performance in elite female handball players. However, it is considered normal to present functional asymmetries in this sport. For this reason, it highlights the importance of assessing body composition and anthropometric variations throughout a competition cycle in female handball players.

D2.S3.2 Physical Activity for Health

D2.S3.2(1) A comparison of placebo and nocebo effects on objective and subjective postural stability: A double-edged sword?

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Positive expectations (i.e. placebo effect) can improve postural control during quiet standing (Villa-Sánchez et al. 2019, Scientific Reports, 6408). However, it is unknown whether suggestion of a performance impairment (i.e. nocebo effect) results in a decline in postural stability. To better understand both phenomena, comparative studies, which include both placebo and nocebo conditions, are needed. The aim of this study was to compare the influence of placebo and nocebo instructions on objective and subjective postural stability in healthy young adults.

Following institutional ethics approval, 42 healthy adults were initially assessed for objective (centre of pressure) and subjective (perceived) postural stability and performance expectations ("I will perform well in the task"; VAS 0–10). Participants were then randomly assigned in equal numbers to a placebo, nocebo or control group. Power analysis showed that a minimum of 42 participants (n = 14 per group) would be required to detect a significant within-between interaction of medium effect size (assuming 1-β = 80%, α = 0.05, Cohen's f = 0.25, 3 groups, and 2 within-subject conditions). Participants in the treatment groups were administered an inert capsule described as a potent supplement, which would "positively" or "negatively" influence their balance performance. Objective and subjective postural stability and performance expectations were reassessed 20 min later. Two-way mixed-model ANOVAs were undertaken to test for the within-subject effects of time (× 2 [baseline vs. experimental]) and between-subject effects of group (× 3 [placebo vs. nocebo vs. control]) on outcome measures.

The nocebo group presented with a reduction in objective (Cohen's d = 0.92–1.61) and subjective (d = 1.97) stability compared to the control group (all p < .001). Conversely, the placebo group presented with improved objective (d = 1.00–1.24) and subjective (d = 1.66) stability compared to before expectation manipulation (all p < .001). The placebo group also showed a significantly greater performance expectation (Cohen's d = 1.88) whilst the nocebo group showed a significantly lower performance expectation (d = 2.09) after expectation manipulation (both p < .001).

Our findings indicate that positive and negative performance expectations can profoundly influence both objective and subjective postural stability. Postural control is clearly susceptible to expectation manipulation, which could have

important practical implications and repercussions on balance testing, training interventions and rehabilitation programmes. For example, practitioners who are not fully aware of the power of words may inadvertently elicit placebo or nocebo effects, which may modulate the efficacy of evidence-based interventions. Positive and negative expectancies are therefore a double-edged sword for postural control.

D2.S3.2(2) The physical behaviour intensity spectrum and body mass index in school-aged children and adolescents: A compositional analysis of pooled individual participant data

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Use of absolute intensity accelerometer cut-points results in physical activity estimates that are prone to measurement error and intensity misclassification. Further, condensing accelerometer data into three or four pre-specified intensity categories causes loss of information because a limited selection of data is used. An alternative approach is to use a wide range of incremental acceleration intensity bands to describe physical activity across the full intensity spectrum. This pooled individual participant data analysis examined compositional associations between the intensity spectrum derived from incremental raw acceleration intensity bands and body mass index z-score (BMIz) in youth and investigated estimated differences in BMIz when time was reallocated between intensity spectrum bands. Data were obtained from 1453 school-aged youth who participated in 10 ethically approved physical activity research studies, which used wrist accelerometer assessments of physical behaviours. The primary outcome was BMIz, and exposure variables were calculated from nine acceleration intensity bands ranging from 0–50 mg to ≥700 mg. These were used to generate time-use compositions expressed as nine specific sets of eight isometric log-ratios (ILRs) representing time spent in one intensity band relative to the others. Multivariate linear regression assessed associations between intensity band compositions and BMIz, with adjustment for sex, age, socioeconomic status, accelerometer model, and recording frequency. Compositional isotemporal substitution analyses estimated predicted differences in BMIz following time reallocations between intensity bands. BMIz was significantly associated with intensity spectrum compositions for boys and girls ($p < 0.001$) and the ≥700 mg intensity band ILR1 was most strongly and inversely associated with BMIz in both sexes, relative to the other ILRs ($p < 0.001$). Estimated differences in BMIz when 5 minutes were reallocated to and from the ≥700 mg intensity band and reallocated among the remaining bands were − 0.28 (95% CI = − 0.39, − 0.17) and 0.44 (95% CI = 0.27, 0.62), respectively, for boys, and − 0.39 (95% CI = − 0.51, −0.28), and 1.06 (95% CI = 0.76, 1.36), respectively, for girls. Time in the highest intensity band (≥700 mg) relative to the remaining intensity bands was significantly and negatively associated with BMIz irrespective of sex. Hypothetical time reallocations involving the ≥700 mg intensity band indicated that the asymmetrical-estimated differences in BMIz were clinically meaningful at even small durations of reallocated time. These findings highlight the utility of the full physical activity intensity spectrum over a priori determined absolute intensity cut-points and further emphasise the benefits of promoting higher intensity physical activity for health in youth.

D2.S3.2(3) REgulate your SItting Time (RESIT): An intervention for reducing sitting time in individuals with type 2 diabetes – findings from a randomised controlled feasibility trial

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Effective management of type 2 diabetes mellitus (T2DM) is essential to reduce the risk of cardiovascular disease (CVD), poor quality of life and secondary complications. High levels of sedentary behaviour are adversely associated with CVD risk and quality of life. The primary aim of this study was to assess the feasibility of delivering and evaluating a novel intervention to reduce and break up sitting in ambulatory people with T2DM. With institutional ethics approval, a mixed-method randomised controlled feasibility study was conducted. Seventy participants (44% female; 61% of Black, Asian and minority ethnic origin) with T2DM aged 18–85 years were recruited and randomly allocated to the REgulate your SItting Time (RESIT) intervention or control group for 6 months. RESIT enables tailoring to the individual but uses standardised behaviour change techniques to support reducing and breaking up sitting. Intervention components include an online education programme, health coaching, and a selection of wearable devices, smartphone apps and computer apps that facilitate self-monitoring and prompts to break up sitting. Measures of device-assessed sitting, standing and stepping, physical function, health and wellbeing were taken at baseline and 3 and 6 months later. Preliminary evidence of the efficacy of the intervention for reducing sitting time (proposed primary outcome for a full trial) was evaluated using descriptive statistics. Participants were interviewed to assess intervention acceptability. Feasibility was demonstrated with a high eligibility rate (84% of individuals screened being eligible) and high recruitment rate (proportion of individuals eligible randomised into

the study) of 67%. Retention rate was high (93%). Data completion rates for daily sitting were high at baseline (100%), 3 months (83% and 94%) and 6 months (83% and 95%) for intervention and controls, respectively. The intervention was deemed to be acceptable by participants, with the health coaching and self-selected wearable devices especially well-received. There was low interest and uptake for the self-selected smartphone and computer apps as participants did not regularly use such devices. At 3 months, the intervention group reduced their daily sitting by 31 ± 87 min/day, with a 4.4 ± 100 min/day reduction in the controls. At 6 months, there was a 22 ± 83 and 24 ± 85 min/day reduction in the intervention and control groups, respectively. In conclusion, this study demonstrates the feasibility of delivering and evaluating a tailored intervention to reduce and break up sitting in people with T2DM. The intervention also has potential efficacy for reducing daily sitting.

D2.S3.2(4) Cross-validation of the Physical Literacy in Children Questionnaire (PL-C Quest) for Primary School aged children in England

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Physical literacy (PL) is the motivation, confidence, physical competence, knowledge and understanding to value and take responsibility for engagement in physical activities for life (International Physical Literacy Association, 2017, https://www.physical-literacy.org.uk/). This definition highlights the purported importance of PL as a critical precursor to child physical activity. Nevertheless, little is known about the current levels of children's PL in England and its association with physical activity. Thus, there is a need to measure levels of PL in children. Recently, a novel, valid and reliable questionnaire-based holistic measure of children's self-reported PL (PL-C Quest) has been developed in Australian children (for children aged 4 to 12 years old) (Barnett et al., 2022, Psychology of Sport and Exercise, 60, 1–12). It is well established that the validity of questionnaire measures assessing complex constructs such as behaviours, skills, and understanding are not necessarily consistent when applied in different populations. Therefore, the present study aimed to utilise the PL-C Quest in England and examine its construct validity. Following institutional ethical approval and written parent and participant consent/assent, data were collected from 264 primary school-aged children (46.6% boys; aged 10.0 ± 0.9 years; 95% white British). Children completed the PL-C Quest which consists of 30 pictorial items relating to PL elements under four PL subdomains (physical, psychological, social, and cognitive). Construct validity was assessed using Confirmatory Factor Analysis (CFA) in SPSS AMOS, v28. The CFA assessed the fit of the measured variables (items) into four hypothesised latent variables (sub-domains) and a higher order factor of PL using the maximum likelihood estimation. Error terms from the measured variables were allowed to correlate within the same factor. Goodness-of-fit values for the CFA showed acceptable model fit. Most items (26 out of 30 items) loaded on subdomains close or above the standard of $\lambda = 0.33$, showing that the latent factor (subdomain) accounted for 10% of the measured variable (item). However, some items did not, specifically, two items under the physical subdomain and two items under the cognitive subdomain. Charting children's perceived PL is important to help to investigate the association it has with physical activity and wider health and wellbeing outcomes. Initial results suggest evidence of construct validity for the PL-C Quest in our sample, supporting its use in children in England. Further research is needed to establish validity in younger children in England aged 4 to 8 years of age.

D2.S3.2(5) The mediating role of physical and cognitive function on the association between Fear of Falling, activity restriction and health-related quality of life in fallers and non-fallers: A structural equation model

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Fear of falling (FoF) is associated with activity restriction and reduced quality of life (QoL), leading to loss of independence. Physical and cognitive functions are associated with FoF. Inconsistencies in the mediating role of physical and cognitive function and complex interrelationships require further investigation; these relationships may also differ between fallers and non-fallers. Our aim was to investigate the direct and indirect pathways between FoF, activity restriction/avoidance behaviour, QoL, and the mediating role of latent (unobserved) variables of physical and cognitive function in both fallers and non-fallers in a cohort of community-dwelling older adults. Data from Wave 1 of The Longitudinal Irish Study of Ageing (TILDA) was used (with permission from ISSDA). The study was approved by the University of Sunderland ethics committee (011063). Outcome measures from TILDA include QoL, FoF, activity restriction, physical function (Timed-Up and Go (TUG) and Grip strength), and cognitive function (Mini-mental State Examination (MMSE)). Data were cleaned and processed in R Studio (version: 1.4.1106). An independent t-test and Welch's t-test were used to determine differences in outcome measures between; 1) fallers and non-fallers, 2) fallers with/without FoF, and 3) non-fallers with/without FoF. Fallers had lower QoL and grip strength and higher TUG; fallers with FoF had lower QoL and grip strength and higher TUG; non-fallers with FoF had lower QoL and grip strength and higher TUG. Point-biserial correlation was used to investigate associations between FoF and the physical/cognitive measures. Structural equation modelling is used to model interrelationships between observed and latent variables, adjusting for relevant medical, health and lifestyle covariates. Our preliminary findings indicate 4761 participants (≥50 years of age) with full datasets; Of which 6.3% reported activity avoidance, 20.7% had FoF, and 20.2% had previously fallen. Statistical differences exist for TUG, Grip, and QoL scores between 1) fallers and non-fallers ($P < 0.01$), 2) fallers with FoF and fallers without FoF ($P < 0.01$), and 3) non-fallers with FoF and non-

fallers without FoF (P < 0.01). Small correlations exist between FoF and QoL(rpb(4759) = 0.148, P = <0.01); FoF and TUG (rpb (4759) = 0.220, P < 0.01); and FoF and Grip strength (rpb (4759) = 0.244, P < 0.01). However, no statistically significant correlation between FoF and MMSE was found (rpb(4759) = 0.071, P < 0.01). The SEM will allow for detailing the complex interrelationships between FoF, activity restriction and QoL, mediated via our latent variables (physical and cognitive function). Furthermore, physical function is different between faller and non-faller groups, and is correlated with FoF.

D2.S3.3 Multidisciplinary: Physiology and Nutrition and Psychology

D2.S3.3(1) Perception of affordances for dribbling in youth soccer: Exploring children as architects of skill development opportunity

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The ability to dribble the ball is a fundamental aspect to the game of soccer (Oppici, et al., 2019, European Journal of Sport Science, 18, 947–954). Prior studies have specifically examined affordances for passing (Oppici, et al., 2019) and shooting (Paterson, et al., 2013, International Journal of Sports Psychology, 44, 179–196) in soccer, but no studies have examined affordances for dribbling. The aim of this study was to examine and explore affordance perception for soccer dribbling using a mixed-methods approach in male grassroots soccer players. Following institutional ethics approval and informed consent, 14 boys aged 10–11 years of age (Mean ± SD = 10.8 ± 0.4 years) regularly engaged in grassroots soccer participated in the present study. Adapting methods previously employed to assess playground affordances (Jongneel, et al., 2015, Journal of Environmental Psychology, 44, 45–52), children were provided with 10 cones and asked to create a dribbling pattern that would maximise the number of touches with a football and then dribble the ball in the pattern they had created for a 1-min period. Children were subsequently interviewed to explore their perception of affordances for soccer dribbling. The number of touches undertaken by children in the 1-min period was spread, ranging from 32 to 118. Pearson's product moment correlations also revealed significant associations between the number of touches/min and average distance between cones (r = −.671, P = .03) with a greater number of touches being associated with a smaller average distance between cones. Thematic analysis from interviews revealed three emergent, but interconnected, themes focused on: Perception of ability and actual ability, Challenge and Autonomy. Children who perceived themselves as "good dribblers" created patterns where the cones were more closely spaced while those who perceived themselves as poorer dribblers created opposite patterns. Those children who created patterns with less space between cones also accrued more touches of the football in their dribbling task. The current study suggests that affordances are not only primary in the children's perception of the environment but also in the design of learning spaces and, if children can modify their environment, they do so in accordance with their perceived action capabilities for their physical ability and body. The present study demonstrates that dribbling performance is scaled to the (perceived) action capabilities of the children and children can act as architects in their own skill development. For sports coaches, offering opportunities to co-design practices would facilitate skill development aligned with children's actual motor competence.

D2.S3.3(2) Effects of 2 min- and 3 min passive recovery periods on the repeated sprint skating ability of ice hockey defencemen and forwards

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To keep the game fast, ice hockey players alternate at a regular interval, known as "shifts". Each shift varies in duration from 30- to 80-s, with 2- to 5-min of recovery between two consecutive shifts. To mimic movement pattern of players during ice hockey match play, coaches and sports scientists have designed repeated sprint skating ability (RSSA) tests (Baron et al., 2021, International Journal of Environmental Research and Public Health, 18, 1–11). This study was aimed to determine the effects of 2- and 3-min recovery periods on the skating ability, heart rate (HR), blood lactate (BLa) concentration and rate of perceived exertion (RPE) of professional ice hockey players. Participants gave written informed consent before participating in the study. Two forms of RSSA tests, RSSA-2 and RSSA-3, were assessed on Forwards (n = 16) and Defencemen (n = 8). In RSSA-2, participants performed 6 sets of 3 × 80-m sprint skating with 2-min passive recovery between two consecutive sets. RSSA-3 was like RSSA-2, but each set of 3 × 80 m sprint was spaced by 3-min recovery. Speed, average HR (HRaver), [BLa] and RPE were measured in both RSSA-2 and RSSA-3. The RPE was determined by using the Borg's CR-10 scale (Borg, 1990, Scandinavian Journal of Work Environment & Health, 16 Suppl, 55–58). To estimate the differences among the mean values, repeated measures of ANOVA were applied with post hoc Tukey's Honestly Significant test. Skating speed was greater in RSSA-3 than the corresponding set of RSSA-2. Forwards were faster than Defencemen; however, the difference was significant (P = 0.033 to 0.701) in some sets of RSSA-2 only. HRaver increased gradually from Set 1 through 6 in RSSA-2 (156 ± 11 and 172 ± 7 beats · min^{-1} respectively) and RSSA-3 (156 ± 8 and 167 ± 7 beats · min^{-1} respectively). RPE was greater in RSSA-2 (6.25 ± 1.27 in Set 1 to 9.96 ± 0.2 in Set 6) than in RSSA-3 (5.79 ± 1.18 in Set 1 to 9.79 ± 0.41 in Set 6). Defencemen perceived greater exertion than Forwards in both RSSA-2 (P = 0.041 to 0.826) and RSSA-3 (P = 0.043 to 0.293). No difference in [BLa] was noted between Forwards and Defencemen although both showed greater (P = 0.001) [BLa] in RSSA-3 (12.3 ± 2.8 mmol · L^{-1}) than in RSSA-2 (8.7 ± 2.6 mmol · L^{-1}).

This study concludes that 1) 3-min recovery enables better performance, lowers HR, and increases [BLa]; 2) Forwards are faster than Defencemen, 3) Defencemen report greater RPE for RSSA tests. This study may be useful for coaches for the effective use of players by selecting suitable recovery time for improved speed and minimisation of early fatigue.

D2.S3.3(3) Perfectionism and exercise dependence: The mediating role of basic psychological needs and introjected regulation

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Perfectionism explains greater amounts of variance in exercise dependence than any other personality disposition (see Bircher et al., 2017 for a review). Recently, researchers have found that motivational factors in part explain the perfectionism-exercise dependence relationship (Costa et al., 2016, International Journal of Mental Health and Addiction, 14, 241–256). These studies tend to focus on one set of motivational factors (e.g., basic psychological needs), when in theory the motivational signature of perfectionism and exercise dependence is likely to be more complex. Using an encompassing self-determination theory framework (Ryan & Deci, 2017, Self-determination theory: Basic psychological needs in motivation, development, and wellness. New York: Guildford), the aims of our study were to examine the perfectionism-exercise dependence relationships, and whether basic psychological needs and introjected regulation explained these relationships. Following institutional ethical approval, distance runners (N = 260, n = 144 females, n = 116 males, mean age: = 42.41 ± 11.95 years) completed measures of multidimensional perfectionism (self-oriented perfectionism, SOP; socially prescribed perfectionism, SPP), basic psychological need satisfaction, basic psychological need thwarting, introjected regulation, and exercise dependence. Bivariate correlations revealed significant positive SOP-exercise dependence ($P < .001$) and SPP-exercise dependence ($P = .002$) relationships. Structural equation modelling suggested that in combination, perfectionism, basic psychological need satisfaction, basic psychological need thwarting and introjected regulation accounted for 34% of the variance in exercise dependence. Tests of indirect effects showed that the SPP-exercise dependence relationship was mediated by basic psychological need thwarting and introjected regulation ($P = .002$). By contrast, the SOP-exercise dependence relationship was not significantly mediated by basic psychological need satisfaction, basic psychological need thwarting, introjected regulation nor a combination of these motivational factors. Our findings suggest that while the relationship between SOP and exercise dependence is direct, need thwarting and introjected regulation represent a motivational signature of SPP and exercise dependence. Strategies designed to challenge the pursuit of perfection in exercise, as well as those that prime motivationally adaptive (i.e., self-determined) reasons for exercising, represent important future research directions and areas of consideration for exercise practitioners.

D2.S3.3(4) The influence of obesity on insulin sensitivity responses to resistance exercise training

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This study aims to investigate the influence of obesity on insulin sensitivity and glycaemic control responses to resistance exercise training. Nineteen men (20–44 years) completed the study protocols. Participants were assigned to one of two groups based on body mass index classification: 1) obese (initial BMI 33.2 ± 3.2 kg · m^{-2}) or 2) normal group (initial BMI 22.7 ± 2.5 kg · m^{-2}). Both groups were tested for body fat percentage (skinfold method), waist and hip circumferences, insulin sensitivity indices using an oral glucose tolerance test, lipid profile, fasting glucose, glycated haemoglobin (HbA1c), blood pressure, and maximum strength using the 1-repetition maximum (1RM) protocol for the leg press and chest press at baseline and after a 10-week resistance exercise training (RE). RE involved the exercises leg press, chest press, lat pulldown, shoulder press, leg extension, leg curl, biceps curl, and triceps extension (3 × 10 repetitions at 10RM for 3 days/week). Blood pressure, HbA1c, low-density lipoprotein, total cholesterol, triglyceride, body circumferences and fat percentage were not changed from pre- to post-RE in both groups ($P > 0.05$ for all). Fasting plasma glucose and high-density lipoprotein were increased at post-RE in the normal group ($P = 0.02$), but not in the obese group ($P = 0.08$) compared to pre-RE. Matsuda insulin sensitivity index (ISI) was increased at post-RE compared to pre-RE in the normal group ($P = 0.002$). ISI was significantly higher in the normal compared to the obese group at post-RE ($P = 0.006$). The hepatic insulin resistance index was reduced in the normal group from 236.8 ± 132.5 at pre-RE to 177.3 ± 82 at post-RE ($P = 0.038$). Hepatic insulin resistance index non-significantly increased in the obese group (from 298.1 ± 252.1 pre-RE to 338.6 ± 280.8 post-RE; $P = 0.16$). There was no significant change in muscle insulin sensitivity in the normal group from pre-RE to post-RE (4.3 ± 3.1 (95% CI, 2.1–6.5) to 6.6 ± 5.9 (95% CI, 2.3–10.9), respectively; $P = 0.1$). The total area under the curve for insulin was decreased in the normal ($P = 0.02$), but not in the obese participants ($P = 0.5$). No other indices were changed. These results suggest that body fat, including the subcutaneous, intramuscular, intrahepatic, and visceral fat might have prevented the insulin sensitivity improvements with RE, and fat loss might be essential for these improvements to occur.

D2.S3.3(5) Athlete burnout reduces sports performance: evidence from multiple samples

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For over two decades, research has examined the phenomenon of athlete burnout. Research, to date, however, has focused almost exclusively on identifying factors implicated in its development. Prominent models of athlete burnout suggest that it will have many adverse consequences – one of which is reduced sports performance. The present study therefore aimed to provide the first empirical examination of this idea. To do so, following institutional ethical approval, we recruited one sample of 106 track and field athletes (mean age = 21.85 ± 3.65) and a second sample of 181 swimmers (mean age = 19.67 ± 1.56). Participants in both samples completed the Athlete Burnout Questionnaire within a period of 7 days before a competition. To examine within-athlete performance, we calculated the difference between an athlete's personal best and their competition performance. Regression analyses indicated that, in both samples, burnout significantly predicted worse comparative performance (Sample 1: B = -0.92, P = .009; Sample 2: B = -1.88, P < .001). The findings support theoretical assertions that athlete burnout does indeed affect sports performance. It appears that athletes experiencing high levels of burnout underperform in comparison to their previous best. Consequently, sports organisations, coaches, and athletes should routinely monitor athlete burnout, and intervene when necessary.

Posters

P.1 The ups and downs of exercise: downhill walking is perceived as more pleasant and elicits lower psychophysiological stress than uphill walking

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Elevated physiological responses associated with metabolic stress (i.e., heart rate [HR] and oxygen uptake [VO2]) are often accompanied with low levels of pleasure (Ekkekakis et al. 2011, Sports Medicine, 41(8), 641–671). Concentric exercises typically culminate in the highest level of physiological and perceived exertion. In contrast, the metabolic and perceptual demand of eccentric exercise is substantially (~20–60%) lower than concentric exercise at a comparable workload. Therefore, eccentric exercise could offer a practical exercise mode that combines exposure to meaningful doses of physiological stress with improved tolerance, pleasure and enjoyment. Therefore, the aim of this study was to examine affective, perceptual and metabolic responses during uphill (UHW) and downhill (DHW) treadmill walking.

Following institutional ethics approval, fourteen healthy young men (age; 24.6 ± 5.3 years) visited the laboratory on two occasions; (1) 20-min DHW (–10% gradient) and (2) 20-min UWH (+10% gradient). UHW and DHW trials were randomised but matched for walking speed (4.5 km·h-1). Affective and perceptual responses were assessed before and every 5 min during each session using the feeling scale (FS) and the rating of perceived exertion (RPE) scale. Metabolic responses (HR and VO2) were measured at the same time intervals. Enjoyment was measured post-exercise using the Physical Activity Enjoyment Scale (PACES). Repeated measures ANOVA were undertaken to test for the effects of time and mode on FS, RPE, HR and VO2. Paired t-test was used to examine post-exercise differences in PACES between UHW and DHW.

Our analyses revealed a significant increase in FS during DHW ($p < .001$, Cohen's $d = 1.19–1.38$), but not UHW ($p > .05$). Throughout exercise, DHW was perceived to be more pleasurable (FS) than UHW ($p < .001$, $d = 0.79–0.89$). RPE was consistently 2–3 points lower during DHW compared to UHW ($p < .01$, $d = 1.26–1.53$). Throughout exercise VO2 ($d = 4.08–4.92$) and HR ($d = 1.83–2.46$) were significantly lower during DHW compared to UHW ($p < .001$). There was no difference in post-exercise PACES scores between UHW and DWH ($p = .619$).

Our findings indicate that DHW is perceived to be more pleasurable (FS) and elicits lower psychophysiological (RPE) and metabolic (HR and VO2) stress than a bout of UHW. This is the first direct evidence that eccentric exercise is more palatable and leads to better affective responses than concentric exercise. Given the lower metabolic and perceptual demand and higher levels of pleasure, eccentric exercise offers a better effort–benefit ratio, which is likely to elicit greater levels of exercise tolerance and subsequent adherence.

P.2 The relationship between multidimensional perfectionism and competitive swimming performance

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As a means of understanding the benefits and costs of perfectionism for athletes, researchers have sought to determine the relationship between dimensions of perfectionism (perfectionistic strivings and perfectionistic concerns) and sports performance. Meta-analytical findings are that perfectionistic striving is related to better performance, whereas perfectionistic concerns are unrelated to performance (Hill et al., 2018, Sport, Exercise, and Performance Psychology, 7, 235–270). However, the majority of the previous research has relied on capturing sport performance without accounting for an athlete's prior ability. The present study aimed to address this limitation by examining if the two higher-order dimensions of perfectionism predict whether athletes underperform or outperform their personal best in competition. With institutional ethics approval, 168 adult swimmers (52% female; mean age: 19.70 ± 1.56 years) competing at a single championship completed the Performance Perfectionism Scale in Sport (PPS-S; Hill et al., 2016, Journal of Psychoeducational Assessment, 34, 653–699) one week prior to competition. Performance was measured as the difference between participant personal best and actual performance at the competition (expressed as a percentage change). Linear regression analysis showed that neither perfectionistic strivings ($B = .337$, $P = .268$) nor perfectionistic concerns ($B = –.313$, $P = .223$) significantly predicted within-athlete performance. Findings from the present study suggest that perfectionism dimensions may not be important when considering an athletes' ability to outperform their previous best attainment. Coupling this point with the robust evidence that shows athlete perfectionism can be a vulnerability factor for a number of maladaptive outcomes (e.g., burnout and depression; Smith et al., 2018, Journal of Clinical Sport Psychology, 12, 179–200), there is a need for caution regarding the extent to which perfectionism is advocated or encouraged when working with athletes. Overall, athlete perfectionism may not be important for performance progression, with future research needed to confirm the findings in other samples and sports.

P.3 Female recreational aerialists: Muscular strength imbalances in dominant and non-dominant shoulders

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Aerial arts are a performance or fitness-based activity requiring strength, flexibility and endurance (Franklin, 2015). Participation in aerial arts utilises different equipment such as aerial hoop, aerial silks, trapeze, hammock and pole (Ruggieri & Costa, 2019). Aerial arts have been present in circus performance for centuries (Shrier et al., 2009), and during the past decade, aerial fitness as an accessible means of exercise for the general population has increased in popularity (Greenspan, 2021). However, limited research exists exploring the physical demands and injury epidemiology of the recreational aerialist. Previous literature highlights the shoulder as a common area for injury amongst aerialists (Hakim, Puel, & Bertucci, 2020; Shrier et al., 2009; Stubbe, Richardson, & van Rijn, 2018), and anecdotal evidence demonstrates aerialists often neglect training bilaterally, favouring the dominant side of the body. Therefore, the aims of the present study were to compare muscular strength between dominant and non-dominant shoulders of female recreational aerialists during isokinetic flexion, extension, internal and external rotation of the shoulder joint, as well as handgrip strength. Following institutional ethical approval, twenty female aerialists (mean ± SD, age 29 ± 5 years, stature 1.6 ± 0.5 m, body mass 63.2 ± 9.1 kg) were tested using an isokinetic dynamometer. Peak torque (N · m) of the dominant and non-dominant shoulder was measured during shoulder extension, shoulder flexion, internal and external rotation at angular velocities of 60,180 and 300°·s^{-1}. Participants completed two repetitions at each velocity, with a 10 second rest between repetitions. Handgrip strength (kg) was measured on the dominant and non-dominant hands using a handheld dynamometer. Results highlighted the dominant shoulder was significantly stronger only at 60°·s^{-1} during shoulder extension (dominant: 34 ± 11 N · m v non-dominant: 30 ± 10 N · m) ($t(19) = 2.610$, $P = 0.017$, $d = 0.584$). There was no significant difference ($P > 0.05$) in strength between the dominant and non-dominant sides during shoulder flexion, internal and external rotation, or handgrip strength. These data are the first to obtain isokinetic peak torque of recreational aerialists during shoulder flexion, shoulder extension, internal and external rotation movements, highlighting recreational aerialists only display muscular imbalance during shoulder extension. The obtained results provide normative data for aerialist shoulder strength in dominant and non-dominant limbs, which may be used by coaches, sports scientists and athletes alike for injury prevention and recovery, as well as a means of comparison in future research of different aerialist populations such as elite or male recreational aerialists.

P.4 The dose-response relationship between training load measures and next-day well-being in professional male academy soccer players

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The imbalance between training and recovery can affect the training output and also present symptoms of overtraining (Malone, Owen, Newton, et al., 2018, Journal of science and medicine in sport,21,29–34). Wellbeing questionnaires offer a simple, non-invasive measure of potentially tracking symptoms of overtraining and fatigue. However, the dose–response relationship between training load (TL) and well-being scores provides mixed conclusions (Taylor, Myers, Sanders et al., 2021, Applied Sciences,11,5926). This study aims to identify the dose–response relationship between TL measures and the next-day wellbeing during the pre-season period. Fourteen (17 ± 1 years, 71.2 ± 5.6 kg, 178 ± 5.8 cm) male professional academy soccer players took part in the study where written informed consent was given by each player and the study was approved by the university ethics committee. The internal TL measures monitored were training impulses (TRIMP) and session rating of perceived exertion multiplied by duration (sRPE-TL) on a 0–10 scale. The TRIMPs included the individual TRIMP, Banister TRIMP, Lucia TRIMP and Edwards TRIMP, where the raw heart data (Polar Team Pro) was exported and used to calculate the respective TRIMPs. External TL measures were total distance, PlayerLoadTM, high-speed running (14.4–19.8 km · h^{-1}), very high-speed running (19.8–25.2 km · h^{-1}) and maximal sprint distance (>25.2 km · h^{-1}). The individual high-speed distance was derived from each participant's treadmill speed, where blood lactate reached 4 mmol·L^{-1}. The well-being questionnaire asked players to rate various perceptions of well-being on a scale ranging from −3 to +3, where 0 represents feeling normal, minus characterises poor perception of well-being and plus denotes positive perceptions of well-being. The well-being questionnaire required players to provide perceptions on sleep duration, recovery, motivation, appetite, fatigue, stress and soreness. Different Bayesian regression models were run with different likelihood functions. The best-fitting models with the lowest out-of-sample prediction error and the highest variance explained (R2) were used. The results of the study suggest the most practical data was typically seen between the perception of lower body soreness and TL. For example, to reduce the perception of lower body soreness by 1 arbitrary unit, players would typically need to miss approximately 2 on-field sessions when considering the relationships with internal and external TL. However, the relationships between all other well-being and TL measures show considerable uncertainty. As such, practitioners should be cautious when trying to manipulate on-field changes to improve a player's well-being response.

P.5 "Children don't get those life experiences": Barriers to physical activity and FMS in children living in deprived areas in the UK

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School settings provide opportunities for physical activity (PA) and the development of fundamental movement skills (FMS) (Morgan et al., 2013, Paediatrics, 132, e1361-e1383). Yet, there is little understanding of the lived experiences of teachers in providing these opportunities for ethnically diverse children living in deprived areas. Given that, children from deprived and BAME backgrounds have poor health outcomes, high inactivity (Eyre, et al., 2013, Diabetic Medicine, 30, 939–945) and poorer FMS proficiency (Adeyemi et al., 2018, Children, 5, 110), understanding factors that influence PA and FMS may help to reduce health inequalities. This qualitative study aimed to explore teachers' perspectives on factors affecting FMS and PA engagement in children living in deprived areas in the UK. Following ethics approval and informed consent, a purposive sample of 14 primary school teachers participated in semi-structured focus groups drawn from schools situated in lower SES wards and ethnically diverse areas in Central England. Inductive thematic analysis was conducted followed by deductive analysis to the socio-ecological model (McLeroy et al., 1988, Health Education, 15, 351–377). Transcripts were returned for comment/correction, reflexivity, analyst triangulation and frequent debriefing were conducted to improve the trustworthiness of the data. Multiple and interrelated factors across all levels of the socio-ecological model were found. Teachers described that children lacked appropriate kit for PE, the ability and perception to be active or perform FMS (intrapersonal), parents and teachers lacked time and held low priority for PE and PA to other roles and responsibilities, teachers lacked confidence in planning and delivery PE and parents safety concerns and financial constraints (interpersonal), as barriers to PA/FMS. Furthermore, school curriculum organisation and delivery, technology and limited space for PA in the home environment (organisation), aesthetics of the environment, norms of the community (community) and curriculum policy were also highlighted. We conclude that initiatives to increase PA and develop the FMS in ethnic and deprived children are likely to be ineffective unless the multiple and interrelated barriers to developing good FMS and PA habits are addressed at all levels and considered more holistically with their complexity. Multidisciplinary solutions are needed across sectors given the range of complex and interrelated factors.

P.6 The reliability of force platform and smartphone application derived measures of vertical jump height in young football players

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Vertical jump assessments are used regularly in sports and exercise settings due to their ease of implementation and broad and population spanning application. Force platform-derived take of velocity (TOV) is considered the gold standard method for jump height assessment (Moir, 2008, Measurement in Physical Education and Exercise Science, 12, 207–218). However, due to its ease of measurement, most tools commonly derive jump height from time in the air (TIA). More recently, the MyJump2 smartphone application has emerged as a low-cost alternative for assessing jump performance (Carlos-Vivas et al., 2018, Journal of Sports Medicine and Physical Fitness, 58, 227–232). To the best of our knowledge, the reliability of MyJump2 has never been tested in young athletes. Therefore, the aim of this study was to evaluate the reliability of countermovement jump (CMJ) performance between the MyJump2 and force platform-derived measures of vertical jump height in young football players. Following ethics approval and parental consent, 30 grassroots football players (8 females; Age: 8.7 ± 2.3 y; Height 140 ± 11.8 cm; Body mass 33.0 ± 8.1 kg) performed three CMJ, separated by 60 s of rest, assessed simultaneously using two uni-axial force plates and the MyJump2 App. Total sample for analysis was N = 89, due to an error with force plate data capture for one trial. Jump height measured from force plates (JHTIA and JHTOV) were compared to MyJump2 App (JHMP) by calculating coefficient of variation (CV), typical error of measurement (TEM), intraclass correlation coefficients (ICC) and by constructing Bland-Altman plots and determining the 95% limits of agreement (LoA). There was excellent reliability between JHTIA and JHTOV (ICC = .955; CI's = .801–.982; TEM = 1.1 cm, CV = 6.6%), and Bland-Altman plots indicated that JHTIA over-predicted JHTOV by 1.33 ± 1.62 cm (LoA = −1.85–4.51 cm). There was also excellent reliability between JHTIA and JHMJ (ICC = .990; CI's = .322-.998; TEM = 1.1 cm, CV = 4.7%), with JHTIA over predicting JHMJ by 0.97 ± 0.41 cm (LoA = 0.17–1.76 cm). The reliability between JHTOV and JHMJ was also excellent (ICC = .971; CI's = .956-.981; TEM = 0.3 cm; CV = 5.7%), and JHMJ over predicted JHTOV by 0.36 ± 1.61 (LoA = −3.52–2.80 cm). The results of the present study indicate that when force plate derived TOV is not available, MyJump2 may be a suitable alternative, but careful evaluation of takeoff and landing mechanics is needed to help reduce the systematic bias in this instrument.

P.7 Psychosocial factors affecting esports players: an umbrella review

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Esports comprises over 100,000 competitive players worldwide, has a global viewership of around 474 million, and generates market revenue nearing $2 billion (Esport Earnings, 24 June 2022, Highest Earnings By Country, https://www.esportsearnings.com/countries). Alongside this recent boom in the esports industry, there has been a concurrent rise in academic literature focusing on the psychosocial factors that affect

performance and wellbeing in esports players (Leis et al., 2022, International Journal of Esports, 1, 1–22). This has culminated in 10 known systematic reviews related to this area with mixed quality including issues with assessing study bias, poor study design explanations, and little statistical analysis. Therefore, the aim was to investigate the study quality of the systematic reviews in esports literature and understand the range of psychosocial factors that affect esports players. Following ethical approval from the university, an umbrella review was performed. Using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA; Page et al., 2021, Systematic Reviews, 10, 1–11) guidelines, 180 articles were identified with 10 reviews eligible for full analysis. A MeaSurement Tool to Assess systematic Reviews 2 (AMSTAR 2; Shea et al., 2017, British Medical Journal, 358, 1–9) was used to assess the overall confidence in the results of the systematic reviews. No review rated as "high" for overall confidence. Three reviews achieved a "moderate" rating, two were rated as "low" and the remaining five were "critically low." The most common critical flaw was that written protocols for conducting the review lacked robust assessments for risk of bias and did not investigate heterogeneity. Five reviews also failed to account for the role of bias in individual studies thus negatively influencing the accuracy of the results. Study outcomes from the reviews showed that player's game expertise, sleep, stress, physical activity, injuries, and social issues had an important impact on player performance and general wellbeing. The results show a need for more rigorous methodology in esports research with an emphasis on ensuring the biases of the studies do not affect the overall findings in the literature. Within practice, esports players and teams could benefit from interdisciplinary sport science teams and interventions to ensure optimal performance and overall positive affect of individuals. Future research should consider individual differences, and the need for more robust empirical and qualitative data to assess psychosocial factors in esports players.

P.8 Do online strength and conditioning sessions provide equivalent internal responses to gym-based sessions

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Home confinement due to COVID-19 rules coupled with a reduced training load and/or an inappropriate training schedule can lead to a partial or complete loss of morphological and physical adaptations previously gained from a soccer training schedule (Demir, Subasi & Harput, 2021, The Physician and Sports Medicine, 1–8, Freire et al., 2020, Frontiers in Psychology, 11, pp. 589,543, Mujika & Padilla, 2000, Sports Medicine, 30, pp. 79–87). This quasi-experimental observational study aimed to investigate whether strength and conditioning delivered in the home via a virtual platform during the Covid-19 pandemic could achieve equivalent physiological outcomes in adolescent female footballers as in a gym. With institutional ethical approval, data was collected over a 43-week period from 29 (U16 & U14) Regional Talent Club female soccer players via a CR-100 scale at the end of each training session, measuring the overall sRPE, differential RPEs: leg (sRPE_L), upper body (sRPE_U) and breathlessness (sRPE_B) as subjective measures of internal load. Mixed linear modelling was used to investigate the effect of training modality (Gym or Zoom) on internal training load accounting for the variability of participants. The mixed linear model with random effects and slopes revealed a statistically significant effect of modalities on sRPE of 7.19 ± 5.2, p.value: < .001 and a direct correlation of fixed effects on sRPE of $r = 0.915$. The difference between gym and zoom mean values was 9.2 arbitrary units (62.3 gym, 53.1 zoom) on an adapted cr100 scale. A visual inspection of equivalence tests showed no equivalence of sRPE and RPE_U across modalities, with RPE_L and RPE_B being not statistically equivalent and not statistically different. The results suggest that home delivered sessions via a virtual platform in this group of girl soccer players could generate a sufficiently valid internal load that may prevent the effects of detraining.

P.9 Relative age effects in basketball: Exploring the selection into and successful transition out of a national talent pathway

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Relative age effects (RAEs) appear consistently prevalent throughout youth basketball literature. However, the selection into and the successful transition out of a national talent pathway in basketball is yet to be explored. Thus, the primary aim of this study was to explore the influence of relative age, gender, and playing time based on the selection into the Regional Talent Hubs and Basketball England youth teams (U16, U18, and U20) and the successful transition into the senior national teams. Participants who were selected into the male (n = 450) and female (n = 314) Basketball England Talent Pathway were allocated into one of three cohorts: (a) Regional Talent Hubs (U12 to U15; n = 183), (b) England National Youth Teams (U16, U18, and U20; n = 537), and (c) England National Senior Teams (n = 44). A chi-square test was used to compare the birth quarter (BQ) distributions of each cohort against the expected distributions, with a Cramer's V used to interpret effect sizes. Odds ratios (ORs) and 95% confidence intervals (CIs) were also calculated to compare the likelihood of each BQ being represented. Males revealed significant RAEs across both the Regional Talent Hubs ($p < 0.001$, $Vc > 0.29$, $OR = 10$) and England National Youth Teams ($p < 0.001$, $Vc > 0.17$, $OR = 3.1$). In comparison, females only had significant RAEs in the Regional Talent Hubs ($p < 0.001$, $Vc > 0.29$, $OR = 2.3$). Despite RAEs being prevalent throughout youth levels, there

were no significant differences in the BQ distribution based on playing time and those who made the successful transition to the England National Senior Teams. These findings demonstrate the potential mechanisms of RAEs in basketball, as well as the impetus to explore more equitable competition within the England Basketball Talent Pathway.

P.10 Physical activity prescribing in eyecare and sight loss services: Findings and future implications

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Research has reported critically low levels of physical activity (PA) among people with sight loss (Smith et al., 2017, BMJ open ophthalmology, 1, e000046). Low levels of PA are concerning as studies have reported poorer health among people with sight loss (Purola et al., 2021, Quality of life research, 30, 2311–2327). Whilst studies have explored the feasibility and effectiveness of PA prescription delivered in primary care, to our knowledge, no studies have explored the feasibility and effectiveness of PA prescription delivered in eye care and sight loss services to target people with sight loss. Therefore, the aims of this research were to identify if adults with uncorrectable sight loss would follow PA advice from eyecare or sight loss service professionals and to explore the barriers and facilitators to implementing PA advice and support into eyecare and sight loss services. Following institutional ethical approval, adults who lived in the UK and who had uncorrectable sight loss were invited to participate in an online survey. Survey questions were developed by the research team and were informed by previous research. In addition, thematic analysis of semi-structured interviews with six sight loss service professionals, and 11 eyecare professionals was conducted, to understand barriers and facilitators to giving people with sight loss PA advice and referring people to PA groups or services. A total of 100 adults participated in the survey (66 females, 34 males, mean age (SD) 50.7 (14.3) years). Most participants reported they would increase their PA if advised to by a GP, optometrist, ophthalmologist, or low vision rehabilitation officer (GP: 70%, optometrist or ophthalmologist 70%, low vision rehabilitation officer 75%), 31% reported they would increase their PA if they were advised to by a dispensing optician. Barriers to sight loss service professionals prescribing PA included: advice being inappropriate if someone was grieving the loss of their sight or if they had other health conditions or mobility limitations, people's confidence to engage in PA, people's awareness of PA opportunities and environmental barriers. Factors such as lack of time, fear of creating a negative experience for patients, and lack of training, were barriers to implementing PA prescribing into eyecare services. In summary, PA prescribing within eyecare and sight loss services may be effective at targeting low PA among people with sight loss. To effectively implement PA prescribing into practice, professionals need to have the knowledge and capability to promote PA.

P.11 The effect of 10 weeks recreational football for health on fatness, functional fitness, and motor skill in older adults: a pilot study

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With old age comes a natural decline in function, which has significant consequences, including an increased risk of falls and disease (Collins et al. date, Wisconsin Medical Journal, 103, 1). Physical activity, including sports, has been sought out as non-pharmacologic strategies to offset declines in physical function and enhance health. Evidence has shown that regular physical activity in older adults decreases the risks of developing major diseases, falls, and muscular weakness (McPhee et al. 2019, Biogerontology, 17, 567–580). Recreational football has been identified as a health and function-enhancing activity in older adulthood (Krustrup et al., 2010, Scandinavian Journal of Medicine and Science in Sports, 20, 1–13). However, there is scant evidence reporting the effects of recreational football interventions on functional fitness and motor performance in older adults. This pilot study sought to address this issue by exploring the effects of a 10-week recreational football intervention on functional fitness and motor development in older adults.

Following ethical approval, an opportunistic sample of nine adults (age 71.1 ± 7.2 years, height 1.7 ± 0.1 m, mass 78.6 ± 12.3 kg) were recruited to take part. The 10-week intervention saw all participants take part in the same recreational football sessions for an hour a week. Pre- and post-intervention anthropometric measurements were taken (height, mass, and body fat percentage). Tests for functional fitness included 30-s chair stand, arm curl, 8-foot timed up-and-go, chair sit and reach, and the 6-min walk (Rikli and Jones, 2001, Human Kinetics). Motor skill was assessed using the short dribble test (Bangsbo and Mohr, 2011, Fitness Testing in Football. Denmark: Stormtryk).

Paired t-tests showed significant differences post-intervention for body fat percentage ($P = .00$), chair sit-to-stand ($P = .035$), and short dribble test ($P = .02$). No significant differences (all $P < .05$) were found for arm curl, 8-foot timed up-and-go, chair sit-and-reach, and 6-min walk.

The results of this study suggest that recreational football can improve lower body muscular endurance, reduce body fat, and improve motor skills in older adults who partake in it. We are conscious of the small sample size in our study and that this is a pre-post design with no control group. This was consciously undertaken as an exploratory study, given the increased perception of participants' risk when engaging in recreational football. Consequently, the current study can be considered

to show promise of evidence that recreational football is beneficial to functional fitness, fatness, and motor skill development for older adults.

P.12 Citrulline malate did not improve aerobic swimming performance in highly trained swimmers

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Citrulline malate (CM) has recently shown promise as a nutritional ergogenic aid for high-intensity exercise performance. Such benefits are thought to occur from peripheral changes in blood flow regulation, ammonia clearance rates, and ATP regeneration. These effects are also thought to extend to whole-body aerobic exercise, though studies have not yet explored this notion. The aim of this study was therefore to investigate the effects of CM on a typical aerobic swimming exercise test. Eleven trained swimmers (age: 17 ± 3 years, height: 1.71 ± 0.05 cm, body mass: 60.6 ± 8.3 kg) participated in this study, which was granted institutional ethical approval. In a double-blind, randomised, crossover design, the participants ingested either CM (15 g) or a placebo 60 min before performing 6 × 300 m maximal freestyle bouts (60 s passive recovery). Blood lactate (BL), systolic (SBP) and diastolic blood pressure (DBP) and ratings of perceived exertion (RPE) were measured at baseline, 60 min post-ingestion, and immediately post-exercise. A paired sample t-test was used to assess CM vs. placebo performance differences, whereas repeated measures ANOVAs determined time × treatment effects for physiological measures. Aggregated time-to-complete 6 × 300 m was faster after CM ingestion (1272.0 ± 57.8 vs. 1276.6 ± 46.4 s, $p = 0.004$, $g = 0.08$). This result should be interpreted cautiously, however, since the smallest worthwhile change in performance (17 s) was observed in nine swimmers: five favouring CM, and four favouring placebo. The cause of these variations was unclear but could have been due to responders/non-responders to the high CM dose or because the exercise test was not sensitive enough to detect performance changes in middle-distance swimmers. Small-to-moderate effect sizes also suggested that CM increased post-exercise BL (6.6 ± 2.9 vs. 5.2 ± 3.0 mmol/L, $g = 0.46$), SBP (149 ± 18 vs. 138 ± 16 mmHg, $g = 0.64$), DBP (79 ± 30 vs. 72 ± 15 mmHg, $g = 0.27$), and RPE (9.0 ± 0.8 vs. 8.6 ± 1.1 units, $g = 0.40$) compared to placebo (all $p > 0.05$). Consequently, this provides evidence that 15 g CM may not have activated the proposed ergogenic mechanisms of CM. However, further research utilising more direct physiological measures is still required (e.g., plasma NO and ammonia concentrations). As this was the first study to investigate CM on whole-body aerobic exercise, future studies can build upon this findings to fully elucidate the possible roles of CM for aerobic performance.

P.13 Assessing the prevalence and risk of disordered eating in female netball players

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Low energy availability (LEA) occurs when there is insufficient energy to support normal physiological function. This is caused when energy intake is lower than exercise energy expenditure, relative to fat-free body mass. Chronic LEA can result in disordered eating (DE), clinical eating disorders (ED) and reduced sporting performance. Professional female athletes are at higher risk of these concerns compared to amateur athletes, with 44% of professional athletes suffering from LEA and 27% experiencing DE. High prevalence of LEA and DE has been reported in a mixed cohort of female team sport athletes, but no research has been carried out on netball players specifically. Equally, it is unknown whether age, position or activity level of netball players affect risk. The aim of this study is to determine the risk of LEA, DE and ED in female netball players and to assess any differences across competitive levels of netball, age, time spent exercising and position. Adult female netball players (n = 108, 18–64 years, 169 ± 7 cm, 63.5 ± 5 kg) completed the London Sport Institute ethics committee-approved online survey, which consisted of the Female Athlete Screening Tool (FAST) and Low Energy Availability in Females (LEAF-Q) questionnaires (Folscher et al., 2015, Sports Medicine, 1, 29). FAST scores >78 suggest a potential ED and a LEAF-Q score ≥8 determine a player at risk of LEA. An effect size of 0.99 and beta at 1.00 was found using G* power post hoc analysis. LEAF-Q and FAST scores showed a moderate, but significant, positive correlation ($r = 0.416$, $P < 0.01$) using a Pearson correlation. Nearly half of the players (43%) were at risk of LEA, whilst 21% were recognised as being at risk of a clinical or subclinical ED. A one-way ANOVA determined that players who exercise 3–4 times per week had significantly higher FAST scores than those who exercised 1–2 times per week ($F(3, 106) = 3.168$, $P = 0.027$). No other significant differences between FAST or LEAF-Q scores for age, position, or competitive level were identified. Stepwise multiple regression also indicates that time spent exercising was a modest predictor of FAST scores ($R2adj = 0.035$, $F(4, 105) = 1.996$, $P = 0.042$). Our findings suggest that days spent exercising may be associated with eating pathology across all levels of netball player. Education may enable early identification of such issues and may prevent potential development of ED and performance deficits in female netball players.

P.14 The acute effect of moderate-intensity continuous exercise and sprint interval exercise in a mentally fatigued state on subjective ratings of mental fatigue

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Mental fatigue (MF) can impair cognitive function, physical performance, and workplace productivity. Loy et al. (2013, Fatigue: Biomedicine, Health, and Behaviour, 1, 223–242) reported that exercise can attenuate the perception of fatigue and future research should identify the minimum exercise dose at which these attenuations occur. The aim of this study was to experimentally induce a state of MF and then assess the impact of 10 min moderate-intensity continuous exercise (MICE) vs. sprint interval exercise (SIE) on MF. With institutional ethical approval, 12 physically active males (age 20.5 ± 0.5 years) completed three trials in a randomised order. Each trial began with a 30 min computerised Incongruent Stroop-Word-and-Colour-Test (C-ISWCT), then A) 10 min cycling at 60% maximum heart rate (MICE), B) 3 × 20 sec sprints interspersed with 3 min unloaded cycling (SIE), C) 15 min seated rest (CON). Trials A and B included a 5 min cycling warm-up at 50 W. A 10 min exercise duration was selected as acute high-intensity interval exercise lasting ~10 min can significantly improve feelings of energy and tiredness (Stenling et al., 2019, Frontiers in Psychology, 10, 1–12). Subjective MF was assessed using a 100-mm visual analogue scale immediately before and after C-ISCWT, after warm-up (5 min into CON), and 30 s after exercise/CON. After C-ISWT, MF increased relative to before C-ISWT (CON: mean difference (MD) 42.2, 95% CI 31.7 to 52.6 mm; d = 2.86; MICE: 36.0, 95% CI 27.1 to 44.9 mm; d = 2.81; SIE: MD 32.7, 95% CI 23.4 to 42.0 mm; d = 2.83). From after C-ISWT to post-warm-up (or 5 min into CON period), MF declined (CON: MD −7.8, 95% CI −1.9 to −13.6 mm; d = −0.64; MICE: MD −15.5, 95% CI −6.5 to −24.4 mm; d = −1.34, SIE: MD −15.6, 95% CI −10.0 to −21.2 mm; d = −1.38). From post-warm-up to post-exercise (or post-CON period), MF declined (CON: MD −5.9, 95% CI −2.9 to −8.8 mm; d = −0.42; MICE: MD −19.9, 95% CI −11.4 to −28.4 mm; d = −1.21; SIE: MD −17.0, 95% CI −8.5 to −25.5 mm; d = −1.30). Results suggest that 10 min of MICE and SIE are similarly effective at attenuating MF compared to CON. Also, notable improvements in MF were achieved after a 5 min light-intensity warm-up. Short bouts of exercise may be a useful way to combat MF, and the duration of exercise that can achieve this may be shorter than previously thought.

P.15 Blood lactate concentration values following exercise and sodium bicarbonate ingestion: Agreement between analysers

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Relationships between analysers for blood lactate concentration ([BLa]) are generally good, although bias is reported as [BLa] increases (Bonaventure et al., 2015, Journal of Sports Science and Medicine, 14, 203–214). Analyser differences may be further accentuated where increased lactate flux from muscle to blood is induced, such as high-intensity exercise following sodium bicarbonate ingestion, resulting in greater and potentially more variable [BLa] values. The aim of this study was to determine the agreement between two lactate analysers for [BLa] following sodium bicarbonate ingestion and high-intensity exercise. Following university ethics approval, eight nationally ranked swimmers volunteered to take part. On two occasions, one hour prior to undertaking a typical training session (8 × 50 m sprints), participants ingested either a sodium bicarbonate ($NaHCO_3$; 0.3 g · kg · bm^{-1}) or a taste matched sodium chloride solution (NaCl: 0.05 g · kg · bm^{-1}). Fingertip capillary blood samples were taken pre-ingestion, pre-exercise and immediately post exercise for the analysis of [BLa] (mmol · l^{-1}) using a Lactate Pro (Lactate Pro LT-1710, Arkray Inc., Kyoto, Japan) and a Biosen analyser (Biosen C_Line analyser, EFK Diagnostics, Cardiff, UK). Differences between trials for each analyser (i.e., trial × time) and differences between analysers for each trial (i.e., analyser × time) were determined using repeated measures factorial analysis of variance with Tukey post-hoc analysis. Agreement between devices was determined using Bland and Altman limits of agreement (LoA) and the existence of proportional or systematic bias using Passing-Bablok regression. A significant trial × time interaction (P = 0.049) was observed for [BLa] using Lactate Pro with differences observed between trials post-exercise (P < 0.05; NaCl: 12.6 ± 1.8 mmol · l^{-1}; $NaHCO_3$: 14.6 ± 1.7 mmol · l^{-1}). No interaction was observed for the Biosen analyser (P < 0.05). Significant device × time interactions were observed for both NaCl and $NaHCO_3$ trials (P = 0.033 and P = 0.007, respectively) with greater values post-exercise from the Biosen analyser (P < 0.05; NaCl: 16.3 ± 4.4 mmol · l^{-1}; $NaHCO_3$: 19.9 ± 5.8 mmol · l^{-1}, respectively) Greater [BLa] values for Biosen were also indicated from the LoA analysis (bias; 1.7 mmol · l^{-1}, LoA; −4.6 to +8.3 mmol · l^{-1}) for all data and when compared within NaCl (1.5 mmol · l^{-1}) and $NaHCO_3$ (1.9 mmol · l^{-1}) trials separately. Differences between analysers were visually evident from ~13.0 and 15.0 mmol · l^{-1} for the NaCl and $NaHCO_3$ trials, respectively. Passing-Bablok regression indicated existence of proportional bias (slope; 1.19, confidence intervals; 1.10 to 1.35). This study quantifies the magnitude of bias between two commonly used lactate analysers thus aiding comparisons between studies where [BLa] results may be in opposition with regard to statistical significance.

P.16 Measurement of sporting abilities using item response theory: An introduction and example using passing ability in soccer

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Measurement of performance in sport has historically followed operationist tendencies and applications of Classical Test

Theory (i.e., true score theory). However, while specific performance is often the focus, it is likely the underlying latent ability that gives rise to performance which is of greater importance particularly for those interested in things such as athlete selection, long-term development, and intervention effectiveness. Item Response Theory (IRT; i.e., latent trait theory) can allow for the modelling of individual latent abilities and their observed performance on a particular test, but, despite early suggestions (Safrit, Cohen, and Costa, 1989, Research Quarterly for Exercise and Sport, 60(4), 325–335), has rarely been applied in sporting contexts. Thus, our aim is to re-introduce and explain this approach for measurement of sport abilities. We use the example of a specific sporting ability, passing in soccer and apply IRT-based models to a test of this ability. As data collection formed part of existing service provision, no identifiable data was involved, all data was handled in accordance with GDPR and guidance from the HRA and REC section 11 of Standard Operating Procedures, a priori ethical approval was not required. Existing data (data collection is ongoing; full data will be presented) was used from 639 tests employing a 360° random light target (22 targets) based passing task with 83 individuals representing an assumed heterogeneous range of ability levels (i.e., ranging from professional to recreational soccer players). We sought to model the binary response data (i.e., whether they accurately passed to the target or not) as a function of both the underlying latent player ability and characteristics of the target in terms of its absolute distance in degrees from the previous target (i.e., how far from the previous pass the current one was). Data were analysed using a Bayesian hierarchical regression framework (Bürkner, 2019, arxiv, DOI: 1905.090501) and a model selection process was conducted by fitting and comparing a range of models varying in complexity from one-parameter logistic (i.e., Rasch model) to four-parameter logistic models, both with and without person (age) and target (right or left turn to pass) covariates, and also with response and response time jointly modelled. We use this example to highlight and explain the application of IRT-based models to sporting data as a powerful and flexible approach to understanding both player abilities and test characteristics in addition to the effect of both person and item covariates.

P.17 Evaluating the effectiveness of Pilates-based exercise interventions in adults with visual impairment

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On average, adults with a visual impairment complete less physical activity compared to the general population (Holbrook et al., 2009, Journal of Visual Impairment & Blindness, 103(1)). Within adults with visual impairment, physical activity is a significant predictor of health-related quality of life and is significantly correlated with life satisfaction (Łabudzki and Tasiemski, 2013, Human Movement, 33, p. 210). Furthermore, this group has been significantly affected by the COVID lockdown and social distancing measures restricting their ability to participate in physical activity, resulting in significant health-related implications (Strongman et al., 2022, Journal of Visual Impairment & Blindness, 116). Whereas previous exercise interventions with people with visual impairment have had a focus on balance, Pilates has not been evaluated as a specific training method for this population (Sweeting et al., 2020, BMJ Open, 10:e034036) despite showing increased dynamic balance, quality of life and mental health in sighted people. The aims of this research were to evaluate to what extent Pilates improves function and wellbeing in adults with a visual impairment, and to establish if Pilates is an effective method of engaging people with visual impairment to return to physical activity post-COVID.

Following institutional ethical approval, adults with visual impairment(s) were recruited from service users of a Cambridge-based sight loss charity, CamSight. Twelve participants (6 M 6 F) have taken part in weekly 45-min instructor-led Pilates classes from September 2021 to July 2022 and completed quality-of-life (WHOQOL-BREF) and balance confidence (CONFBAL) measures at the start and end of the study. Qualitative surveys using open-ended questions were also completed during the study to further evaluate their experiences. This research is ongoing and planned for completion in July 2022, when key quantitative findings can be extracted from the study data. The survey data has been analysed using reflexive thematic analysis, with key themes relating to accessibility, community, mental health, independence and autonomy.

This research assesses the effectiveness of using Pilates as an exercise intervention in adults with visual impairment and evaluates the mental health and wellbeing effects of this intervention. This research will inform future sports development activities for people with visual impairment and develop best-practice guidelines co-created with the participant group to ensure future interventions are effective.

P.18 The effect of 20-weeks of high-fat diet consumption on isometric, concentric and eccentric contractile performance of isolated fast and slow-twitch skeletal muscle in mice

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Recent evidence suggests that high-fat diet (HFD) consumption can directly impair the contractile function of skeletal muscle. Despite evidence inferring muscle and contractile mode-specific effects of HFD, no study has yet considered the impact of HFD on eccentric muscle function. The generation of eccentric muscle force differs mechanistically from concentric and isometric force production, and thus, HFD effects are unlikely uniform. The present work uniquely examined the effect of 20 weeks HFD on the isometric, concentric and eccentric muscle function of isolated mouse soleus (SOL) and extensor digitorum longus (EDL) muscles. Following institutional ethics approval, 4 weeks old CD-1 female mice were randomly split

into a control (N = 16) or HFD (N = 17) group and for 20 weeks consumed standard lab chow or HFD respectively. Following this period, an SOL and EDL muscle were isolated from each individual, and assessment of maximal isometric force and concentric work loop power was performed. Each muscle was then subjected to either multiple concentric work loop activations or multiple eccentric work loop activations. Post-fatigue recovery, as an indicator of incurred damage, was measured via assessment of concentric work loop power. Maximal force and power were analysed via either independent sample T-Test or Mann–Whitney tests, and fatigue was analysed using Statistical Parametric Mapping and recovery using mixed-model ANOVA. In the EDL, absolute concentric power and concentric power normalised to muscle mass were reduced in the HFD group ($P < 0.038$). HFD resulted in faster concentric fatigue and reduced eccentric activity-induced muscle damage ($P < 0.05$). For the SOL, maximal isometric force was increased and maximal eccentric power normalised to muscle mass and concentric fatigue were reduced in the HFD group ($P < 0.05$). These data indicate, for the first time, that HFD effects on eccentric muscle function are muscle-specific and have little relationship with HFD-induced changes in isometric or concentric muscle function. HFD has the potential to negatively affect the intrinsic concentric and eccentric power-producing capacity of muscle, resulting in larger muscles that perform relatively worse compared to control. This in combination with reduced absolute concentric work loop power output of the EDL and fatigue resistance of both the EDL and SOL may limit in vivo locomotor performance. These findings further indicate a protective effect of HFD for limiting eccentric muscle damage in fast-twitch muscle.

P.19 Acute effects of exercise on cognitive function and prefrontal cortex oxygenation in older adults

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A mental function can be affected by brain ageing, associated with morphological and physiological changes even in healthy older people (Bettio et al., 2017. Neuroscience & Biobehavioral Reviews, 79, 66–86). Scientific evidence supports that a healthy lifestyle, as well as an aerobic exercise session, can reduce the deleterious effects of brain ageing (Hillman et al., 2008. Nature reviews neuroscience, 9, 58–65; Mandolesi et al., 2018. Frontiers in psychology, 9, 509). However, it is unknown, whether older adults would experience similar benefits in the cognitive function when compared to young adults during a single bout of aerobic exercise. Therefore, the aim of this study was to assess the effects of acute exercise on cognitive function and prefrontal cortex oxygenation in older adults. With institutional ethics approval, twenty-eight older adults (mean age: 64 ± 3.8 years, height: 1.60 ± 9, body mass: 73.9 ± 14.3, 14 women: 50%) took part in this randomised, controlled, cross-over clinical trial to investigate the acute effects of exercise on cognitive function and prefrontal cortex (PFC). A functional near-infrared spectroscopy system was used to measure PFC oxygenation during exercise and cognitive tasks. Mental planning, cognitive flexibility, and emotion recognition were assessed prior to commencement and 15 min after the exercise bout. The generalised estimating equation was used to assess the interaction effects between condition (cycling exercise vs. control) and time (pre- vs. post-intervention) factor on cognitive performance, with statistical significance set at 5%. The exercise improved participants' reaction times to recognise emotions (interaction effect: positive $\chi2 = 6.46$; negative $P = 0.011$; $\chi2 = 8.49$, $P = 0.004$; and neutral emotion $\chi2 = 11.35$, $P = 0.001$) and one index of cognitive flexibility ($\chi2 = 4.3$, $P = 0.038$). Also, upon completion of the exercise test, greater levels of oxygenated haemoglobin were observed in the right PFC when compared to the control condition (all $P < 0.001$). Findings suggest that a single moderate aerobic exercise can increase cerebral oxygenation and performance cognition, which reinforces the importance of exercise in older adults.

P.20 The impact of running with and without a guide on short distance running performance for athletes with a vision impairment

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This study aimed to investigate the impact of running with or without a guide on short distance running performance (100 m, 200 m and 400 m) for athletes with a vision impairment (VI).

Ethical approval was granted by the Vision and Hearing Sciences School Research Ethics Panel at Anglia Ruskin University in Cambridge, UK. Data including athletes' and guides' sex, age and race times were extracted from 11 elite competitions. Differences in race times, when athletes competed with or without a guide, as well as a separate sub-analysis of athletes who have competed both with and without a guide, were analysed using Mann-Whitney U tests and t-tests.

Male athletes predominantly ran without a guide (100 m = 91.4%, 200 m = 89.1%, 400 m = 84.8%), whereas female athletes mainly ran with a guide (100 m = 60.5%, 200 m = 80.0%, 400 m = 72.0%). No significant difference in 100 m race times were found between male athletes who ran with a guide or without a guide ($p = 0.647$, $U = 150$). For 200 m ($p = 0.001$, $U = 169$, $d = 1.03$) and 400 m ($p = 0.030$, $U = 207$, $d = 0.67$), race times were significantly slower for male athletes running with (mean rank 200 m = 36.80, 400 m = 33.57) versus without a guide (mean rank 200 m = 19.43, 400 m = 21.69). Conversely, 100 m ($p = 0.015$, $U = 123$, $d = 0.80$), 200 m

($p = 0.025$, $U = 29$, $d = 0.89$) and 400 m ($p = 0.029$, $U = 27$, $d = 0.97$) race times were significantly faster for female athletes, who ran with (mean rank 100 m = 18.25, 200 m = 13.71, 400 m = 11.00) versus without a guide (mean rank 100 m = 27.74, 200 m = 22.67, 400 m = 21.69).

Running with a guide affects VI athletes' race times. The influence of running with a guide and the gender mix of VI athlete and guide should be considered in any research with the aim of establishing a new classification system for VI athletes.

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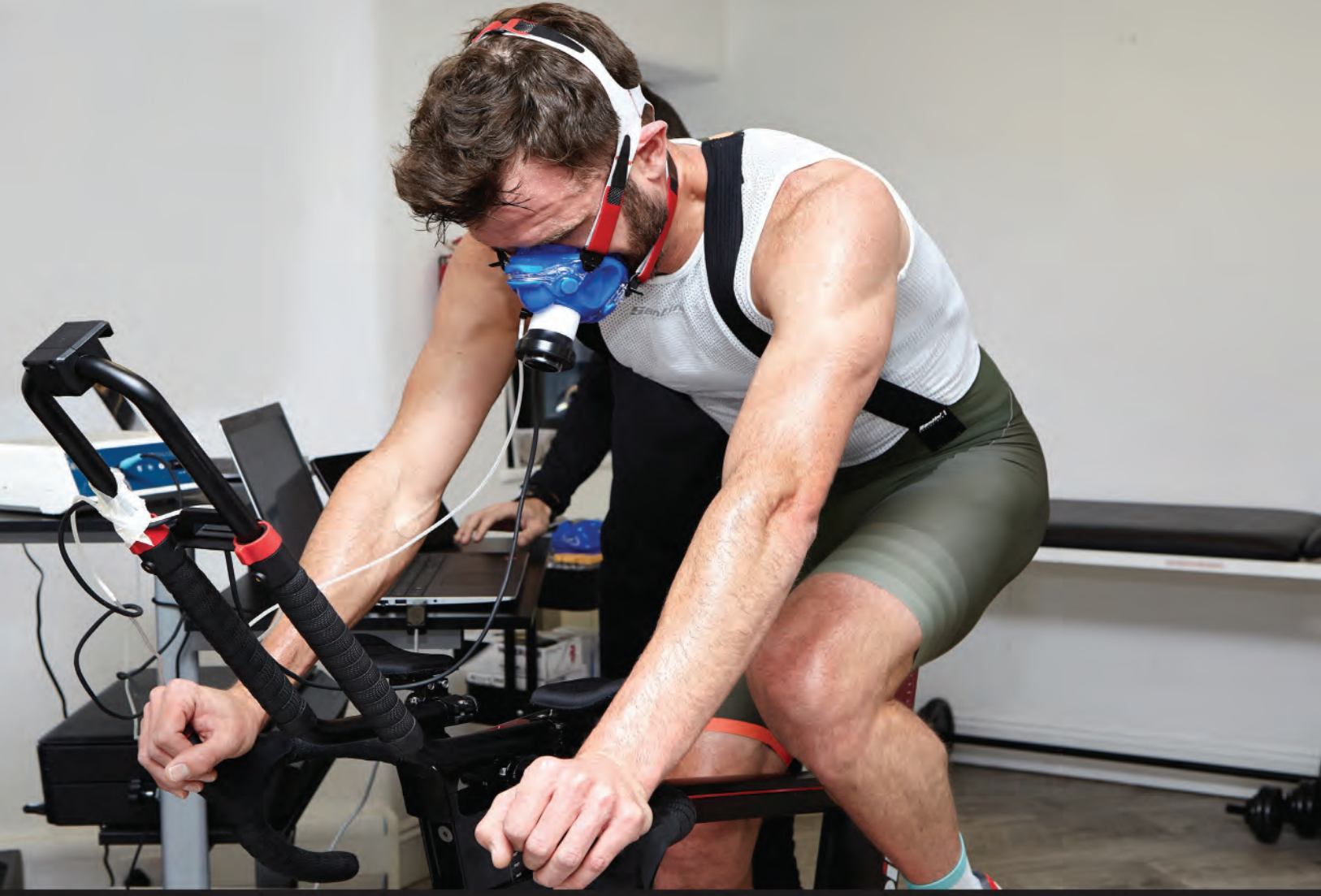

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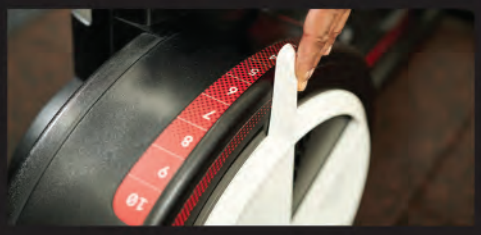

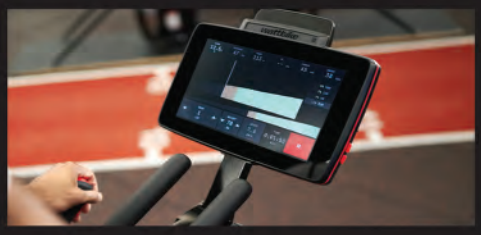

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