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D1.S3 - Free Communications

D1.S3.1 - Free Communications - Physical Activity for Health

D1.S3.1(1) BASES Expert Statement: The use of accelerometers to assess free-living physical activity

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Introduction: Use of accelerometers to measure free-living physical activity and other movement behaviours has grown substantially over the last decade. Indeed, accelerometers are now used at scale in cohort studies such as UK Biobank[1] and NHANES[2]. In step with this increased accelerometer use has been accessibility of raw acceleration data. Use of raw acceleration data that is equivalent between devices and brands should theoretically improve comparability of movement behaviour outcomes reported by researchers[3].

Background and Evidence: Accelerometers can record time-stamped physical activity data at high frequencies. These data have traditionally taken the form of proprietary movement counts, which are dimensionless values used to estimate physical activity levels. Accumulated counts/day or averaged counts/minute are summary metrics reflecting daily volume of physical activity. To give biological meaning to these data, researchers have typically applied cut-points (i.e., thresholds) to estimate time spent in physical activity intensities of interest. However, different sets of cut-points exist and physical activity estimates derived from cut-points are prone to bias and intensity misclassification[4], because cut-points are influenced by factors like the accelerometer brand/model, population of interest, and the protocols used in the original cut-point calibration studies[3]. Such factors inhibit between-study comparability, make it difficult to properly understand relationships between physical activity and health, and therefore hinder translation of research to public health goals.The last 5-years has seen growth in use of raw acceleration output which overcomes many issues associated with proprietary counts. Alternative summary output metrics such as the Euclidian Norm Minus One (ENMO)[5], Mean Amplitude Deviation (MAD)[6], and Monitor-Independent Movement Summary (MIMS) units[7] are theoretically comparable between devices and are increasingly used as alternatives to counts. Further, raw acceleration outcome metrics have been specifically developed to overcome the problems of cut-points and to improve between-study comparability. For example, average acceleration and intensity gradient refer to the volume, and intensity profile of physical activity, respectively[8]. These metrics are based on directly measured raw accelerations and are therefore not subject to the variation in output produced by application of different cut-points. They are independently associated with a range of health-related outcomes in different populations[8,9] and are largely equivalent between accelerometer brands[10o]. Translational metrics have also been developed, which can be related to the prevalence of meeting physical activity guidelines[11]. Though such metrics are being increasingly used, it has also become possible to convert raw acceleration data back to counts[12]. This allows backward compatibility to earlier research but can further compound confusion among accelerometer users.

Conclusions and Recommendations: As the utility of open-source data processing software grows and more studies employ raw accelerations to produce physical activity outcomes, the potential for using these metrics in physical activity research and practice also increases. However, the existence of different raw acceleration outcomes and translational metrics, and the ability to convert between raw acceleration and counts data creates a confusing picture for researchers and research users. Hence, there is a need for an Expert Statement to elucidate the issues and provide recommendations to guide researchers and practitioners working with accelerometers.

D1.S3.1(2) Physical Activity Behaviour in Nature among Adolescents: A Qualitative Investigation of Influences and Outcomes

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Physical activity in nature may offer additive benefits, particularly for mental health, and promote pro-environmental behaviours when compared with physical activity indoors or in urban environments (Coventry et al., 2021, SSM-population health, 16, 100934; Barragan-Jason et al., 2023, Biological

Conservation, 277, 109842). The World Health Organisation's Global Action Plan on Physical Activity 2018-2030 underscores the links between physical activity in nature, health, and climate action within the framework of achieving the United Nations' Sustainable Development Goals. Notably, both physical activity and nature connection tend to decline during the transition from childhood to adolescence, a critical period for interventions that can have lasting impacts (Corder et al., 2019, British Journal of Sports Medicine, 53(8), 496-503; Keith et al., 2021, PLoS One, 16(7), e0255421). The primary aim of this research is to identify the influences on adolescents' physical activity in nature and to explore the outcomes related to health, well-being, and pro-environmental behaviours. This qualitative study employed semi-structured interviews with adolescents aged 10-13 years across Bedfordshire and Norfolk, covering school years 5 to 8. Ethical approval was granted by the University of Bedfordshire Research Ethics Committee. Data collection comprised both face-to-face and online interviews. Interviews were transcribed verbatim, reaching data saturation at n = 39 from diverse socio-economic and ethnic backgrounds in green and blue spaces. Inductive analysis identified key themes, and subsequent deductive analysis mapped them to the Capability, Opportunity and Motivation - Behaviour model and Theoretical Domains Framework. Preliminary analysis of n = 15 interviews developed five key themes: 1)"Social influences," particularly that friends and parents play a significant role in adolescents' engagement in physical activity in nature; 2)"Accessibility" is a critical factor, as many adolescents lacked transport, and had limited access to local natural spaces; 3)"Safety concerns," both personal and parental, are significant barriers to participation; 4)"Restorative mental health" was identified as a key outcome through stress reduction; 5)"Environmental responsibility" differences were apparent across age groups, with Year 6 participants (aged 10-11 years) demonstrating a more apparent environmental awareness and an enhanced sense of responsibility, particularly concerning air quality and active travel, which links to pro-environmental outcomes. Analysis of the full dataset will provide an understanding of the multifaceted influences on adolescents' physical activity in nature, and recommendations will include a behavioural analysis with mapping of suggested intervention strategies from the Behaviour Change Wheel. The outcomes will guide targeted, theory-informed intervention development to increase engagement in physical activity in nature among adolescents.

D1.S3.1(3) BASES Expert Statement: The Role of Prescribed Exercise for Promoting Physical and Cognitive Health for People Living with Down Syndrome

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Introduction: Understanding Down Syndrome: DS often referred to as Trisomy-2,1 is the most common chromosomal disorder in the world, resulting in around 1 in 700 births annually in the UK. It's a genetic disorder caused by the presence of either a whole additional or partial chromosome-21. This additional chromosome is linked to alterations in physiological, biochemical, anatomical, cognitive, and metabolic profiles. Such characteristics include chronotropic incompetence, where the heart rate does not increase in line with an increase in exercise intensity, neuromuscular conditions, reduced lung function, immunological suppression, impaired decision making, verbal reasoning, processing, attention, and problem solving. Together these promote poor health outcomes which contribute to reduced life expectancy for this population compared to people who do not have DS as well as impaired social skills. These symptoms are made worse through a lack of exercise and physical activity in the population.
Physical Inactivity in Down Syndrome: Both the National Health Service in the UK and the Department for Health and Human Services in the USA recommend that all adults including those with a disability should complete 150 minutes of moderate intensity exercise, such as walking, or jogging or 75 minutes of vigorous activity such as playing football or circuit training per week. Evidence suggests that the DS population fall far short of these recommended minimums achieving on average just 10.1 minutes of moderate activity and 1.7 minutes of vigorous activity per day. Furthermore, as population data suggests that the amount of time, they are inactive during the day is high averaging 412 minutes per day.
Generational clocks: This will be the first generation of those living with DS who will outlive their parents and/or primary caregivers. This has significant ramifications for their overall health and how they integrate within society.
Background and Evidence: Data shows that the simple act of walking just three times a week significantly increased walking distance by nearly 12%, indicating cardiorespiratory health gains. Exercise also shown to promote significant gains in decision making speed, vigilance and were able to make correct decisions more readily. In DS, the act of walking requires heightened attention to the task at hand triggering the information-movement cycle. Thus, the simple act of walking requires greater vigilant We have thus for the DS population defined walking as a skill.

Conclusions and Recommendations: Exercise should be tailored to the fitness level of the individual and their stage of cognitive development. More complex exercises will foster greater gains in cognitive development. Intensity of the exercise should be moderate to promote both the cardiorespiratory and cognitive responses in the less fit individuals. As physical fitness increases intensity can be increased, as this will also increase cognitive development.

D1.S3.1(4) A comparison of affective responses and exercise enjoyment for continuous and sprint interval exercise

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Regular exercise is key for good health, but many people don't achieve minimum physical activity recommendations. An important factor in exercise participation is the (dis)pleasure felt while exercising, which can be measured as changes in affective valence (AV). It has been hypothesised that if the drop in AV with exercise can be minimised, people are more likely to enjoy the exercise, and consequently more likely to take up and adhere to an exercise routine. Therefore, the aim of this study was to compare affective responses between different exercise routines. With institutional ethics approval, 29 participants (18 F; mean ± SD age: 24 ± 5 years, BMI 23 ± 3 kg · m-2, VO_2max: 39 ± 6 mL·kg-1·min-1) completed 5 cycling sessions in a randomised order, involving three moderate-intensity continuous protocols (MICT; 30 min at 80%, 100%, or 110% of the ventilatory threshold (VT)), reduced-exertion high-intensity interval training (REHIT: 2 x 20-s all-out sprints in a 10-min session), and sprint interval training (SIT: 4 x 30-s all-out sprints in a 22-min session). AV was measured using the Feeling Scale before, at various timepoints during, immediately post, and 10 min post-exercise. The physical activity enjoyment scale (PACES) was administered 10 min post-exercise. Protocol preference was assessed following the final session by asking participants to pick which protocol they wanted to repeat for a (deceptive) final session. AV significantly decreased from baseline during all exercise trials (80% VT: -1.3 ± 2.1, $p = 0.003$; 100% VT: -1.9 ± 2.4, $p < 0.001$; 110% VT: -3.6 ± 2.9, $p < 0.001$; REHIT: -1.4±1.6, $p < 0.001$; SIT: -2.6 ± 2.5, $p < 0.001$). Although exercise intensity appeared to determine the rate of decrease, the short duration of all-out sprints during REHIT and SIT attenuated the drop, such that the drop in AV was no different between 80% VT, 100% VT, and REHIT, but significantly greater during 110% VT and SIT compared to each of these ($p < 0.01$ for all, except 100% VT vs. SIT: ns). Remembered exercise enjoyment was significantly greater for REHIT (88 ± 16) compared to both 110% VT (73 ± 20, $p = 0.003$) and SIT (71 ± 22, $p = 0<0.001$), but not to 80% VT (82 ± 18) or 100% VT (76 ± 21). N = 21 participants (72%) expressed a preference for REHIT, with n = 5 preferring 80% VT, and n = 1 each preferring 100% VT, 110% VT or SIT. In conclusion, by limiting sprint duration and repetitions, REHIT is not associated with greater drops in AV compared to MICT. It is also preferred, and at least equally enjoyed, over 30 min bouts of MICT. This suggests that REHIT may be used as an acceptable exercise intervention.

D1.S3.1(5) Exercise experiences and readiness to exercise in athletes with solid organ transplant.

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The wide range of reasons for organ transplant is equally matched by diverse pre-transplant exercise behaviours and beliefs (Hames et al., 2022, BMJ Open Sport & Exercise Medicine, 8, e001248). Understanding when participants are physically and mentally ready to start exercise post-transplant is of clear importance in achieving successful rehabilitation. The aim of this study was to determine the exercise experiences and readiness to exercise in solid-organ transplant recipients (SOTR) involved in competitive sport. Six heart recipients (4 males; 18-76 yrs) volunteered to take part in this study which had received ethics committee approval (ref. P135021). All participants were active in exercise prior to receiving their transplant and currently trained at least twice each week for a variety of sports. Participants took part in a focus group to examine; What exercise means to them; What exercise recommendations they had received post-transplant and; When they felt able to return to training following surgery. Transcripts were analysed using thematic content analysis. When asked 'What exercise means to you' participants noted the importance of exercise to their lives (' … .always being part of my life', [P2]) and meaning 'Everything' [P1] to them, which was further emphasised following surgery; ' … .it's very important to you know, stay healthy and look after my new organ … .' [P1, 6]. No consistent exercise guidelines were provided post-transplant, ranging from ' … ..walk two miles a day … ..' [P2] and ' … .to get three 20- to 30-minute walks in the day … .' [P6] to more formal arrangements involving cardiac rehabilitation [P3, P6] or research scenarios [P3]. One participant noted ' … .a lot of the doctors are reticent to give you any advice, on high level sport or any sport … .' [P3]. In considering when participants felt ready to exercise after receiving their transplants, those participants who had long periods of illness and severe deconditioning (n=3) noted that ' … .rebuilding muscle mass … .' [P4, P6] and getting ' … .over the muscle wasting … .' [P2] were of key importance. One participant within one year post-transplant noted ' … ..I feel like my peers are quite anxious in terms of what I can do'. All participants, however, noted the importance of 'listening to your body' when undertaking exercise training. This study of trained SOTR shows the need for development of generic initial post-transplant exercise guidelines, particularly for muscle strength, and empowering interoception. Future work should consider improving understanding of exercise experiences in SOTR and their immediate support networks as well as those recipients inactive prior to transplant.

D1.S3.2 - Free Communications – Sport and Performance

D1.S3.2(1) An education intervention to improve female team sport athletes' knowledge of and behaviours around the menstrual cycle.

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The menstrual cycle (MC) can negatively affect aspects of female athletes' performance, but athletes cite rarely discussing this with coaches and perceive themselves to lack knowledge in MC-related topics. Consequently, MC

education is recommended to improve female athlete health, wellbeing and performance. However, there is no guidance on the best approach to MC education, with little consideration of theoretical frameworks such as the COM-B behaviour change model to effectively complete this. Therefore, the aim of this study was to evaluate an education intervention to improve female athletes' knowledge of, and behaviours around, the MC. Three one-hour MC education workshops were delivered to players from Cardiff City women's football club over two months. The workshops were designed to improve knowledge and encourage MC tracking and athlete-coach conversations, in consideration of the athletes' capabilities, opportunities and motivations. With institutional ethics approval, pre-intervention questionnaires were completed by 23 participants (mean age: 23 ± 4 years) to assess their experiences of menstruation and tracking, frequency and comfort of discussing the MC with coaches, and MC knowledge. A knowledge score was given out of 20 for answers to the knowledge assessment questions. Post-intervention questionnaires were completed approximately four months after the last workshop to assess changes in behaviours and knowledge. Average knowledge score significantly improved after the intervention ($P = 0.001$), increasing from 45% (±23) to 67% (± 21). However, no significant differences were found in MC tracking (pre: 74%, post: 83%, $P = 0.73$), or in comfort levels (average scores out of 10 where '1 = I don't feel comfortable at all': pre: 4.2 ± 2.2, post: 3.8 ± 2.9, $P = 0.79$). On average, participants said that they have talked to their coaches about their MC 'once or twice'. This did not significantly change after the intervention ($P = 0.41$) despite 48% of participants experiencing symptoms that affected their ability to train or play to their best. Whilst education workshops may be effective at improving knowledge, three sessions may not be sufficient to change behaviours around the MC. Behaviour change is complex and there are many social, physical and psychological barriers to an individual changing their behaviours. For behaviour change to be successful, more than one intervention may be necessary alongside athlete education. To change the wider sporting system and encourage female athletes to feel comfortable to discuss their MC with coaches more frequently, coach-facing interventions and environmental changes may also be required.

D1.S3.2(2) The impact of sex differences and drop height on the qualitative evaluation of single-leg drop jumps

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Women have a higher rate of ACL injuries compared to men, largely due to biomechanical differences. However, assessment tasks often remain consistent across sexes, potentially influencing perceived difficulty. Single-leg drop jump tasks are commonly used for ACL evaluation, employing both quantitative (e.g., jump height) and qualitative methods (Pedley et al., 2022, J Strength Cond Res., 36(9): 2573-2580). This study investigates the impact of sex differences and drop height on single-leg drop jumps using qualitative evaluation methods. With institutional ethics approval, 14 female (age: 21.8±2.9 years; height: 1.62±0.09m; body mass: 57.9±9.5kg) and 26 male participants (age: 21.0±2.6 years; height: 1.76±0.06m; body mass: 71.5±7.4kg) performed single-leg drop jumps from heights of 20 cm and 30 cm, three times each, using their dominant leg. A force plate (type 9286A, Kistler, Switzerland) measured the interval from initial contact (>15N) to take-off (<15N). Jumps were classified as Good, Moderate, or Poor based on the presence and timing of an impact peak (<20%), and the Pearson's correlation coefficient ($r<0.8$) between force and center of mass displacement. The attenuation phase was identified as the period from the impact peak to when the slope turns from negative to positive. It was classified into four types based on the net attenuation impulse and time: A: short and large, B: short and small, C: long and large, D: long and small. Jump height, RSI (jump height/contact time), impact peak timing, and correlation coefficient were analyzed using two-way repeated measures ANOVA with sex and drop height as factors, and effect sizes (η^2) were calculated. Chi-square tests were used for category proportions. For jump height and RSI, no interaction effects were observed, but a significant main effect of sex ($P < 0.01$, $\eta^2 = 0.525$; $P < 0.01$, $\eta^2 = 0.413$) was found. Significant interaction was observed for the correlation coefficient ($P < 0.01$, $\eta^2 = 0.143$). Regarding the stretch-shortening cycle classification, at 20 cm, 21.4% of women and 53.9% of men were classified as Poor. At 30 cm, this increased to 71.4% for women and 65.4% for men. Regarding the attenuation phase classification, at 20 cm, the highest proportion for women was D at 50%, while for men it was B at 50%. At 30 cm, the highest proportion for women was C at 71.4%, while for men it was C at 46.2%. These results suggest that women may adopt different jump strategies in response to changes in drop height.

D1.S3.2(3) Perspectives of British Fencing Members on the Inclusion of Transgender People in Fencing in the UK

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In 2021, the International Olympic Committee (IOC) updated its policy, prompting many national governing bodies (NGBs) to revise their competition policies regarding transgender athletes. These revisions are required to consider fairness, safety, inclusivity in an athlete centered manner. In line with this, the aim of the current study was to explore the views of British Fencing (BF) members on transgender athlete inclusion in UK fencing.With institutional ethical approval, a survey was distributed to BF members over

the age of 18, garnering 697 valid responses (mean ± s, age = 43.77 ± 18.15 years; 420 men, 222 women, 38 identifying outside traditional gender binary, 14 preferred not to say). The survey consisted of 19 closed questions and 14 open ended questions, and 18 follow-up interviews. Demographic questions included participation level (i.e., competitive, or recreational), weapons fenced, and fencing experience. Questions explored attitudes towards transgender participation, perceptions of retained advantages in transition, policy suggestions for gender inclusion, and methods to encourage transgender participation in UK fencing. Data were analysed using descriptive statistics and thematic analysis. Among women competing in National Championships, 16.2% supported transgender women's inclusion based on gender identity, with 19.1% supporting this at BF Ranking Events, and 12.8% at Home Nation Events. Suggestions for fair inclusion included case-by-case assessments and requiring a specific duration of hormone replacement therapy. Most respondents welcomed transgender men in gendered categories. Additionally, 45.5% believed gender-led competitive opportunities might not always be appropriate, 25.5% were unsure, 17.7% disagreed, and 12.1% did not respond. About 39.3% of women supported an open category at National Championships, 40.6% at BF Ranking Events, and 39.7% at Home Nation Events. Ongoing research on the topic was deemed crucial. Regular reviews of competitive policy based on the latest research were also emphasised. Findings of the thematic analysis of interviews highlighted three themes: 'Inclusive Culture', 'Skills Over Physical Attributes', and 'Gendered Equity'. In conclusion, the majority favoured creating open categories and were supportive of inclusion at recreation settings. Fencing was seen as an inclusive environment and to change this would be detrimental to both transgender people and the sport, especially in non-competitive settings.

D1.S3.2(4) The multidimensional profiling of youth male rugby union players: a systematic scoping review, nominal group technique and survey

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Player profiling is commonly used within youth rugby union (RU) to assess a range of factors for talent identification and development purposes (Dimundo et al., 2021, Journal of Expertise, 4, 33-55). However, profiling typically focusses on physical characteristics, despite the multidisciplinary nature of talent identification and development (Dimundo et al., 2021, Journal of Expertise, 4, 33-55). This three-part study aimed to establish the most common factors for profiling in male rugby union, identify factors to profile within youth male rugby union, and consider the importance and feasibility of profiling these factors. Part one employed a systematic scoping review. For part two, seven expert practitioners participated in a Nominal Group Technique session to identify the factors to profile within youth male rugby union players. Part three included twenty practitioners from a Tier One rugby nation and nine researchers, who ranked their agreement for the importance of the identified factors, and the feasibility of their measurement. With institutional ethics approval, the review identified 107 studies profiling 50 factors in male rugby union players, across five higher order themes: physical (n = 67), demographic (n = 25), psychological (n = 20), technical (n = 20), and tactical (n = 6). Expert practitioners reported an additional 20 factors that should be profiled. Over 70% of survey participants agreed that 40 factors were important for male youth rugby union player pathway progression and 28 factors were feasible to measure. Only 16 factors reached 70% agreement for both importance and feasibility. Factors from across all six themes were considered important, re-emphasising the need for wider use of multidimensional profiling within youth male rugby union. The results from this study are being used to aid the development of a multidimensional profiling tool for use within a longitudinal study.

D1.S3.2(5) Interchangeability of time vs distance trials vs 30-15 IFT in estimating maximal aerobic speed in academy soccer players

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We aimed to investigate whether a 6 min distance trial (6minDT), 1800 m time trial (1800mTT) or the 30-15 Intermittent Fitness Test (30-15IFT) may be used interchangeably to estimate Maximal Aerobic Speed (MAS) in academy soccer players, competing in the Premier League U18 and National League Alliance Academy North, in England. Twenty-six (n = 26) male academy soccer players (age: 17.2 ± 0.6 [15.5 - 18.5] years; stature: 178.4 ± 5.1 [170.0 - 193.2] cm; body mass: 71.8 ± 7.7 [60.0 - 90.4] kg), completed a 30-15IFT on a 3G pitch, with MAS defined as 87% of test final stage velocity. Distance and time trials were then performed on a full-size outdoor 3G or Grass pitch in a counterbalanced order. Total Distance was measured via 10 Hz Global Positioning System units with MAS determined as distance divided by time to completion. All tests were performed on a MD+2 or MD+3, each separated by 1-2 weeks. Ethics clearance was received by the institutional research ethics sub-committee. Data analysis was performed in RStudio (Posit Software, PBC). The associations between MAS estimates were calculated using Pearson's product-moment correlation coefficients and a robust repeated measures ANOVA was performed (robustlmm package) to estimate marginal mean differences between tests (emmeans package). Players achieved a MAS (mean ± SD) of 4.39 ± 0.24 [3.77 - 4.78] m·s-1 during the 6minDT, 4.49 ± 0.26 [4.01 - 4.85] m·s-1 during the 1800mTT, and 4.94 ± 0.22 [4.59 - 5.32] m·s-1 during the 30-15IFT. All associations between tests were observed to be positive. Associations between 1800mTT and 6minDT

ranged from moderate to very large (r = 0.72; 95% confidence interval, 0.46 to 0.86). Further moderate to very large associations were observed between the 30-15IFT and time and distance trials (6minDT: r = 0.65; 0.35 to 0.83; 1800mTT: 0.66, 0.37 to 0.84). MAS estimated from the 30-15IFT was significantly higher than that estimated from both the distance-based trial (6minDT: 0.57, 0.50 to 0.65 m·s-1, p<0.0001) and time-trial (1800mTT: 0.45, 0.37 to 0.52 m·s-1, p <0.0001). Our distance-based trial resulted in a lower estimation of MAS compared to the time trial (-0.13, -0.21 to -0.05 m·s-1, p = 0.0002). In conclusion, our data suggest that whilst there are some associations between MAS estimated from the 6minDT, 1800mTT, and 30-15IFT, all three tests provide clearly different estimations of MAS.

D1.S3.3 - Free Communications – Biomechanics and Motor Behaviour

D1.S3.3(1) A countermovement jump with an arm swing is defined by four functional degrees of freedom and an enhanced proximal-to-distal delay

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An abundance of motor strategies exist in human movement to coordinate multiple segments and achieve the same outcome (Li, 2006, Motor Control, 10, 301–310). One method of simplifying the understanding of this system is by identifying independent functional degrees of freedom (fDOF). The aim of this study is to compare jump performance and fDOF present in countermovement jumps without (CMJ^{NoArms}) and with (CMJ_Arms) an arm swing. With institutional ethical approval, motion capture data of CMJ_NoArms and CMJ^{-Arms} of eighteen participants (8 women: height = 168.1 ± 6.9 cm, weight = 62.8 ± 6.9 kg; 10 men: height = 178.0 ± 8.0 cm, weight = 82.4 ± 7.5 kg) were analyzed using FreeBody, a segment-based musculoskeletal model (Cleather and Bull, Royal Society Open Science, 2, 140449). Total and time normalized impulses were calculated from the vertical ground reaction and joint contact forces (JCF). The fDOFs of the 39 muscle and 15 3-dimensional JCF were identified through principal component analysis and muscles were grouped by their peak timings. Jump performance was greater in CMJ_Arms with higher external (P = 0.012; medians: CMJ_NoArms = 0.515 BW·s, CMJ_Arms = 0.571 BW·s), hip (P < 0.001, mean difference = 0.315 BW·s) and ankle (P = 0.009, mean difference = 0.307 BW·s) impulses and a greater time-normalized hip impulse (P = 0.006, mean difference = 0.185 BW·s/s). Three and four fDOFs were found for the JCF during CMJ_NoArms and CMJ_Arms respectively, explaining more than 95% of the variation. The muscle force-curve profiles were categorised into seven groups with sequential peak timings. Muscle groups 1 to 4 containing the prime movers (biceps femoris, gluteus maximus, vastus lateralis and soleus respectively) were explained by three and four fDOF for CMJ_NoArms and CMJ_Arms respectively. The largest difference between CMJ_NoArms and CMJ_Arms occurred in the delay between the hip extensors (group 2) and knee extensors (group 3) (CMJ_NoArms: 0.035 s, CMJ_Arms: 0.134 s). These results show that the increased ground contact time in CMJ_Arms enhanced the proximal-to-distal strategy, generating higher forces at the hip and improving jump performance. The similarity between the muscle activation and JCF patterns of individuals suggests that there is a reduced demand on the control system with the underlying anatomy providing mechanical constraints during jumping. The additional fDOF present in CMJ_Arms suggests that the arms are not mechanically coupled with the lower extremity, and training a specific optimal CMJ_Arms technique may improve jump performance.

D1.S3.3(2) Analysing Kinematic Differences in Male and Female Golfers Using VideoPose3D Human Pose Estimation

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The comparison of kinematic variables between males and females is well documented in golf research (Zheng, N., Barrentine, S. W., Fleisig, G. S., & Andrews, J. R. 2008. International Journal of Sports Medicine, 29,12). While marker-based motion capture is the traditional approach to kinematic analysis in golf, it is impractical for daily use (Van der Kruk, E., & Reijne, M. M. 2018. European Journal of Sport Science, 18,6, 806–819). Three-dimensional (3D) Human Pose Estimation (HPE) models can estimate joint positions and orientations from images and videos (Zheng, C., Wu, W., Chen, C., Yang, T., Zhu, S., Shen, J., Kehtarnavaz, N., & Shah, M. 2022. Journal of Association for Computing Machinery). HPE is single camera compatible making it more practical in real-world settings, however, since HPE uses manual annotations instead of fixed markers on anatomical landmarks, it is uncertain if it can accurately identify kinematic differences. This study aimed to determine if a HPE model could identify kinematic differences between males and females in the full swing. The VideoPose3D model was used to extract kinematic variables from 30 video clips (15 male and 15 female) from the GolfDB dataset. Using Python (3.11.5), VideoPose3D processed the video clips, starting with feature extraction from 2D images. HPE then analysed these features, and a lifter predicted 3D joint values. The study focused on measuring maximum angular velocity (degs/sec) and angular acceleration (rads/sec^2) for the left and right wrist, elbow, shoulder girdle, arm to trunk, left shoulder adduction, axial trunk rotation, and pelvic girdle. No significant difference was found in angular velocity of the right elbow (p = 0.147) or angular acceleration (p = 0.438), but a significant difference was found between angular velocity of the left elbow (p = 0.030) and left shoulder adduction (p =0.037). These results contrast with previous findings outlining that males have higher angular velocity

and acceleration than females (Parker, J., Hellström, J., & Olsson, M. C. 2022. Sports Biomechanics, 21(6), 731–747). Although the unknown skill levels of the participants could have contributed to the varying results, the possible reason might be the difference between HPE joint centres and mocap anatomical landmarks. This causes the variation precision in angular kinematic variables. Future research should confirm this issue with validation study and consider converting pose estimation to mocap data to support HPE identifying the kinematic differences for practical applications.This study was conducted under Sheffield Hallam University's ethics.

D1.S3.3(3) A timings analysis of the return of serve in wheelchair tennis to infer the importance of anticipation of serves

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The prevalence of anticipatory behaviour in any interceptive action depends on the spatio-temporal demands of the task. With no existing research exploring the time constraints in wheelchair tennis (WT), the role of anticipation in effectively returning WT serves is unknown. Therefore, the aims of this study were (1) to quantify the time constraints in the serve-return dyad in WT, (2) to understand the relationship between serve quality, receiver response, and return shot outcomes, and (3) discuss the importance of anticipation skill in WT serve returns. Video footage of 369 returns-of-serve by 19 professional wheelchair tennis players (10 from men's open, 5 from women's open, 4 from quad's) in 13 matches from international tournaments were analysed to calculate ball transit time (TT), serve accuracy, the returner's movement initiation time (MIT), movement time (MT) and the quality of the returner's position just before ball contact. Repeated measures correlations were calculated between the timing variables. One linear multi-level model was used to compare timing variables between first and second serves and another was used to determine the relationship between the timing variables and the shot outcome variables. Significant difference in TT was observed between first and second serves. However, no significant difference in average MIT (M = ~300 ms) was observed (Cohen's d = .44, P = .65). Thus, returners initiated lateral movement at the same time irrespective of different serve speeds. This suggests that pre-contact kinematic information from the server's action and ball toss might be used to calibrate their return movement and determine when to initiate their response. MIT was a non-significant predictor of return outcomes (Cohen's d = .75, P = .30), i.e., earlier or later initiation of lateral movement towards the ball was not related to more offensive or defensive return outcomes, respectively. Lower TT (P = .01, Cohen's d = 2.67) and more accurate serves (P < .001, Cohen's d = 5.09) predicted a more defensive pre-contact returner position. Also, for first serves, players were in a defensive pre-contact position on 29.4% of returns. This suggests there is significant scope for improvement when returning faster first serves in WT. With faster and more accurate WT serves leading to more defensive return outcomes, and serve speeds in WT increasing over the years, players might need to become more attuned to advance information. This would allow them to move earlier and potentially make a higher proportion of offensive return shots.

D1.S3.3(4) Assessing anterior talofibular ligament strain and biomechanical properties in-vivo in healthy conditions

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Most lateral ankle sprains involve trauma to the anterior talofibular ligament (ATFL). ATFL has the poorest strain behaviour of all the lateral ankle ligaments (Butler and Walsh, 2004, Foot and Ankle International, 25, 8-12) so understanding its functional capacity in-vivo may be beneficial for injury prevention and rehabilitation. However, a robust and reliable in-vivo approach to assess this capacity is needed first. Therefore, this work aims to provide such an approach using B-mode ultrasound and shear-wave elastography (SWE). With institutional ethics approval, bilateral ATFLs were imaged from 22 healthy participants (12f/10m; 27 ± 5 years; 1.74 ± 0.08m; 75.5 ± 11.0kg) using a custom-made arthrometer (Best et al., 2016, Knee Surgery, Sports Traumatology, Arthroscopy, 24, 963-970) to passively load the test ankle into increasing angles of inversion (0°,5°,10°,20°). Dependent variables were length (mm), symmetry (%), strain (%, calculated with respect to a reference starting length at 0° inversion) and shear-wave velocity (SWV; m/s). Reliability and standard error in the measurement (SEM) were calculated for length and SWV. All variables were entered for main (limb and angle) and interaction effects using two-way ANOVA (P < 0.05). Excellent reliability and SEM were recorded from measurements taken at reference starting position (length: R=0.996, SEM: 0.2mm; SWV: R=0.989, SEM: 0.03m/s). There were significant limb (P<0.001) and angle (P < 0.001) effects in ATFL length and strain. ATFL was shorter in the right limb (0°: 20.3±2.5mm vs 22.7±2.2mm, P < 0.001; 20°: 23.0±2.5mm vs 24.1±2.4mm, P<0.01). The symmetry index was significantly different across all angles (P < 0.001), but only meaningfully (e.g. >10%) at 0°. Strain–joint angle relationships significantly increased in both limbs and more so in the right limb reaching 14.0 ± 7.3% of its reference neutral length at 20° inversion vs 6.5±3.3% in the left limb (P < 0.001). There was no significant limb effect for SWV (P > 0.05), but a significant angle (P < 0.001) effect. Our data demonstrate that the current approach for determining ATFL biomechanical properties in-vivo is reliable and sensitive to changes in inversion angle in healthy conditions; thus, it may be applicable to clinical and rehabilitation research. Indications are that ultimate strain in ligaments can reach values of up to 30% (Gracey et al., 2020, Nature Reviews Rheumatology, 16, 193-207). The present

findings suggest that the safety factor (Kongsgaard et al., 2005, Journal of Applied Physiology, 55, 1965-1971) in ATFL decreases with increasing ankle inversion and reaches values close to 2 at extreme angles, which may explain why this ligament is commonly implicated in lateral ankle sprain injury.

D1.S3.4 - Free Communications – Physiology and Nutrition

D1.S3.4(1) Prof Edward Winter Early Career Researcher Award winner: The Effects of External and Mixed-Method Cooling on Epée Fencing Performance

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Fencing athletes are required to wear full body protective clothing when competing which can cause high body temperatures, and thermal sensation especially in Direct Elimination (DE) fights (Oates, Price, & Bottoms, 2023[13], Journal of Elite Sport Performance, 3(1), 1–9). The aims of this study were to determine the effects of external (EXT) and mixed-methods (MIX) cooling on physiological, perceptual and performance responses of epée fencing. With institutional ethics approval, ten trained epée fencers (age: 35 ± 9 years, stature: 175 ± 8cm, body mass: 74.7 ± 14.6kg) competed in 3 DE fights (3 x 3-minute bouts with 1 minute rest between bouts) with cooling applied in a cross-over research design. The cooling conditions were control (CON; 300ml room temperature water), EXT (wearing an Evaporative Cooling Vest (ECV) + 300ml room temperature water), or MIX (ECV + cold-water ingestion (300ml at ~2°C) for 10 minutes during the rest period between fights. During DE fights gastrointestinal temperature via ingestible pill, 4 site (biceps, chest, thigh, and calf) mean skin temperature (Tskin), heart rate, mask temperature, blood lactate concentration, movement characteristics, points scored and conceded, points difference, thermal sensation, thermal comfort, and differentiated ratings of perceived exertion were recorded. Cognitive function was assessed pre DE 1 and post DE 3. There were significantly lower ($p < 0.05$) Tskin recorded in DE 2 and DE 3 (~0.8- 0.9°C) for EXT and MIX than CON. There was a lower ($p < 0.05$) thermal sensation pre DE 2 and DE 3 for EXT (DE 2: ~0.5; DE 3: ~0.7) and MIX (DE 2: ~0.5; DE 3: ~0.7) compared to CON and post DE 2 and DE 3 for MIX compared to CON (DE 2: ~0.7; DE 3: ~1.0). There were no other significant differences for any other physiological, perceptual, or performance variables. There seemed to be an individual response for cooling on performance, with 7/10 participants having a positive points difference in DE 3 in MIX compared to 4/10 in both EXT and CON, indicating more participants won fights in MIX than EXT and CON. Overall, EXT and MIX are practical, quick, and simple cooling methods for epée fencers, that decreases Tskin and thermal sensation of fencing performance. However, fencers should determine which is the most effective method to use in training prior to competition due to individual performance preferences.

D1.S3.4(2) The effect of a combined cooling intervention on cognitive function in the heat during an intermittent running protocol.

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Optimal cognitive function is essential for performance in intermittent sports. Specific domains, including perception, executive function, memory, and attention have been associated with football-specific skills including dribbling (Scharfen and Memmert, 2019, Frontiers in Psychology, 10, 817). However, these four cognitive domains can be impaired when core temperatures are elevated during exercise in the heat (Gaoua, Racinais, Grantham and El Massioui, 2011, International Journal of Hyperthermia, 27, 1-9). Internal and external cooling methods have demonstrated positive benefits individually (Saldaris, Landers and Lay, 2019, International Journal of Sports Physiological and Psychology, 15(4), 503-510; Tyler and Sunderland, 2011, Journal of Athletic Training, 46(1), 61-68), however there is a lack of research on combining cooling interventions on athlete's cognitive function when exercising in hot conditions. Therefore, the aim was to investigate the effects of a combined cooling intervention on cognitive function in the heat during an intermittent running protocol. Following institutional ethical approval, in a randomised, order-balanced, crossover design, twelve unacclimatised males (age: 22.3 ± 3.0 years, body mass: 73.4 ± 5.1kg, height: 181.0 ± 5.3cm, VO2 max: 51.2 ± 9.5ml/kg/min) participated in a control (thermoneutral water; CON) and combined cooling trial (COOL). COOL consisted of an ice slurry, made of up 50% ice and 50% water, weighing 7.5g/kg of body mass during pre-cool, 3.75g/kg during half-time and 1g/kg during the drinks break. The neck collar consisted of ~250g of ice placed in a cotton sheet. A battery of cognitive tests assessing perception, executive function, working memory, and selective attention were completed prior to, during and following a 90-minute intermittent running protocol in the heat (33°C, 50% relative humidity) designed to replicate activity patterns of football. How participants were feeling, perceived exertion, thermal sensation, thermal comfort and felt arousal as well as rectal, neck, forehead and skin temperature were taken throughout. In CON, response times were quicker on the complex level of the Stroop task ($p = 0.002$, $d=0.09$) and the visual search test ($p = 0.014$) at full-time compared to COOL. During COOL, response times were quicker at half-time on the Stroop task complex level ($p=0.024$). Lower rectal temperatures were seen overall during COOL (CON: 37.44 ± 0.65°C; COOL: 37.28±0.68°C, $p = 0.031$, $d = 0.24$) as well as lower skin, neck, and forehead temperatures ($p < 0.05$). Lower ratings of thermal sensation, thermal comfort and perceived exertion were recorded during COOL ($p < 0.05$). Whilst minimal differences in perception, executive function, memory or attention were found,

the results highlight a practical strategy to improve physiological and perceptual responses to intermittent exercise in the heat.

D1.S3.4(3) Resistance training induced changes in ultrasound muscle thickness are not correlated with changes in MRI measures of muscle size across the constituent muscles of the quadriceps femoris

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Whilst pre to post resistance training (RT) changes in vastus lateralis (VL) ultrasound muscle thickness (MT) have been reported to be significantly related to changes in VL maximum anatomical cross-sectional area (ACSAmax) measured via MRI (Franchi et al, 2018, Scandinavian Journal of Medicine and Science In Sports; 28:846–853), it is unclear if this is also the case across other constituent muscles of the quadriceps femoris (QF). The purpose of this study was to determine if RT induced changes in ultrasound MT are correlated with changes in MRI measures of muscle size across the constituent muscles of the QF. Thirty-nine healthy young males volunteered to take part in this study that was ethically approved by the Loughborough University Ethics Review Sub-Committee. Prior to and following 15 weeks of lower body RT (knee extension, knee flexion, and leg press; x3/wk) participants undertook musculoskeletal scans of the dominant thigh. MRI scans were completed between the anterior superior iliac spine and the lateral tibial condyle and images were manually segmented to quantify volume and ACSAmax of the constituent muscles of the QF. Two-dimensional ultrasound scanning was conducted to determine MT of each constituent muscle of the QF at the following proportions of thigh length: vastus medialis 20%; vastus intermedius and VL 50%; and rectus femoris 75% (0%= knee joint space). Pearson's product moment bivariate correlations were performed between pre to post RT percentage changes in: (1) ultrasound-derived MT; and (2) corresponding MRI-derived measures of muscle size. There were no significant bivariate correlations between pre to post RT changes in ultrasound MT and MRI-derived ACSAmax for any of the constituent muscles of the QF ($-0.081 \leq r \leq 0.281$; $0.083 \leq p \leq 0.624$) or the overall QF ($r = 0.086$; $p = 0.195$). Similarly, there were no significant bivariate correlations between pre to post RT changes in ultrasound MT and MRI-derived muscle volume for any of the constituent muscles of the QF ($-0.051 \leq r \leq 0.281$; $0.083 \leq p \leq 0.759$) or the overall QF ($r = 0.031$; $p = 0.849$). The results of this study indicate that relative to the current criterion methods for assessing the magnitude of RT induced changes in muscle size (i.e. MRI-derived ACSAmax and volume) muscle thickness determined via ultrasonography is lacking in predictive capability.

D1.S3.4(4) Agreement of a recall questionnaire versus a daily log to assess habitual breakfast consumption frequency among adolescents

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Despite the wide use of recall questionnaires to conveniently assess habitual breakfast frequency among adolescents, the level of agreement between such questionnaires and daily diaries has not been investigated. Differences in definitions of 'breakfast' with the lack of an established and well-defined measurement tool may contribute to discrepancies in findings across studies (Monzani et al, 2019, Nutrients, 11(2), 387). The aim of this study was to determine the level of agreement between a brief recall questionnaire and daily dairies to assess breakfast frequency using three frequently used definitions of 'breakfast' among adolescents. With institutional ethical approval, 116 adolescents (60% girls, aged 12.5 ± 0.8; BMI 19 ± 4.5 kg/m2) were included in the study. Participants completed a breakfast log by indicating "yes" or "no" and taking a photograph of breakfast on each morning across 7 days, including school and weekend days. The researchers determined whether breakfast had been consumed or omitted on each day using the following three definitions: 1) subjective breakfast consumption (participant-defined, "yes or no") (Paoli et al, 2019, Nutrients, 11(4), 719), 2) containing more than 50-kcal within 2 hours of waking (researcher-defined) (Betts et al, 2016, Proceedings of the Nutrition Society, 75(4), 464-474), and 3) containing at least one food group within 2 hours of waking (researcher-defined) (O'Neil et al, 2014, Journal of the Academy of Nutrition and Dietetics, 14(12), S8-S26). On day 8, participants completed a brief recall questionnaire on habitual breakfast consumption for the previous 7 days, which included the three definitions of 'breakfast' used for log analysis. The agreement of the habitual breakfast questionnaire and daily log was assessed using weighted kappa (κ). The daily breakfast consumption prevalence was 60.3% using the subjective and 50-kcal definitions, and 24.1% using the food groups definition for the daily logs. For the recall questionnaire, the prevalence was 58.6%, 50.0% and 37.9% for the subjective, 50-kcal and food groups definitions, respectively. The questionnaire reported a moderate to substantial agreement with the daily logs for the 'subjective group' definition ($\kappa = 0.75$-0.76) and the '50-kcal' definition without and with breakfast examples ($\kappa = 0.59$-0.63). For the 'food groups' definition, agreement was fair regardless of whether breakfast examples were provided or not ($\kappa = 0.29$-0.38). Thus,

a habitual breakfast questionnaire where breakfast is defined either subjectively or using a 50-kcal cut-off without or with breakfast examples, can be recommended for use in future research among adolescents.

D1.S3.4(5) The Validity and Reliability of Borg 6-20 Rating of Perceived Exertion among Stroke Individuals

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Aims: Borg 6-20 RPE scale has been used intensively in the past few decades. However, this scale has not been validated among stroke survivors. Therefore, this assessed the validity and reliability of Borg 6-20 RPE scale among stroke patients.Methods: The study was approved by the ethical committee at the university of Jordan. Eight stroke patients volunteered for the study. Each participant completed eight (8) exercise tests; four leg cycling exercise tests and four treadmill exercise tests. In the first leg cycling exercise test participants exercised at stages of 2-min at 30 W, 45 W, 60 W, 78 W to assess whether stroke patients are able to rate their RPE appropriately. In the first treadmill exercise test participants exercised at stages of 2-min at 1.6, 2.08, 2.56 & 3.04 km/h. The second bike and treadmill exercise tests were exactly the same as in the first exercise test in order to assess the reliability of the first estimation trial. In the third bike and treadmill exercise test, participants were asked to exercise at stages of 2 minutes at RPEs 9, 11, 13, 15 of Borg 6-20 RPE scale in order to assess whether stroke patients are able to produce PO and speed (km/h) equal to the pre-assigned RPEs. The fourth bike and treadmill exercise test was exactly the same as in the third exercise test in order to assess the reliability of the first production trial (Production 2).Results: The results showed that there was very strong linear relationship between PO and RPE and between PO and HR during the two leg cycling estimation trials ($r \geq 0.985$) and during the two production trials ($r \geq 0.970$). The results also showed that there was very strong linear relationship between speed (km/h) and RPE and between speed (km/h) and HR during the two treadmill estimation trials ($r \geq 0.985$) and during the two production trials ($r \geq 0.990$). There were no significant differences in PO and HR between the first and the second cycling estimation trials ($P > 0.05$) and between the first and the second cycling production trials ($P > 0.05$). There were no significant differences in speed (km/h) and HR between the first and the second treadmill estimation trials ($P > 0.05$) and between the first and the second treadmill production trials ($P > 0.05$).Recommendations: Borg 6-20 RPE scale should be used during rehabilitation and training among stroke patients.

D1.S3.5 - Free Communications – Psychology

D1.S3.5(1) Attribution retraining in sport: a case study approach piloting a co-produced motivation-enhancing intervention

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Attribution Retraining (AR) is a motivation-enhancing intervention which aims to improve generation of healthier reflections for performance (Perry et al., 2010: Journal of Social Clinical Psychology, 668-700). Delivering a protocol co-produced with athletes, coaches, sport practitioners, and academics, the aim of this study was to pilot an Attribution Retraining in Sport (ARiS) intervention. Using a case study approach, university futsal players (n = 10) and their coaching team (n = 4) participated in a pilot ARiS intervention delivered over 5 stages: (1) needs analysis and observation, (2) psychoeducation, (3) ARiS leadership group creation, (4) attributional retraining, and (5) evaluation. With institutional ethics approval, the lead researcher attended training sessions (n = 6), match days (n = 2) and classroom-based sessions (n = 6) over 3 weeks to observe existing practices within the group. Upon completion, futsal players completed questionnaires to assess their attributions, subjective performance, social support, and mental well-being. Think Aloud (TA) was also used to capture live attributions during performance (Eccles & Arsal, 2017: Qualitative Research in Sport and Exercise Psychology, 514-531). Stage 2 included delivery of a classroom-based workshop followed by a practical session to apply taught concepts. Stage 3 established an intervention leadership group (n = 4) whose primary task was to ensure taught concepts continued to be embedded. Stage 4 involved the delivery of AR induction in a classroom-based session followed by AR consolidation in a competitive fixture versus a National Futsal Tier 1 Team. Stage 5 included a pre-post intervention comparison of study variables. Preliminary questionnaire findings showed a decrease in healthy attributions; however, TA data indicated an increase in healthier attributions during performance. As futsal players completed questionnaires based on their most recent performance, it appeared that the result influenced any intervention effects – if the result was positive, athletes were less likely to want to change their attributions for performance – indicating unhealthy attribution patterns around stability. To assess this, a third time point measurement was completed at the end of the futsal season during a non-competitive period. Results revealed that 9 out 10 futsal players were making healthier attributions 6 weeks post ARiS intervention. In conclusion, ARiS increased healthier attributions for most

participants and positively impacted mental well-being, subjective performance, and received social support. Future research and applied implications may consider the use of ARiS as a motivation and control-enhancing intervention across a range of sports and participants.

D1.S3.5(2) The combined utility of eye-tracking technology and cued retrospective think-aloud to investigate cognitive–perceptual mechanisms underpinning the visual gaze behaviours of climbing coaches

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Sports coaching by nature is vision-intensive, requiring sports coaches to perceive, interpret and evaluate complex, dynamical, and ambiguous visual information in time-pressured environments (Gegenfurtner, et al., 2023, Re-theorising learning and research methods in learning research, 142-158). Expert coaches demonstrate superior perceptual-cognitive skill through the use of extensive domain-specific knowledge to extrapolate key information from their environment and, subsequently, make better, more efficient decisions (Mann, et al., 2007, Journal of Sport and Exercise Psychology, 29, 457-478). This study aimed to investigate the cognitive-perceptual mechanisms that underpin visual expertise in the observational analysis of climbing performance. Using a novel and previously underutilised methodological approach, the study combined eye-tracking and cued retrospective think-aloud to capture the visual gaze behaviours, and their underpinning cognitions, that define visual expertise in climbing coaching. With institutional ethics approval, 61 coaches (20 expert, 21 intermediate, 20 novice) were asked to view video footage of 9 intermediate boulderers (2 females; 7 males) and analyse the quality of their performance. During the coach's analysis of the climber's performance, eye-tracking recorded the coach's gaze behaviour (fixation count, fixation duration, fixation location) to identify which aspects of the climber's performance coaches attended to most frequently. Eye-tracking data was subsequently utilised as the basis for cued retrospective think-aloud (CRTA) interviews, whereby coaches were asked to retrospectively verbalise what aspects of the climber's performance they were attending to during their analysis, using a replay of the climber's performance with the coach's eye-tracking data overlaid to stimulate discussion. CRTA data was analysed using inductive thematic analysis. The resulting eye-tracking data identified notable expertise-based differences in the areas of interest most attended to by coaches. CRTA data provided further explanation as to the cognitive-perceptual mechanisms underpinning the coaches' visual search strategy. Expert coaches were more cognizant of their visual search strategy and able to extract a greater level of detail when compared to their lesser experienced counterparts. CRTA data further elicited specific gaze strategies employed by coaches, such as the use of visual spots, visual pivots, and gaze anchors. Through complex domain-specific knowledge structures and learned visual practices, expert coaches actively focus on the most relevant aspects of a climber's performance for analysis. The findings demonstrate the utility of combining eye-tracking and CRTA interviewing as a new, efficient methodology of capturing the cognitive–perceptual processes underpinning coaching expertise, and a valid and reliable source of data to inform coach education initiatives.

D1.S3.5(3) BASES Master Dissertation of the Year winner: Exploration into Organisational Culture Within Women's Football

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Women's football is increasing in global popularity. Yet, researchers have highlighted unsatisfactory player working conditions and a high prevalence of mental health disorders. The present study explored women's football culture from the perspectives of individuals belonging to a successful women's football club. Participants were invited to share their general perceptions of women's football culture and also more specifically, pertaining to their experiences within this club. Following ethical approval, an exploratory case study design was used, and eight semi-structured interviews were conducted with staff and players belonging to the same club. Following a reflexive thematic analysis, key themes were used to develop three composite vignettes. Each vignette incorporated both staff and player voices and reflected the complex culture of this club. Themes of 'life on the pedestal', 'suffocating scrutiny' and 'injustice' were explored, and key findings were that women's football was highly integrated within this club. Nonetheless, player's mental health was detrimentally affected by their working conditions, expectations from staff, and the use of manipulation, humiliation, and punishment tactics from the manager. Overall, the present findings could be taken to indicate a culture normalises the prioritisation of success over player well-being. Based on these findings, we propose several recommendations, including education concerning player working conditions and mental health, and the need for greater psychological support for players, particularly surrounding disordered eating.

D1.S3.5(4) Working with an ageing population: Considerations for sport and exercise psychologists

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The global population is rapidly ageing. By 2050, it is anticipated that the proportion of older adults globally will have doubled. As a marker of the significance of this demographic shift, the World Health Organization (WHO) has designated the current decade as the "decade of healthy ageing" (WHO, 2020, Decade of Healthy Ageing:

Baseline Report: WHO). These changes in our population mean that it is not only a possibility that sport and exercise psychologists will come into contact with older adults in their work, but they should expect to. Consequently, it is vital that practitioners possess the required knowledge and skills to support older people with sport and exercise. At present, however, there is a paucity of educational resources and practical guidelines for sport and exercise psychologists to draw upon to assist them when working with older people. To address this, the aim of this presentation is to outline considerations for sport and exercise psychologists when working with older people. More specifically, we will address five core areas: (1) discriminatory attitudes and practices; (2) being sensitive to the needs and preferences of individual older adults; (3) the importance of being aware of the role of health and social care services in the lives of older people; (4) mental health considerations; and (5) the role that sport and exercise psychologists can have in promoting healthy lifestyles in later life. Overall, our goal is for practitioners to develop knowledge that will help them to provide the best support possible for older people and to become age-friendly in their practice. No ethical approval is required for the contents of this talk.

D1.S3.5(5) Developing as an Autistic Sport and Exercise Psychologist: An Ethnographical Approach

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Developing as a person and practitioner has been a considerable topic of interest in terms of sport and exercise psychology and for sport practitioners more broadly (e.g., McEwan et al., 2019). It is clear that personal characteristics and individuation have a substantial impact on one's development and effectiveness as a practitioner; unfortunately, characteristics representing more marginalised groups have been understudied (e.g., Fogaça et al., 2024). Neurodivergent individuals have distinct experiences that impact their lives, and as a result, development and ways of living more broadly. More specifically, autistic individuals possess specific characteristics that impact their processing, ways of thinking, interpersonal interactions, and more; these factors have notable impact on a person's development and practice. Despite this, there is no research exploring how being neurodivergent impacts one's development as a sport and exercise psychologist. The present study explores one autistic woman's journey to becoming a sport and exercise psychologist through an ethnographical approach. The first author's reflections, taken over a period of six years, were thematically analysed by the second and third authors, and the data was co-constructed into broader themes that reflect the philosophical, professional, and human development that occurs throughout sport and exercise psychology training. This research, inclusive of reflective extracts, reflects the following themes: incompatibility with certain sport cultures, intersecting identities, integrating identities, support needs, and autistic strengths. From the results of this study, we suggest a range of support mechanisms for autistic practitioners (e.g., reasonable accommodation), explore how supervisors can best support autistic trainees, detail how different ways of thinking can benefit performance and development in sport, and provide additional evidence to the concept that individuation and authenticity as a person and practitioner are integral to good sport psychology practice. Implications for sport psychology and broader sport science professions are explored.

D2.S1 – 5 in 5 Free Communications

D2.S1.1 5 in 5 Free Communications – Mixed disciplinary

D2.S1.1(1) Current Perspectives on Physical Activity, Exercise, Sport, and Nutrition in People Living with Phenylketonuria (PKU)

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Phenylketonuria (PKU) is a rare, genetic metabolic disorder affecting around 1 in 10,000 babies. PKU patients have a reduced ability to convert the amino acid phenylalanine (Phe) to tyrosine (Tyr) via the phenylalanine hydroxylase (PAH) enzyme. Characterised by physiological, neurological, and intellectual disabilities if undiagnosed. The primary form of treatment to control phenylalanine (Phe) blood levels, is a protein-restricted diet along with amino acid supplementation from birth. Poor treatment adherence/control results in high Phe causing cognitive, neurological, and functioning issues, with unknown effects on brain development (Brown, C. S., & Lichter-Konecki, U. (2016). Phenylketonuria (PKU): A problem solved?. Molecular genetics and metabolism reports, 6, 8-12). There is limited research of how exercise and physical activity impacts PKU patients. The aim of this study was to identify participation rates in physical activity and exercise behaviours in PKU patients. With institutional ethical approval, an online survey was completed by patients with PKU > 16 years or caregivers of PKU patients who are < 16 years. This survey covered questions regarding PKU management, physical activity and exercise participation, and associated behaviours. The survey was available for 6 months to complete at relevant conferences and online. From 162 responses 80% reported to have classical PKU 26-33-year-olds being the most responsive. 94% were on a Phe-restricted diet 91% taking all their prescribed protein substitute. 91% took part in regular PA, 76% took part in regular exercise. 82% believed there was NOT enough support in managing PA, exercise, PKU dietary control and Phe levelsThis initial study has highlighted the issues in

physical activity, exercise and nutrition which need addressing in active PKU patients. The following study highlights key areas of focus for PKU which is to explore the impact of exercise on metabolic control (i.e., Phe levels), and the supporting educational material on exercise and PKU.

D2.S1.1(2) Physical activity and adults with attention deficit hyperactivity disorder: perspectives on barriers, facilitators, and preferences. A scoping review.

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Following years of research exploring physical activity (PA) and ADHD in children, PA has been proposed as an adjunct treatment (Young et al., 2023, The Mental Health Review, 28(3), 303–321), leading to PA now being explored as a possible adjunct treatment for adults with ADHD. However, upon considering current studies involving adults, it highlights a lack of theoretical underpinning in interventions and poor adherence to intervention protocols, which may stem from conditional factors of ADHD. Therefore, the aim of the review was to explore qualitative research establishing perceived PA barriers, facilitators, and preferences. A scoping review was conducted to explore these factors by screening for studies across eleven databases between 2016-2024, inclusive of adult males and females with ADHD aged over 18. Searching identified 4,870 potential articles, and three articles were included in the final review (Cochrane et al., 2022, International Journal of Mental Health, 51(3), 267–285; Ogrodnik et al., 2023, Journal of Developmental and Physical Disabilities, 36, 1–21; Sulzer et al., 2022, Journal of American College Health, 71(9), 2628–2638). Evidence synthesis was conducted by grouping findings into themes of characteristics of the participants, ADHD and PA. Participants within the included studies were predominantly young female adults (69.59%). The results indicated that adults with ADHD are willing to engage in PA for health and to manage symptoms of ADHD and comorbid mental health challenges. Reported PA preferences include group exercise, involving cardio and non-cardio exercises at moderate to high intensity, led by a trained professional. In terms of perceived barriers, adults with ADHD reported executive function challenges, while perceived facilitators of PA include hyperfocus, social support, and stimulating activity. However, key gaps within the literature exist that require further investigation, including the nuanced and detailed exploration of participant preferences and the recruitment of larger, more diverse participant groups to fully establish the PA barriers, facilitators, and preferences of adults with ADHD. This is the first scoping review to consider research including adults with ADHD separate from children and to explore perceived PA barriers, facilitators, and preferences of adults with ADHD. Consequently, developing an evidence base to support the theoretical underpinning of future interventions and include the perspectives of those with ADHD to drive the direction of future research must be developed. Nevertheless, to support adults with ADHD to access and experience the benefits of PA, further high-quality research is required.

D2.S1.1(3) Embracing Mistakes as a Trainee Practitioner

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The aim of this presentation is to share the mistakes of a trainee sport and exercise psychologist (TSEP) and how they have been used as learning experiences for professional development. McEwan et al (2019, Psychology of Sport and Exercise, 45,101542) looked to understand the experiences of TSEP throughout their training journey, Tod, et al, (2009 Journal of Applied Sport Psychology, 21, 1-16) focused on how they develop as a practitioners or to compare trainee and experience practitioner development McEwan and Tod (2023, Psychology of Sport and Exercise, 64,102343). These studies focus on how trainees develop skills, competencies, and professional approach as a practitioner, however they don't share mistakes which trainees make and how they are used as part of the learning experience. Metcalfe, (2017, Annual Review of Psychology, 68,465-489) found that making mistakes is a fundamental part of learning but can cause significant emotional distress this forms a key element to practitioner development (e.g. McEwan, & Tod, 2023). Fischer et al, (2006, Journal of General Internal Medicine, 21, 419-423) found that sharing these mistakes with others can form an important part of trainee development. Barker, et al, (2012, Journal of Applied Sport Psychology, 25,4–32) suggested that single case studies can provide further understanding in evaluating applied practice and enable a deeper dive into personal experiences to inform future practice. A single-case approach has been used to understand the mistakes of one trainee, the emotional response and how they were used as learning experiences. Ethical considerations looked at the trainee being the researcher and using the supervisor as a critical friend to reduce any bias and maintain rigor throughout the study. Reflection and supervisor meetings were used to identify challenges, potential mistakes and emotional stress, these were then collated into a list of key mistakes made to then be reflected on for learning outcomes. These mistakes were then discussed and reflected on further with their supervisor to identify learning outcomes. The mistakes include, taking on too many clients, being unclear on professional approach, under or over preparing for work with clients, not considering the impact of other work and life commitments on work with clients and not prioritising self care. This reflective account of a TSEP discusses

these mistakes, how these were identified, reflected on and what were the learning outcomes are for the trainee. With the aim to support trainees with examples of mistakes, and how to learn from them

D2.S1.1(4) Strength in Solitude? Investigating the potential benefits or consequences of isolation on student-athletes' wellbeing and performance

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Isolation is something a lot of people can experience (West, Kellner & Moore-West, 1986) and is still without a "blanket" definition (Wang et al., 2017). Isolation can be interpreted both positively and negatively, depending on the context (Wang et al., 2017). This study investigated isolation and the different definitions it can have to each individual. It also investigated what effects isolation can have on students who also compete in sports. The research provided great insight into a student-athletes' mindset in competitive environments and what support networks they may seek in more isolating periods. This study consisted of nine student-athletes attending 5 different UK universities, all over the age of 18 and were competing in a sport alongside studying. They participated in semi-structured interviews lasting approximately 30 minutes. The method of analysis used in the study was an Interpretative Phenomenological Analysis (IPA) (Tomkins, 2017) as this method of analysis can provide in-depth detail into an individual and their experiences. The results of the study provided 3 themes. 'Burdensome' referring to athletes contemplating about whether to discuss their isolation with others. 'Strength of Support' in reference to stronger or weaker support networks of student athletes. Lastly, 'My Passion' discussing an athlete's love for their sport and how that helps manage any experiences of isolation

D2.S1.1(5) Parental behaviour predicts children's motor competence for active play: A longitudinal analysis with 199 families

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Developing motor skills for active play can increase children's physical activity (PA) levels and promote social participation. Due to their long-term family role, parents can have an impact on children's engagement in active play. However, their influence on the development of motor skills for active play is unknown. Therefore, the goal of the present study was to analyse whether parent's PA-related influences at 5y predicted their child's motor skill competence for active play at 9y. Having received ethics approval (Deakin University Human Research Ethics Committee ID 175-2007; Victorian Office for Children Ref: CDF/07/1138), children were recruited as part of the Melbourne based INFANT study (Hesketh et al., 2013, Contemporary Clinical Trials, 13, 145-151). We collected data when children were 5y and 9.5y. Parents self-reported (purpose-designed survey) on their parenting PA efficacy ($\alpha = .83$), facilitation ($\alpha = .74$), and attitude ($\alpha = .64$) towards children`s PA at 5y. At 9.5 years, parents' proxy-reported on their child's motor skill competence for active play (play items of the pictorial scale of Perceived Motor Skill Competence). First, we tested all three parenting constructs (efficacy, facilitation, attitude) as predictors of motor skill competence for active play in separate regression models. Subsequently, we calculated a multivariate regression model with each construct to directly compare their combined influence on motor skill competence for active play. All models were controlled for factors that were initially identified as relevant ($p < 0.10$) for active play motor skill competence in a separate covariate analysis (child sex, parent socioeconomic position, child body mass index, and child objectively measured motor skills at age 5). The sample involved a total of 199 families. Parental PA efficacy ($\beta = .25$, $p < .001$), facilitation ($\beta = .28$, $p<.001$), and attitude ($\beta = .30$, $p <.001$), when their child was 5y, each served as predictors for active play motor skill competence at 9.5y in the univariate regression models. In the multivariate model, parental facilitation ($\beta = .16$, $p < .05$) dominated the longitudinal association with children's motor skill competence for active play, thus suppressing any effect of attitude and efficacy. The significance of parental influences on motor skill competence for active play underlines the importance of targeting parents in promoting children's development of motor skill competence in unstructured PA contexts. Future research and practice should place a particular focus on how parents can effectively facilitate physically active lifestyles.

D2.S1.2 5 in 5 Free Communications – Sport and Performance

D2.S1.2(1) Referees' and Professional Medical Professionals' Knowledge and Attitudes Towards Concussion in English Football

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Sports-Related Concussion describes immediate and transient symptoms of mild-Traumatic Brain Injury during sport (Mooney et al., 2020, Concussion, 5(3)). Some sports have educational interventions enhancing knowledge and understanding of SRC (Rugby Football Union [RFU], 2021; Football Association [FA], 2023). Previous research has shown external influences on clinical decision making when SRC is involved (Gouttebarge, 2021, BMJ Open Sport & Exercise Medicine, 7, 1-4). This project aimed to understand knowledge and attitudes towards concussion in referees and medical professionals in football measuring awareness of FA concussion guidelines and concussion education engagement. With institutional ethical approval,

a cross-sectional design utilised online surveys sent to referees and medical professionals with snowball sampling. Surveys utilised short answer, multiple-choice, multiple-answer and Likert scale questions based on previous research. Medical professionals from the top four English leagues (n = 27) and referees from across the English football pyramid (n = 32) responded with 9.25% and 10.42% response rates respectively to role-specific questionnaires designed to measure knowledge, understanding and attitudes towards concussion and management protocols. Neither group understood benefits of removal from play or graduated return to play. Correct identification of all signs and symptoms of concussion were 41% and 89% in referees and medical staff respectively. On average 96.5% thought signs and symptoms of severe brain injury indicated concussion. Medical professionals were dependent on presentation of signs and symptoms (93%) to inform undertaking diagnostic assessments, the most common of which was the SCAT-5 assessment. Responses indicate poor ability to differentiate between signs and symptoms of concussion and severe brain injury. Both groupsdemonstrated imparied understanding of the benefits of removing players from play and undertaking graduated return to play protocols. A majority of medical professionals (51.9%) indicated they had felt pressure to keep a player in competition despite suspecting a concussion. Of referees 37.5% had no first aid or additional training on concussion. Both groups showed openness to undertaking concussion-specific training in future with 90.6% of referees and 96.3% of medical professionals responding favorably. Knowledge and understanding of concussion in professional football medical staff and football referees has not been previously researched. Previous findings indicated less experience of pressure to keep suspected concussied players on the pitch (Gouttebarge, 2021). Methods of clinical reasoning aligned with previous findings in professional football (Broglio et al., 2011). Future research should aim to better understanding knowledge, understanding and attuitudes in players as well as the effectiveness of education interventions on knowledge, attitudes and behaviours.

D2.S1.2(2) The Reliability and Construct Validity of the Functional Threshold Power Test in Recreational Cyclists

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The functional threshold power (FTP) 20-min test (FTP20) is popular amongst cyclists and coaches due to the theory it can predict the power output that can be sustained for 60-mins. However, little is known in terms of the reliability and validity of this construct, therefore the aim of this study was to assess the reliability of the FTP20 test and the construct validity of this test to predict 60-min power. With institutional ethical approval, twenty-two male recreational cyclists (age = 32 ± 10 years, body mass (BM) = 77.2 ± 6.8 kg, VO2max = 59.4 ± 5.6 ml. kg BM) completed four trials consisting of a maximal oxygen uptake test (VO2max), a familiarisation trial of the FTP20, two experimental FTP20 tests, and a time to volitional exhaustion (TLIM) at FTP. The repeatability for mean power output (MPO) during the FTP20 was excellent (r = 0.94, CI 0.82, 0.98, P < 0.001). Mean TLIM (at FTP20) was 42 ± 17-min, with six participants within 10-min of the 60-min suggested threshold. These results suggest that the FTP20 is reliable, however it does not predict 60-min power with a high level of validity. Future research should explore adapting the calculation of FTP whereby the intensity may be lowered (i.e., 80-90% MPO of FTP20), particularly as most participants' TLIM was far below the suggested 60-min time frame.

D2.S1.2(3) Psychophysiological Interventions in Biathlon

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Biathlon places a huge demand on psychophysiological processes (Josefsson et al., 2021) yet there is limited research to investigate these. This study aimed to investigate the effect of brief educational interventions based around quiet eye and heart rate variability on shooting performance. Nine international biathletes took part in a cross-over design study where shooting performance was measured at baseline and post-intervention. During shooting testing participants had their heartrate variability and gaze behaviour measured. For the intervention participants undertook educational workshops in quiet-eye and slow-paced breathing. Participants also completed workbooks to provide information on their knowledge of each topic pre- and post-intervention, this was rated on a Likert scale from "1" none at all to "7" excellent. Following testing, participants took part in focus groups to gain insight into their experiences. Thematic analysis of focus groups while Mann Whitney U and Wilcoxon Signed Rank tests were used to analyse quantitative data. Results show that the interventions significantly improved shooting performance (Z = 2.34, p = 0.02). Given the small sample size and missing data, there should be caution around the interpretation of shooting improvement. Prior to the workshops participants had very little knowledge of the interventions (quiet eye = 1, slow paced breathing = 1.7) and following the workshops this significantly increased (p < 0.05) (quiet eye = 4.5, slow paced breathing = 5). Participants reported positive responses to the interventions via the focus groups. For example, participants reported the quiet-eye technique helped them to have more control over their gaze behaviour and the paced breathing helped to reduce distractions and increase relaxation. There were some reported barriers to using the interventions such as difficulty associated with changing existing routines, interventions conflicting with coaching advice and general scepticism. Overall, there were positive influences on both shooting performance and psychological state as a result of both interventions. The findings, specifically those

from the workshops and focus groups, suggest that further education for athletes into the psychophysiological factors which may underpin shooting performance is greatly needed.

D2.S1.2(4) Comparison of sudden cardiac arrests/deaths in South African & European professional football leagues: risks, incidence, and preventive measure: A systematic review

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Background: Football, commonly known as soccer, is one of the most popular sports in the world with millions of players and supporters. Sudden cardiac arrest/death(s) (SCA/SCD) are rare but traumatising incidents in sports, particularly in football. SCD are the leading cause of death in young athletes, and this raise concerns in football. Soccer is a physically demanding exercise. Athletes with an undiagnosed cardiovascular abnormality may be at a risk for SCA/SCD.
Methodology: A literature search was done using Science direct, Oxford Academics, Sage Journals, Wiley Online Library, Taylor Francis Online, SpringerLink and PubMed using a combination of keywords and operators such as the Boolean search type to produce accurate results. Experimental studies, Observational Cross Sectional, Prospective and Exploratory Publications were included in our review if the articles focused on SCD/SCA in professional football leagues and studies conducted on professional football players in South Africa and European countries and articles written in English.
Results: A total of 5 confederation with 123 cases (mean age 37 ± 17 years, 100% men) with SCA/SCD were reported; 67 EUFA players (54.5%), 17 AFC players (13.8%), 16 (13%) CSDF players, 19 CAF (15.4%) & 4 CONCACAF players (3.3%) cases. A diagnosis by autopsy or definite medical reports was established in 140 cases (58.3%). The leading cause in players >35 years was CAD (76%) and in players ≤35 years was (SCD, 22%). In players ≤35 years the leading cause of SCD varied by region (CPR) resulted in a survival rate of 85% with the use of an (AED) compared with 35% without.
Conclusion: Education in SCD/SCA should be improved by national football registries. Immediate access to an AED at training and competition sites, as well as CPR training for players, coaches, and staff members, should be compulsory to improve survival from SCA/SCD. South Africa is currently on the rise with SCD/SCA, and our current study is focusing on the PSL & NFD risk profile data.

D2.S1.2(5) The effects of blood flow restriction and inspiratory muscle training on performance with healthy individuals.

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Aim: To investigate the efficacy of Blood Flow Restriction training (BFRT) in improving athlete performance.
Background: The concept of applying BFR specifically to the respiratory muscles is novel and has not been extensively explored in scientific literature. On the contrary, over two decades of Inspiratory Muscle Training (IMT) show the impact of respiratory muscle exercise on athlete performance (Illi et al., 2012). BFRT involves restricting venous blood flow while maintaining arterial inflow, creating a hypoxic environment in the targeted muscles (Takarada et al., 2000) whilst IMT involves training the inspiratory muscles against an increased resistance, which leads to progressive overload and adaptation. The application of a training threshold, typically 30-50% of maximum inspiratory pressure, is a key component that drives the physiological adaptations of increased inspiratory muscle strength and endurance (McConnell et al., 1995).
Methods: An 8-week experimental study comprising two visits (PRE-intervention and POST-intervention) compared the Inspiratory Muscle Training (IMT) group vs the BFRT group. Ethical approval was granted by the University of Derby Ethics Pannel (ETH2324-1659). The inclusion criteria involved healthy, physically active individuals aged between 25 and 35 with no medical conditions that would compromise the interventions (e.g., asthma or COPD). PRE and POST maximal inspiratory pressure (MIP) and maximal expiratory pressure (MEP) tests, alongside measurements of lung capacity and a 20km time trial were collected.
Results: A total of 8 findings show that BFRT significantly enhanced cardiorespiratory fitness and improved athlete performance measured with a 20km trial. BFRT was as effective as IMT in enhancing pulmonary function and respiratory muscle strength ($p < 0.05$).
Discussion: While the sample size was relatively small, the findings suggest that BFRT is a low-risk low-cost alternative to high-intensive training for improving athletic performance. By incorporating BFRt, coaches can optimise their 'athletes' performance and fitness level and athletes can benefit from improved endurance and overall physical condition leading to better competitive results. Overall, this study has the potential to impact current training practices, offering a new approach that re-visits current knowledge on respiratory muscle training.

D2.S3 - Free Communications

D2.S3.1 - Free Communications - Physical Activity for Health

D2.S3.1(1) Impact and implementation of an Early Years fundamental motor skills intervention for children 4–5 years

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Fundamental motor skills (FMS) are the cornerstone of a child's motor development encompassing locomotor skills, object manipulations and stability skills (Zeng, Johnson, Boles and Bellows, 2019, Journal of Sport and Health Science 8, 122-129). Early childhood educational environments are considered important spaces for PA attainment and FMS instruction (Dobell, Faghy, Pringle and Roscoe, 2023, Children, 10,1004) and are also popular interventional settings to increase FMS competency (Weir et al., 2017, Sports Medicine, 47, 2045-2068). That said, concerns remain over the current level of FMS competencies and intervention is required. Therefore, the aim of this study was to investigate if a targeted 'Early Years FMS intervention', delivered by a specialist physical education (PE) provider, improved the FMS of 4–5-year-old children. With institutional ethics approval, the 'Early Years FMS intervention' ran for 18 weeks, 1 hour per week, using a standardised programme of activities to develop FMS competencies across 219 children from 15 schools in the Midlands, UK. An adapted assessment was employed as a measure of FMS, assessing locomotor, object control, and stability skills at weeks 1, 9, and 18. The FMS were each rated as green = competent, amber = working towards, or red = not meeting the standards of the skill. A description of key programme implementation characteristics was described. Statistically significant increases in FMS competencies were achieved across all FMS for 80% of the children at 18 weeks ($p<0.001$). Locomotor skills went from 42.83% competent pre-intervention to 88.22% post-intervention, object control skills 20.55% pre-intervention to 87.21% post-intervention and stability skills 35.16% pre-intervention to 96.96% post-intervention ($p<0.001$). Key findings from this investigation support the idea that significant increases in FMS proficiency can be achieved through a specific 18-week 'Early Years FMS intervention' for most children. Key implementation characteristics for the intervention included consistent staffing, a standardised clear and logical programme, and a variety of pedagogical approaches delivered by specialist PE staff. Given the absence of studies that report on programme content, these insights are important in facilitating effectiveness and future learning. As such any wider implementation of the system needs to be supported with appropriate training, education, and resources for those staff members involved in delivering interventions.

D2.S3.1(2) Examining non-linear relationships between body mass index and competencies for health-enhancing physical activity: results of a data pooling study across 18 studies

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Previous studies illuminated associations between body mass and physical activity (PA), revealing that individuals with obesity perform less PA than people with normal weight (e.g., van Dyck et al., 2015, International Journal of Obesity, 39, 199-207; Cárdenas Fuentes et al., 2018, European Journal of Public Health, 28, 944-950). To inform effective interventions, it is therefore crucial to comprehensively understand the personal mechanisms determining human PA behaviour. However, there are scant insights regarding the variety of individual determinants of PA in relation to body mass. In this context, the model of physical activity-related health competence (PAHCO) can serve as a theoretical framework, as it specifies three different sub-competencies (movement competence, control competence, self-regulation competence) by bundling physical, cognitive, and motivational determinants of health-enhancing PA. This study aimed to model courses of PAHCO across the spectrum of body mass index (BMI). We used cross-sectional data of 3,670 individuals (BMI 25.54 ±5.71 kg/m^2; age 46.11±14.96 years) from a large data pooling with 18 ethics-approved primary studies employing the physical activity-related health competence (PAHCO) questionnaire (Reliability: McDonald's $\omega t \geq .89$). Analyses of covariance determined potential differences in ten PAHCO indicators by BMI categories (underweight, normal weight, overweight, obesity). Due to significant differences between samples marking a cluster effect ($0.02 \leq ICC \leq 0.33$), we calculated age-and gender-adjusted multilevel models with the 18 samples as a second order (random effects) factor. We described and compared non-linear courses of

the PAHCO indicators across the BMI spectrum. Finally, we examined whether the associations between BMI and PAHCO were moderated by the presence of a chronic disease (slope-as-outcome approach). The levels of all competence indicators for health-enhancing PA differed significantly between the four BMI categories ($F \geq 14.8$, $p < .001$). More specifically, the curves of all PAHCO indicators could be best described by cubic functions along the BMI spectrum, having their maximum around normal weight ($19.25 \leq x \leq 25.70$) whilst regressing with underweight and with increasing obesity ($0.02 \leq Rmarg^2 \leq 0.31$). In our models, the identified associations between body mass and PAHCO were independent from the potential presence of a chronic disease ($\Delta\chi^2(9) \leq 8.74$, $p \geq .462$). This study adds to associations between BMI and PA levels by specifying individuals' multidimensional requirements for health-enhancing PA. The present findings call for an integration of physical, motivational, and cognitive factors in practices of PA promotion and sustainable obesity treatment. This integration can be realized by interlocking 'training', 'learning' and 'experiencing' in line with a person-centred approach for enabling better long-term adherence to health-enhancing PA.

D2.S3.1(3) Effects of interventions on sedentary behaviour and biomarkers of cardiovascular disease in individuals with a spinal cord injury: a systematic review

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Individuals with spinal cord injury are highly sedentary, which could partly explain why this group have a higher risk of cardiovascular disease than non-disabled individuals. Despite the potential cardiovascular and metabolic benefits of reducing sedentary behaviour in non-disabled populations, the effectiveness of sedentary behaviour interventions is poorly understood in individuals with spinal cord injury. Upper limb function is spared in individuals with paraplegia, meaning retained opportunity to reduce and break up sedentary behaviour with physical activity. This study aimed to systematically review the effects of interventions on sedentary behaviour and cardiovascular disease biomarkers in individuals with paraplegia. Thirteen databases, clinical trial registries and pre-print registries were searched to identify relevant articles. Titles, abstracts and full texts of identified articles were screened for eligibility. Eligible articles included participants with paraplegia, studies of any quantitative design, studies with or without comparators, interventions that measured sedentary behaviour as an outcome and/or targeted decreases in sedentary behaviour, and intervention studies that measured ≥1 cardiovascular disease biomarker. Quality of evidence for each outcome was assessed using the Grading of Recommendations, Assessment, Development and Evaluation (GRADE) criteria. Eligible studies were categorised according to study design, intervention characteristics, study population, methods used to measure outcomes and risk of bias to interpret results via a narrative synthesis. Database searches yielded 9,378 articles. Following screening, eight articles, comprising six individual studies, were eligible for inclusion. One acute, laboratory-based study targeted breaks in sedentary behaviour, whereas all other studies included interventions that targeted increases in physical activity. Three of the five interventions that measured sedentary behaviour (via self-report or device-assessed) led to a significant reduction in this outcome; all five interventions targeted increases in physical activity. Four of the five interventions that measured cardiovascular disease biomarker outcomes reported a significant improvement in at least one biomarker; only one of these targeted sedentary behaviour. Quality of evidence was deemed moderate for device-assessed sedentary behaviour, glycaemic biomarkers and lipid biomarkers, low for blood pressure and body composition biomarkers, and very low for self-reported sedentary behaviour outcomes. Physical activity interventions showed some efficacy for reducing sedentary behaviour and improving cardiovascular disease biomarkers in individuals with paraplegia. There is insufficient evidence to determine the effectiveness of interventions targeting sedentary behaviour specifically. Future research is required to evaluate the effectiveness of sedentary behaviour interventions for improving cardiovascular health in individuals with paraplegia to appropriately inform clinical care and public health guidelines.

D2.S3.1(4) Participation in Organised After-School Activities and Mental Health Outcomes

Implications of a 5-Year Project in the Canadian School Sport System.

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Empirical evidence highlights how there are many important factors to consider in order to optimise mental health during adolescence. Organized after-school activities, when appropriately structured, have been shown effective at offering some protective factors from mental illness. In 2020, the COVID-19 pandemic induced sudden and significant changes in the daily lives of adolescents who faced sport cancelations, a shift to online learning, and an overall drastic reduction in their social activities. These abrupt and persistent changes raised concerns about potential prolonged adverse effects on adolescents' mental health outcomes.The purpose of this presentation is to discuss the wider implications of a 5-year project conducted within the Canadian school sport system. The project was implemented in close collaboration with School Sport Canada, the Canadian national governing body for school-based

athletics. Data were gathered from 2019 to 2024, offering a comprehensive portrait of the longitudinal impacts of participation in organised after-school activities on mental health outcomes before, during, and following the COVID-19 pandemic.With institutional ethics approval, initial (Year 1) sample consisted of 930 Canadian high school student-athletes who completed once annually for five years an online questionnaire that measured: (a) involvement in organised after-school activities (i.e., high school sport, community sport, non-sport extracurricular activities), (b) screen time, (c) sleep duration and quality, and (d) multiple dimensions of mental health through validated scales (i.e., Positive Youth Development Inventory, Basic Psychological Need Satisfaction and Frustration Scale, Positive Mental Health Scale, Kessler Psychological Distress Scale (K10), Sources of Stress Scale).Results indicated that the COVID-19 pandemic and the prolonged cancelation of organised activities led to significant disturbances amongst the participants. The presentation is intended to offer a general portrait of the pandemic's impact, providing a comprehensive overview of the participants' developmental trajectory, particularly concerning mental health outcomes.The results of this presentation will be discussed with the intent to share wider implications for how mental health can be more inclusively considered within the design and implementation of sport programmes for adolescents. If sport is to serve a useful role as a public health initiative for the greater good, then we must consider how to best offer programmes that support adolescents' mental health and well-being over time. By elucidating the results of a 5-year project conducted in the Canadian school sport system, this presentation contributes to current understandings, advocating for the essential roles played by organised after-school activities within the very fabric of our societies.

D2.S3.1(5) Multistakeholder perspectives of the determinants of family fundamental movement skills practice: a qualitative systematic review

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Childhood obesity has been declared as a serious public health challenge and continues to proliferate in frequency and severity, exposing children to severe disease states and premature mortality (Marcus et al., 2022, Journal of Internal Medicine, 292, 870-891). Fundamental movement skills (FMS) are rudimentary motor abilities in young children that act as a prerequisite to physical activity (PA) engagement and provide a plethora of physical and psychosocial health benefits, including weight maintenance (Wick et al., 2017, Sports Medicine, 47, 2045-2068). Yet, a substantial gap exists in children's FMS ability that is failing to create a suitable foundation for meaningful PA despite a myriad of interventions within early childhood education (Duncan et al., 2022, Journal of Motor Learning and Development, 10, 7-26). Therefore, a change of approach may be needed. Parents and caregivers are role models to their children and families can create nurturing environments that significantly improve FMS competence (Flynn et al., 2023, Children, 10, 1247). However, there is a lack of understanding of family needs, and this insight could prove vital for future intervention design and implementation. To our knowledge, this study was the first to explore the determinants of family FMS practice via a systematic synthesis of qualitative evidence. Ethical approval was not required for this review. This review was conducted using the PRISMA framework. Keyword searches were completed in SPORTDiscus, PubMed, Scopus, Web of Science, and Embase. Qualitative studies were included that offered key stakeholder perspectives relating to the FMS of 2-6-year-old children in the family context via focus group discussions, semi-structured interviews, or visual methodologies that provided an important voice to children. Seven articles from five countries met the inclusion criteria. Thematic analysis was used to identify key themes and subthemes. Emergent themes included: knowledge and awareness of FMS; value of FMS and attitude towards teaching; cultural priorities and family dynamics; time, financial, and safety constraints. Children indicated a preference for imaginative play and control of activity choice. Rules at home, and availability of toys, equipment, friends, and family members for play served as both barriers and facilitators. Findings suggest parents have a limited understanding of FMS or the confidence to teach. Greater knowledge exchange between stakeholders is needed to facilitate more effective FMS instruction at home. More family initiatives are required to provide better access to outdoor spaces, facilities, and equipment that support FMS practice in the community.

D2.S3.2 - Free Communications - Sport and Performance

D2.S3.2(1) Tracking powerchair football using sensors, the wheelchair mobility performance demands of the sport

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Powerchair football is an excellent opportunity for people with a higher level of impairment to access football. Players use an electric-motorised wheelchair, with a total of four players per team on court. The sport is unique in combining all ages, disabilities, and genders competing together. Classification levels are defined by head and trunk impairment as well as drive control, creating two classes (PF1 = high-impairment, PF2 = low-impairment). Powerchairs are limited at 10km/h forward and reverse, to allow an equal playing field and secure safe game play. Little is known about the actual game demands in powerchair football. The purpose of this study was (a) to explore the feasibility of using inertial measurement unit (IMU) technology in powerchair football and (b) evaluate wheelchair mobility performance during gameplay in powerchair football. Ethical

approval was granted by Loughborough University. Sample size was based on wheelchair sports research. Sixty-four powerchair football players with mixed impairments (Cerebral palsy, Muscular dystrophy), classification levels (PF1, PF2) and genders were measured during official gameplay of Championship and Premiership matches in May/June 2023 (Nottingham, United Kingdom). All powerchair football players were equipped with IMUs (MoveSense HR2). One sensor was attached to the centre of the wheel to measure linear velocities and accelerations. A second sensor was attached to the middle of the powerchair to measure rotational variables. Statistical differences in game play demands were assessed using Python (3.10.11) with a two-way ANOVA on competition level (Championship vs. Premiership) and Classification (PF1 vs. PF2). On a competition level there were differences between Premiership and Championship level players in active playing time (80 vs 87%, $p < 0.01$, $d = 0.12$), reverse distances per min (16.24 vs. 19.64 m/min, $p < 0.01$, $d = 0.11$) and average reverse velocity (-0.78 vs. -0.92 m/s, $p < 0.01$, $d = 0.04$). On a classification level there were differences between PF1 and PF2 players in active playing time (82 vs 90%, $p< 0.01$, $d=0.10$), average velocity (1.16 vs. 1.24 m/s, $p = 0.03$, $d = 0.03$), average forward acceleration (1.36 vs. 1.49 m/s2, $p = 0.01$, $d = 0.03$), number of high speed turns per min (3.3 vs. 4.1, $p < 0.01$, $d = 0.06$), average rotational velocity (47.9 vs. 52.0 deg/s, $p < 0.01$, $d = 0.06$) and peak rotational velocity (297 vs. 348 deg/s, $p < 0.01$, $d = 0.10$). The current study showed good feasibility of using IMU technology to assess wheelchair mobility performance in powerchair football. Understanding mobility performance on a classification and competition level helps to understand game demands, sustain an equal playing field, and secure safe gameplay in powerchair football.

D2.S3.2(2) How do cycling coaches define and use training intensity distribution models?

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Training load in cyclists can be quantified using a variety of methods and is often generalised into a model of training intensity distribution (TID) which may be defined by physiological constructs such as the lactate threshold or critical power (Hofmann and Tschakert, 2017, Frontiers in Physiology, 8, 145-153). Three common models are polarised, threshold, and pyramidal (Casado et al., 2022, International Journal of Sports Physiology & Performance, 17, 820-833). However, there is a lack of consensus regarding the training load quantification practices of cycling coaches. The aim of this study was to explore the practices and perspectives of cycling coaches on training load quantification, with specific reference to the use of intensity distribution models. Following institutional ethics approval an online survey was distributed to cycling coaches worldwide between March and June 2024. Questions covered knowledge and definitions of TID models, how training prescription was adapted depending on period of the season, how many zones they use, and if/how they track training load. 117 coaches (103 male, 14 female), with 13.2 ± 7.7 years' coaching experience responded. The survey revealed that the most well-known TID model was polarised, recognised by 89.7% of respondents. The threshold model was known to 79.4% and the pyramidal model to 75.2%. Respondents near-universally described TID models using a three-zone method, despite most coaches stating they used 5-7 zones in their coaching. On average a polarised TID was described by coaches as consisting of 80.8%/3.3%/17.4% low/moderate/high intensity respectively. There was some inconsistency as to whether the polarised model should include any moderate intensity, the most common response defined polarised as 80%/0%/20% low/moderate/high. Pyramidal TID was described as including a decreasing percentage in each zone as intensity increased. Respondents defined pyramidal as 67.5%/23.4%/9.1% low/moderate/high on average. Across all models, respondents' definitions of a threshold TID varied most. There was an increase in moderate intensity, although responses were split whether the highest percentage should be at low or moderate intensity. On average participants defined a threshold TID as 44.5%/44.0%/13.2% low/moderate/high. The responses from some coaches suggested their implementation of TID models was more flexible with adaptations made to change the intensity depending on factors such as training volume and experience. Further issues associated with implementing TID models are the uncertainty around how physiological measures delineating the intensities zones are determined as this could affect the reliability of zones and comparing TID models.

D2.S3.2(3) Cardiac structure and function in resistance-trained athletes versus untrained male adults

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Research examining the Athlete's Heart has often focused on athletes engaged in chronic endurance training. However, due to the smaller volume of studies available (Utomi et al., 2013, Heart, 99, 1727-1733) no clear consensus has emerged on the structural and functional adaptations often observed in resistance-trained (RT) athletes. The aim of the current investigation was to examine cardiac structure and function in RT athletes compared to healthy untrained (UT) individuals using echocardiography. Following institutional ethical approval, an observational cross-sectional study conducted echocardiographic examinations on male RT athletes (n = 12; age: 29 ± 4 years [95%CI: 27 – 32]; body mass: 93 ± 19 kg [95%CI: 82 - 104]) and age-matched UT volunteers (n = 12; age: 30 ± 5 years [95%CI: 27-33]; body mass: 80 ± 7 kg [95%CI: 76 - 84]). Resting blood pressure and anthropometric were gathered to allow indexing of structural cardiac parameters to body size and composition. Compared to both UT individuals and normative data (Lang

et al., 2015, European Heart Journal – Cardiovascular Imaging, 16(3), 233-271) RT athletes displayed greater septal wall thickness (RT: 1.2 ± 0.1 cm; UT: 0.9 ± 0.1 cm; P < 0.001), posterior wall thickness (RT: 1.2 ± 0.1 cm; UT: 0.8 ± 0.1 cm; P < 0.001) and absolute left ventricular mass (RT: 275 ± 50 g; UT: 162 ± 25 g; P < 0.01). Even after accounting for the differences in body size and composition, greater left ventricular mass in RT athletes remained significant greater (P < 0.01). No significant between group differences were reported in either systolic or diastolic function. In conclusion, both structural and functional differences in cardiac measures are apparent when comparing those engaged in chronic RT to UT individuals. Furthermore, despite these structural differences, no significant impairments in left ventricular cardiac function were observed. However, whilst the cardiac dimensions of most RT athletes do not exceed the upper normal limits for physiological hypertrophy, the exact mechanism for these differences is unclear and warrants further investigation.

D2.S3.2(4) Contact and head acceleration characteristics of a female rugby union team during an international tournament

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Rugby union participation imposes substantial stressors and demands upon players, including locomotor demands and contact exposure. Contact and head acceleration event (HAE) exposure have been studied in match-play but have yet to be reported in female rugby union training. Quantifying contact and HAE exposure in both match-play and training is required to improve load management, injury prevention and other player welfare strategies. The aim of this study was to report contact and HAE exposure characteristics of an international female rugby union team, across a three-week international tournament, encompassing match and training contexts. With institutional ethical approval, contact and HAE exposure of 28 female rugby union players were assessed using video analysis and instrumented mouthguards. Three matches and 16 training sessions were coded using consensus operational definitions, and synchronised with instrumented mouthguard data, enabling calculation of HAE incidence and propensity by skill type. Effect sizes and 95% confidence intervals (ES+95%CI) were calculated to quantify the magnitude of differences. Training activity accounted for 76-85% of weekly contact volume. There was a large difference in forwards' and backs' contact volumes during matches (45.5+27.1 vs. 20.8+12.6 contacts per match, ES = 1.12+0.55) and full contact training (26.9 +7.4 vs. 11.6+2.7 contacts per match week, ES=2.64+0.63), whereas the effect size for contact volume in controlled contact training was small (80.5+28.4 vs. 74.6+22.1 contacts per match week, ES=0.23+0.46). HAE propensity was greater in matches than training for all peak linear and angular acceleration thresholds. The tackle event accounted for 82% and 71% of HAEs >25g in matches and training respectively. Contact exposure of training should be routinely monitored, considering the substantial contribution of training to weekly cumulative exposure. The inter-individual variation observed in HAE propensity suggests that load management should be considered on an individual basis. Strategies to reduce HAE burden should be focussed on the tackle area, given that the majority of HAEs are attributed to the ball carrier and tackler.

D2.S3.3 - Free Communications - Physical Activity for Health

D2.S3.3(1) Experiential learning in the community: Exploring a sport and exercise science student-led exercise programme

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Curriculums in sport and exercise science aim to equip students with the knowledge and practical skills needed for professional advancement and health promotion. Despite opportunities like short-term placements, there is a need for more specific real-world experiences to develop key skills and employability. The primary aim of this study was to provide sport and exercise science students with an experiential learning opportunity to enhance their confidence, instructional skills, and employability. Secondary objectives included assessing the sustainability of student-centred experiential learning and gathering client feedback to inform future programme improvements. The study was conducted in two stages: project development and implementation of a student-led exercise programme. Following institutional ethical approval, six undergraduate students from the University of Surrey, holding Gym Instructor or Personal Trainer certifications, led exercise sessions for six healthy 18–54-year-old clients over four weeks. Clients participated in two supervised 60 min sessions per week, with health/fitness appraisals conducted before and after the intervention. Students concurrently engaged in reflective practice with academic mentors. Data collection included pre- and post-intervention questionnaires, semi-structured focus groups, and client feedback, analysed via inductive thematic analysis. Questionnaire data revealed that all students agreed the project enhanced their competencies, application of academic knowledge, and professionalism, with 80% indicating improved perceived employability. Students also reported increased confidence and professional competence post-intervention. Thematic analysis identified three key themes: navigating professional development, student-centred learning, and holistic learning environments. Students emphasised the importance of experiential learning in developing both technical and transferable skills, highlighting the value of autonomy and decision-making in real-world contexts. Clients also expressed positive

feedback, suggesting the programme's extension and potential monetisation. Experiential learning was recognised for enhancing professional competence, prioritising client needs, and fostering a growth mindset. It provided a toolkit for developing communication, problem-solving, and adaptability skills, facilitating real-world work complexities. This collaborative work served as a springboard for shaping future teaching, envisioning the project evolving into a comprehensive and ongoing exercise programme catering to healthy individuals, those with long-term conditions, and specific clinical conditions in the community. Further work is required to ascertain the long-term feasibility of experiential learning, especially if this approach is to be offered to a larger cohort of students and embedded within a university degree programme. This pilot project demonstrated promising results in enhancing students' professional skills and confidence, highlighting how experiential learning can be integrated into the sport and exercise curriculum, its sustainability, and potential impact on students.

D2.S3.3(2) The effect of 12 weeks table tennis on cognitive performance, physical activity and health state of people with early-stage signs and symptoms of dementia – promising results from the hAlt project

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Physical activity (PA) can assist in managing dementia but one of the barriers is lack of available activities the carer and person with dementia can do together (van Alphen et al., 2016, Archives of Gerontology and Geriatrics, 66, 109–118). Table tennis (TT) is a safe and beneficial activity (Olson et al., 2020, Archives of Rehabilitation Research and Clinical Translation, 2(3), 100064) the carer and the person with dementia can partake together. The present study examined the effect of 12 weeks of TT on cognitive performance, PA and the health state of people with early-stage signs and symptoms of dementia. With ethical approval, 29 people from 6 different countries (male = 14, female = 15, age 70 ± 6 years), participated in a 12-week TT programme, delivered twice a week for 45 minutes, by qualified TT instructors. The sample consisted of people with cognitive complaints (Subjective Cognitive Decline, SCD) or Mild Cognitive Impairment (MCI). Questionnaires for cognitive performance (Montreal Cognitive Assessment,(MoCA)), SCD complaints, health state (based on five dimensions - Mobility, Self-care, Usual activities, Pain/Discomfort, Anxiety/Depression (EQ-5D-5L)) and PA (General Practitioner Physical Activity Questionnaire) were administered immediately prior to and after the 12-weeks. The Sign test was used to compare the pre- and post-programme scores, with Holm-Bonferroni correction for repeated pairwise comparisons. Binomial test effect size (Cohen's g) was calculated for significant differences and interpreted as negligible, small, moderate, and large for values of <0.05, 0.05 - 0.15, 0.015 - 0.25, and >0.25, respectively. Significance was set at 0.05. Data is reported as median (IQR). There was evidence of large improvement in cognitive performance (pre: 23(5), post: 25(4), $p = 0.022$, $g = 0.28$) but no evidence of SCD change. There was also evidence of large improvement for mobility (pre: 2(2), post: 1(1), $p = 0.039$, $g = 0.39$) but no evidence of improvement in any of the other dimensions. Finally, there was weak evidence of large improvement for PA (pre: 2(2), post: 3(1), $p = 0.065$, $g = 0.32$). These results are the first to explore the potential benefits of TT for people with early-stage signs and symptoms of dementia. The improvements in cognition and mobility combined with the lack of SCD are a positive outcome, suggesting TT as a promising non-pharmacological intervention that combines physical and cognitive training for people with SCD and MCI. Future studies with larger sample sizes and control group are needed to verify the results.

D2.S3.3(3) 'Adults, Kids & Activity': A novel, multi-method approach to explore a practitioner education intervention

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Inactivity among young people is a growing global concern. Educating adults, or 'practitioners', who work with young people, has been recognised as a potential method to improve Physical Literacy (PL) and subsequent Physical Activity (PA) throughout life. However, few intervention-based studies examine the effects on both practitioners and children. This study employed a novel, multi-method RE-AIM approach (Reach, Effectiveness, Adoption, Implementation, Maintenance) to investigate this multifaceted concept in both key groups. This work aims to demonstrate the application of these methods so others may consider similar approaches. The methods were aligned with an existing ontological model to ensure compatibility (North, 2017, Sport Coaching Research and Practice 1st ed, Routledge). Participants included coaches, teachers, broader PL facilitators and their associated young learners, all of whom provided informed, voluntary consent. Ethics were granted by the University Ethics Panel. Quantitative Methods: Three sequential questionnaires (pre-training, post-training, and six months post-training) assessed self-reported attributes in practitioners—knowledge, confidence, and attitude (Likert scale). Wilcoxon signed-rank tests for non-parametric data were utilized to investigate changes in

these attributes, with rank-biserial correlation [r] used to calculate effect size. Bayesian statistical analysis was conducted to explore changes between organisational groups. Qualitative Methods: Purposeful sampling was used to represent various organisational groups. Interviews with adults captured perceived barriers and facilitators to Adoption and Implementation one year post-training. Children's perspectives (n=12) were explored using Unfinished Stories, a novel drawing-based interview method, to assess Reach. Thematic content analysis was conducted on both verbal data (adults and children) and visual narratives (children). The intervention successfully educated practitioners (n=926), with reported Adoption and Implementation. Significant improvements (p<0.001, r=0.94) were observed and retained six months post-training, although there were significant decreases between post-training and six months (p<0.001, r=0.49). Organisational groups did not differ significantly, with extreme evidence found for equal groups (BF10=<0.001). The methods were suitable for observing these changes. Higher-order themes differed between practitioners and children. Practitioners (n=17) highlighted organisational structure and pedagogy, while children (n=12) emphasised technology, family/friends, and sports/games, often noting the absence of adults. The CV-19 pandemic may have influenced these themes occurring over the collection period. The multi-method RE-AIM approach effectively explored multiple participant groups. The training intervention led to positive statistical changes, supported by practitioner interviews. However, discrepancies were noted between the voices of practitioners and children, particularly regarding digital play. Valuing and accommodating the child's voice in research is crucial to effectively promote PA throughout life.

D2.S3.3(4) The mediating role of fat mass in the relationship between cardiorespiratory fitness with insulin resistance in children

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Improving insulin resistance in childhood may play an important role for reducing the future risk of cardiometabolic diseases. Cardiorespiratory fitness (CRF) may have a beneficial association with insulin resistance in children, yet this association is confounded by body composition. The aim of this study was to investigate the mediating role of fat mass in the relationship of CRF with insulin resistance in children. This study used cross sectional data collected at baseline on a population sample of children taking part in the Physical Activity and Nutrition in Children study (PANIC; Clinical Trial NCT 01803776). Ethics approval was granted by the Research Ethics Committee of the Hospital District of Northern Savo (Kuopio) and guardian consent and participant assent were obtained. A total of 451 (216 girls, 235 boys) 6–8 year olds with complete data were included in the analysis. CRF was determined using peak power output from an incremental cycling exercise test to exhaustion, and subsequently scaled for body mass and lean body mass using both ratio standard and allometric models. Fat mass and lean mass were assessed using dual-energy x-ray absorptiometry. Fasting plasma glucose and serum insulin levels were used to calculate homeostatic model assessment for insulin resistance (HOMA-IR). Ratio scaled CRF for body mass was inversely associated with HOMA-IR in both boys (standardised beta (β) = -0.307; P<0.001) and girls (β = -0.223; P=0.001). However, this association was attenuated with allometrically scaled CRF for body mass (β = -0.155; P=0.019 for boys only) and was no longer significant when scaling CRF for lean mass. Fat mass mediated 80% and 100% (P<0.001) of the association between ratio scaled CRF for body mass and HOMA-IR in girls and boys respectively and 100% (P<0.001) of the association between allometrically scaled CRF for body weight and HOMA-IR in boys. The assumptions for mediation analysis were not met when scaling CRF for lean mass. The relationship between CRF and insulin resistance in children is dependent on the scaling approach to control for body size and composition. A large mediating role for fat mass was observed for the association between CRF scaled for body mass and insulin resistance, indicating this expression of CRF is confounded by body composition. When scaling CRF for lean mass, no significant associations with insulin resistance was observed, suggesting CRF may not have a beneficial effect on this health outcome.

D2.S3.3(5) Co-design of a Physical Activity and Sedentary Behaviour Intervention for Adults with Fabry Disease

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Fabry disease is an inherited metabolic disorder. It is caused by a genetic fault in the alpha-galactosidase A enzyme, which is responsible for catalysing the breakdown of glycoproteins and glycolipids (primarily globotriaosylceramide) in the lysosomes of cells. Individuals with Fabry disease experience a build-up of globotriaosylceramide which results in multi-organ disease, most notably affecting the brain, heart and kidneys. Fabry disease can also have a profound impact on mental health and quality of life. Currently, treatments for Fabry disease are pharmacological and predominantly focus on the physical symptoms of the disease. Non-pharmacological interventions that help to improve mental health and quality of life in Fabry disease are scarce. In the general population and individuals with disabilities, increasing physical activity and reducing sedentary time is associated with improved mental health and quality of life. Therefore, the aim of this study is to co-design a physical activity and sedentary behaviour intervention tailored to the needs of adults with Fabry disease. With university and NHS ethical approvals, views and experiences of physical activity and sedentary behaviour were explored via focus groups with 13 adults with Fabry disease, eight family

members, and six MPS Society (charity) staff. Semi-structured interviews were also conducted with 10 healthcare professionals (consultants, registrars, clinical nurse specialists, and a physiotherapist). The information gathered from the focus groups and interviews informed participatory workshops (with adults with Fabry disease) to test intervention concepts and define the intervention design. Data is being analysed using the Framework Method, combining both inductive and deductive coding. Themes generated from the focus groups and interviews suggest that the intervention would comprise of five components: (1) an initial assessment of baseline physical activity levels and sedentary behaviour, and goal setting with a healthcare professional, (2) tailored feedback on physical activity and sedentary time, (3) online education covering the importance of engaging in physical activity and limiting sedentary behaviour, and examples of adaptable physical activities, (4) a wearable device that tracks physical activity and sedentary time, and (5) peer support. Workshops are currently being planned to test and refine intervention concepts. This study has identified intervention strategies to promote physical activity and limit sedentary behaviour in adults with Fabry disease. The feasibility, acceptability and effectiveness of the co-designed intervention will be subsequently evaluated, which could help to optimise the management of Fabry disease in the future.

D2.S3.4 - Free Communications - Physiology and Nutrition

D2.S3.4(1) Understanding the test-retest reliability and physiological profile associated with a 16.1 km cycling time trial in trained cyclists within cool and hot environmental conditions

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The 16.1 km cycling time trial (TT) is the most popular distance covered by competitive cyclists in the United Kingdom, despite its prevalence, limited literature has actively investigated the changes in physiological and perceptual responses which occur in cool (15°C) and hot (28.5°C) environmental conditions. Exercise within warm environments promotes an increased glycolytic contribution, leading to increased blood lactate (BLa), reduced blood pH and performance when intensity is matched. However, research has typically used time to exhaustion or total work done protocols, which have previously been shown to be less ecologically valid than a fixed distance TT. Despite a plethora of studies investigating the test-retest reliability of the 16.1 km cycling TT under normal laboratory conditions, no literature has investigated the reliability of exercise within a hot environment (28.5°C) and done so using a modern, commercially available, cycle ergometer (Wattbike Pro, Nottingham, England). Therefore, this series of studies aimed to (A) investigate the test-retest reliability of the Wattbike Pro and (B) the associated physiological responses during a 16.1 km TT in both cool and hot conditions. Following institutional ethical approval, for part A, 16 trained cyclists were recruited (O_2max 55.0 ± 9.5 mL.kg^{-1}.min^{-1}; peak power output 365 ± 55 W). Participants performed a familiarisation before completing two experimental TTs. No significant differences were observed between TT1 and TT2 for time, power output and speed (mean difference = 3.25 s, 3.2 W, and 0.15 km·h^{-1}, respectively). All performance data demonstrated excellent reproducibility (CV range = 0.8 – 1.9%) with trivial sTE (0.16 – 0.20). The 16.1 km cycling TT when conducted on a Wattbike Pro ergometer demonstrates a very reliable performance criteria in cohorts of trained cyclists when exercising in hot conditions. In part B, 11 trained cyclists volunteered to participate (VO_2max 54.0 ± 9.9 mL.kg^{-1}.min^{-1} and peak power output 366 ± 37 W) participants performed the procedures above, with the inclusion of 2 additional trials in the cool. Performance in the heat was significantly slower compared to cool (+29.6 s, -14.9 W), with increased blood HCO_3- and pH, with lower BLa concentrations, compared to the cool environment, coinciding with reduced TT performance and RER. During the TT, participants reported similar RPE in both conditions, with significantly greater ratings of fatigue when exercising in the hot conditions with significantly elevated ratings of thermal sensation and thermal comfort. Overall, the 16.1 km TT is reliable, with reduced metabolic strain in hot conditions.

D2.S3.4(2) Assessing Nutrition Knowledge and Dietary Practices among Male and Female Athletes in Colleges of Education in the Volta Region of Ghana

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Nutrition is important in an athlete's life in a variety of ways, contributing to high levels of performance, recovery, and achieving and sustaining health (Ozdoğan & Ozcelik, 2011). Limited research has examined nutrition knowledge and dietary practices of athletes in Colleges of Education (CoE) in Africa, particularly in Ghana. Therefore, the study assessed the nutrition knowledge and dietary practices among male and female athletes in CoE in the Volta Region of Ghana. The study employed a cross-sectional survey design. The population consisted of a total of 330 collegiate athletes (175 males and 155 females). A census technique was adopted for the study. Ethical approval was obtained from the ethics committee of the University of Education. Data was collected both face-to-face and online with an adapted questionnaire by Trakman et al., 2017. The questionnaire contained 30 closed-ended test items and included demographic characteristics,

nutrition knowledge, dietary practices and challenges of dietary practices. Nutrition knowledge section consisted of weight management, macronutrients, micronutrients, hydration, and sports nutrition. Dietary practices section included frequency of food intake. Challenges of dietary practices section included lack of knowledge, cost, time constraints, cultural background, lack of appetite, peer influence, family feeding, long periods of cooking, social media influence and sickness. The questionnaire was validated by supervisors and experts in the department of health, physical education, recreation and sports. The reliability of the questionnaire was done through test-retest method and yielded a Cronbach Alpha value of 0.73. Data was analysed using means, standard deviations, and independent samples t-test and all analyses were done using Statistical Package for Social Sciences version 25.0. The level of significance was $p<0.05$. The study revealed high level of nutrition knowledge ($M = 4.01$, $SD = 0.46$) based on the criterion mean interpretation scale of 3.0 and dietary practices ($M = 2.60$, $SD = 0.41$) based on the criterion mean interpretation scale of 2.5 among participants. The study also revealed that cost, time and family feeding were the major challenges participants faced in the course of dietary practices. There was no statistically significant difference ($p = 0.448$) in dietary practices among participants with respect to gender. The study concluded that participants had high level of nutrition knowledge and dietary practices where gender did not have a significant effect on dietary practices among participants. Additionally, cost, time and family feeding were the major challenges that confronted participants in the course of dietary practices.

D2.S3.5 - Free Communications – Psychology

D2.S3.5(1) Expert Statement: Affective Responses to Exercise

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Introduction: Low rates of physical activity (PA) seem to be an intractable problem among Western populations (Guthold et al., 2018). The traditional public health approach to promoting PA, which focuses on the benefits of exercise and consequences of sedentary behaviour, has been criticised for failing to improve engagement (Hallal et al, 2012), and alternative approaches have been suggested (e.g., Biddle et al., 2021). In the proposed Expert Statement, we will crystallise the evidence pertaining to exercise-related affect as a determinant of exercise behaviour.ackground and Evidence: Affective responses to exercise concern people's feelings towards the concept of exercise, as well as their feelings during exercise. The term affect is broad and includes core affect, emotions, and moods. Core affect underpins all emotions and moods and is proposed to exist on two dimensions of valence (pleasure–displeasure) and activation (low–high arousal). Important considerations for sport and exercise scientists include delineating which construct they are interested in (core affect, emotions or moods), which conceptualisation of the construct is most appropriate and selecting suitable measurement tools (Ekkekakis, 2013).To understand how core affect changes as a function of exercise intensity, Ekkekakis (2003) proposed the Dual Mode Theory. This theory highlights two biological markers – ventilatory threshold (VT) and respiratory compensation point (RCP) – as key turn points for affective responses during exercise. Workloads below VT (moderate) typically result in positive affective responses, between VT and RCP (heavy) there is a variable affective response, and above RCP (severe) there is a universal decline in affective valence. Exercise intensity is considered a substantial determinant of affective response.Contemporary understanding of exercise-related decision making has embraced dual-process models, and affective responses are proposed as significant drivers for the recurrent decision to engage in exercise. The Affective-Reflective Theory of Physical Inactivity (Brand & Ekkekakis, 2018) holds that people's decision to engage in exercise behaviour is driven by two processes, namely automatic (Type 1) and reflective (Type 2) processes. These processes are predicated on affective exercise experiences (e.g., feeling bad during exercise) and cognitive judgments about exercise (e.g., is exercise healthy?), respectively.Experimental evidence supports the importance of affect in future exercise behaviour. Rhodes and Kates' (2015) systematic review concluded that affective responses during moderate-intensity exercise were linked to future activity, and that affective responses during and after exercise were correlated with affective judgements pertaining to future physical activity. In their meta-analysis, Chen et al. (2020) identified that positive affective variables mediated the relationship between an intervention and physical activity.Conclusions and Recommendations:How people experience exercise is of paramount importance in determining their future engagement. An understanding of the relationship between exercise and affective responses can help guide exercise prescription and recommendations. To help promote more pleasant exercise experiences, numerous strategies have been shown to be effective (Hutchinson et al., 2023; Jones et al., 2024; Zenko et al., 2024; for review see Jones & Zenko, 2023).

D2.S3.5(2) A Case Study: The enhancement of association football officiating through the application of performance psychology

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Despite the growing professionalisation of sports, research on the performance psychology of match officials remains limited. For example, only 3% of sports psychology studies delve into referees and match officials (Hancock, Dawson, Auger, 2020, Journal of Sport Psychology, 12, 123-135). The Professional Game Match Officials Limited (PGMOL) has identified nine Key Performance Characteristics (KPCs) essential for measuring the performance and development of match officials. Among these, four align with performance psychology: developmental mindset, resilience, interpersonal skills, and leadership. With institutional ethical approval, this case study focuses on a 30-year-old male referee who has been officiating in the English Football League (EFL) for two years. Referred by his coach to enhance his interpersonal skills and emotional regulation, this intervention aimed to bolster these critical areas using a structured psychological approach based on Keegan's model of applied sport psychology consultancy (Keegan, 2015, Journal of Science and Medicine in Sport, 19, 493). This six-week intervention included three meetings and attendance at one of the referee's matches. The initial assessment noted a strong technical knowledge but highlighted challenges in on field interpersonal interactions, resulting in ineffective communication and rapport building with players. Emotional responses sometimes compromised authority and decision-making. Interventions aimed to improve communication, conflict resolution, and emotional regulation during high-pressure scenarios. These interventions focused on analysing past incidents, identifying breakdown points, and formulating strategies for more effective handling of similar situations. Emotional regulation during high-pressure scenarios, such as when issuing cards or managing mass confrontations, focused on slowing down processes and taking mindful breaths. Throughout the intervention, the match official actively engaged in reflective practice, supplemented using video clips to demonstrate his progress. These clips formed an integral part of the consultancy process, providing tangible evidence of improvement and facilitating targeted feedback. In and post intervention evaluation centered around behavioural changes, match official self-reflection and coach feedback. Results showed significant positive shifts in all areas, with increased acceptance and respect from teams, enhanced confidence, reduced conflict, improved emotional management, and authority maintenance. Observations highlighted the referee's enhanced confidence and reduced conflict in interpersonal interactions, while feedback from the coach emphasised improvements in emotional management and authority maintenance. This case study demonstrates the efficacy of tailored psychological interventions in enhancing the interpersonal skills and emotional regulation of association football match officials. Further research is recommended to explore the enduring effects of such interventions and the applicability of KPCs across officiating levels.

D2.S3.5(3) Minding the Gap: How Trainee Sport and Exercise Psychologists' Navigate the Personal and Professional Divide.

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Objectives: This project examined trainee sport and exercise psychologist's search for coherence between the person and the profession (termed individuation).Methods: The study received ethical approval from the lead author's ethics review committee. Seven participants (5 female and 2 males, aged 20-44 at the first interview) enrolled on a Professional Doctorate in Sport and Exercise Psychology participated in 2-3 individual interviews across 5 years regarding their professional development during training. The semi-structured Interviews have been designed to explore participants' (a) motivations for becoming practitioners, (b) major development tasks, (c) theoretical orientations, (d) role and working styles, (e) influential information sources, (f) criteria for evaluating their service delivery effectiveness, (g) service delivery emotions, and (h) preferred learning methods. Interviews have been audio-recorded and transcribed verbatim. We subjected transcripts to an abductive thematic content analysis to interpret participant's perspectives about the alignment of the personal and professional self.Results: Participants' individuation process reflected qualities of individuality and connectedness. Individuality concerned participants aim to develop a clear sense of self as a practitioner. Movement from relying less on external knowledge and more on trusting personal judgments reflected the development of individuality. Increased self-trust and awareness allowed for movement from 'working on' to 'working with' clients. Connectedness through interpersonal relationships (e.g., peers, supervisors) influenced participants' individuality. An interplay between individuality and connectedness was evidenced when participants asserted their individuality from those whom they were connected.Conclusion: The results illuminate trainee movement along the individuation pathway and how individuals try to negotiate a fit between who they are and their cultures and contexts (Rønnestad & Skovholt, 2013). Findings point to applied implications, such as how to help trainees manage their development.

D2.S3.5(4) A cross-sectional test of the 2 x 2 model of perfectionism and orthorexia in exercisers

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A Cross-sectional Test of the 2 x 2 Model of Perfectionism and Orthorexia in ExercisersObjective: Research has shown that perfectionism is a transdiagnostic risk factor for eating disorders and disordered eating. This extends to orthorexia - an obsession with healthy nutrition. Our initial research in this area has shown cross-sectional and longitudinal links between elements of perfectionism and orthorexia in exercisers. This study builds on this work to provide the first examination of the interaction of perfectionism dimensions – self-oriented and socially prescribed perfectionism - in predicting orthorexia and test of the hypotheses of the 2 x 2 model of perfectionism. Design: A cross-sectional, correlational design was employed.

Method: The study was pre-registered on PyschArchives and approved by a Cross-School Research Ethics Committee (ETH2223-0236). 291 (104 female) gym-goers (M age = 32.91 years, SD = 8.86) completed domain specific measures of perfectionism and orthorexia on one occasion. Procedures outline by Gaudreau and Thompson (2012) were followed to test the hypotheses of the 2 x 2 model of perfectionism and, in the presence of a statistically significant interaction, the Johnson-Neyman (J-N) technique was also used to identify perfectionistic tipping points.Results: The results suggest that levels of orthorexia do differ depending on combinations of perfectionism dimensions. However, the hypotheses of the 2 x 2 model were either unsupported or contradicted. This was because high SOP acted as an antagonising factor rather than buffering factor in the subtypes, and mixed perfectionism was the most problematic subtype. The J-N technique showed two tipping points whereby self-oriented perfectionism was associated with significantly higher levels of total orthorexia and problems with healthy eating at very low levels of socially prescribed perfectionism onwards.Conclusions: Dimensions of perfectionism interact to predict orthorexia but high (versus low) levels of self-oriented perfectionism is associated with higher not lower orthorexia.Keywords: disordered eating, diet, exercise, self-oriented perfectionism, socially prescribed perfectionism

D2.S3.5(5) Exploring how soccer players with perfectionism navigate challenges in talent pathways

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Talent pathways are essential for the development and success of aspiring footballers, yet limited research exists on their experiences within these pathways. The study provides the first qualitative exploration of the experiences associated with perfectionism among footballers in talent pathways and how they respond to challenges in this context. A two-stage approach was adopted. Following institutional ethical approval, in stage one, footballers completed self-report measures of perfectionism and perfectionistic cognitions. From a sample of 26 footballers from talent pathways (e.g., national team pathway, performance schools, club-based academies) who self-identified as perfectionists, 22 footballers (10 males, 12 females, Mage = 16.31 years, SD = 3.73) met the criteria and agreed to participate. In stage two, footballers with higher levels of perfectionism and perfectionistic cognitions (1 SD above the mean of samples from previous studies) participated in semi-structured one-to-one interviews. Four participated in pilot interviews (Mage = 17 years, SD = 5.35) and the remaining 18 formed the final sample for interviews (10 female, 8 male; 14 adolescents, 4 adults, Mage = 16.17 years, SD = 3.47). The main interview questions were based on previous qualitative studies of perfectionism in sport (e.g., Hill et al., 2015) and aimed to explore experiences related to Flett and Hewitt's (2016) concept of perfectionistic reactivity (e.g., "Can you describe in what way(s) your perfectionism shows itself?"). The analysis followed the steps of semantic thematic analysis as outlined by Braun and Clarke (2021), and to ensure qualitative quality, Tracy's (2010) "big eight" criteria were rigorously followed. Seven themes were identified: (1) cycles of anxiety, (2) sadness at being a substitute, (3) self-criticism and hopelessness during slumps, (4) ruminating on mistakes, (5) worthless when injured, (6) shame in success and intolerance of defeat, and (7) punishment for failure: psychological distress. Participants experienced heightened anxiety before and during performance, especially when they were substitutes. In the face of poor performance, mistakes, and injuries, participants were likely to respond with self-criticism, hopelessness, and negative emotions. Post-match, they ruminated after both success and defeat, with some reporting extreme psychological difficulties (e.g., eating disorder symptoms). The results suggest that perfectionism impacts aspiring footballers, often hindering routine parts of participation and ability to handle setbacks and performance difficulties. This study highlights the need for targeted sport psychology interventions to address perfectionistic tendencies and support athlete well-being.

Posters Day 1

D1.P1 Should external load quantification for female wheelchair basketball be individualised?

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Quantifying external match load (EML) in wheelchair court sports is vital for effective management of training programs and optimizing competitive performance (Paulson and Goosey-Tolfrey, 2017, International Journal of Sports Physiology and Performance, 12, 275 – 286). The aim of this study was to examine the agreement between fixed and individualised (IND) speed zones used to quantify EML and their relationship with internal match load (IML) measures. Following ethical approval, 31 female wheelchair basketball players (age: 28 ± 7 years, experience: 11 ± 5 years, weekly training: 12 ± 4 h) had their EML measured using inertial measurement units (Movesense Active, 52 hz) with one on wheelchair frame, and one on hub of wheel (Rietveld et al, 2019, PLoS ONE, 14). IML was quantified using the summated heart rate (HR) zone method and a session RPE (sRPE) using the Borg CR-10 scale (Borg, 1998). Eleven international players (INT) were observed over 13 friendly international level games (71 observations) and 20 premier league players (WPL) over 1 - 2 games (24 observations). The percentage time spent in six speed zones was compared for ARB (<0, 0–1, 1-2, 2-3, 3-4, >4 m.s-1) and IND (<0, 0-20, 20–50, 50–80, 80–95, >95% max velocity) zonal methods using an ANOVA. Additionally, absolute time spent in these zones was correlated with IML using Pearson and Spearman Rho correlations in SPSS. The IND method resulted in more time spent in the low-speed zone (Z3), than the fixed method at both international (d = 3.75, 95% CI: -0.03 to 0.02) and WPL (d = 2.63, 95% CI: 0.03 to 0.07) levels ($p < 0.001$). The fixed method resulted in more time spent in the high (Z5, $d \geq 4.32$) and very high (Z6, $d \geq 2.11$) zones, compared to the IND method, at both levels ($p < 0.001$). Greater differences were observed between methods at the INT level (Z5, d = 18.57; Z6, d = 4.89) compared to the WPL level (Z5, d = 4.32, Z6, d = 2.11) ($p < 0.025$). Both competition levels showed large correlations between zones 2 – 4 and IML using both zonal methods (r = 0.69 – 0.91, 95% CI: > 0.54 to < 0.96). This study highlights discrepancies in EML quantification between the two zonal methods, supporting the need for further research regarding the application of IND speed zones in wheelchair basketball.

D1.P2 Effectiveness of a psychosocial skills and characteristics development programme embedded into an English male professional soccer academy

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Psychosocial skills and characteristics (PSCs) are believed to be the key drivers in realising development of potential in soccer academies (Till and Baker, 2020, Frontiers in Psychology 11, 1664-1078). The aim of this study was to explore the effectiveness of an individualised 21-week PSC development program in a male Category 3 soccer academy based on previous research (Mitchell, Cowburn, Piggott, Littlewood, Cook, and Till, 2022, Sport Psychologist, 36(2), 1-42; Mitchell, Cowburn, Alder, Till, Littlewood, Cook, and Piggott, 2024, International Sport Coaching Journal, (Ahead of Print), 1-13). Ethical approval was granted from the University of Central Lancashire's institutional ethics committee (BAHSS2 0305). Nine players (age 12.63 ± 0.18 years) from the U13 squad volunteered to participate in the study. An action research methodology was used (Lewin, 1946, Journal of Social Issues 2, 34-46) whereby the lead researcher was embedded within the academy to plan, implement, and review the PSC development programme in accordance with academy coaches (n = 2). Data were gathered pre- and post-PSC intervention using the psychological characteristics of developing excellence questionnaire version 2 (PCDEQ2) (Hill, MacNamara and Collins, 2019, European Journal of Sport Science, 19(4), 517-528) and performance profiles (Butler and Hardy, 1992, The Sport Psychologist, 6, 253–264). Changes in player PSCs were analysed using paired samples t-tests with Cohen's d effect size used to determine the magnitude of change. For PCDEQ2 scores, small positive effects were noted for self-directed control and management (d = 0.31) and active coping (d = 0.27). Imagery and active preparation (d = -0.42), perfectionistic tendencies (d = -0.43) and seeking and using social support (d = -0.22) showed negative small effects. For the performance profile scores, moderate positive effects were observed on emotional control (d = 0.76), self-awareness (d = 0.52), and being a good learner (d = 0.47). Moderate negative effects were observed for commitment (d = -0.56), and concentration (d = -0.79). In conclusion, a 21-week PSC development programme embedded within a Category 3 soccer academy had both small-to-moderate positive and negative effects on player PSCs. Further research is needed to explore effectiveness of approaches for delivering PSCs in soccer academy environments in conjunction with academy coaches.

D1.P3 Mastering the Game: Understanding the performance psychology component of the PGMOL key performance characteristics model of elite match officiating in association football.

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Key Performance Characteristics (KPC) are specific attributes and skills essential for achieving high standards and consistent performance in association football match officials (referees and assistant referees). The Professional Game Match Officials Limited (PGMOL) KPC model is a theoretical framework with nine KPCs, developed by an expert panel of active and former elite match officials, PGMOL coaches and support staff, and English Premier League (EPL) academy coaches. Ethical approval for this review was granted, ensuring adherence to all ethical guidelines and standards. In elite match officiating, KPCs are the cornerstone of holistic performance, development, and assessment. The PGMOL formulated nine KPCs including Developmental Mindset, Leadership, Interpersonal Skills, Match Day Communication, Football Insights, Resilience, Lifestyle Management, and Physical Attributes. Elite match officiating in competitive matches demands exceptional psychological and performance capabilities. MacMahon and Plessner (2008) (MacMahon and Plessner, 2008, International Journal of Sports Science & Coaching, 3, 141-160) highlight the importance of performance metrics in maintaining fairness and integrity in competitive environments. This study explores the significance of KPCs in the context of elite match officiating, focusing on the four KPCs rooted in performance psychology: Leadership, Developmental Mindset, Interpersonal Skills, and Resilience. These psychological characteristics are grounded in Bandura's Social Cognitive Theory, which hypothesises that personal factors, behaviour, and environmental influences interact to contribute to individual performance (Bandura, 1986, Social foundations of thought and action: A social cognitive theory. Englewood Cliffs). Understanding these KPCs is vital as they help match officials manage the pressures and challenges inherent in their roles. For instance, resilience enables match officials to recover from setbacks, a developmental mindset fosters continuous improvement, leadership skills facilitate effective management of on-field dynamics, and strong interpersonal skills enhance communication with players and coaches. By systematically analysing these KPCs, this framework provides a comprehensive structure for developing targeted training programmes enhancing the performance of elite association football match officials. By strengthening these KPCs, match officials can experience a comprehensive approach to their development. This review provides a foundation for future research on the impact of KPCs on elite match official holistic development. The implementation of psychological support systems within match officials' development programmes aims to optimise the performance and well-being of elite match officials. This research highlights the critical role of psychological preparedness in achieving excellence in officiating, advocating for a thorough and all-embracing approach to match officials' development that integrates technical skills, psychological and physical aspects of performance.

D1.P4 Criterion metric choice alters high-intensity phase demands in university female soccer players.

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High-intensity phases (HIP) or worst-case scenarios (i.e. the highest demand phase for a set time interval) are commonly reported in football codes as the peak value for each criterion metric (Whitehead et al. 2018, Sports
Medicine, 48, 2549-2575). However, in practice these demands may not occur concurrently. Therefore, this study aimed to 1) determine if demands are affected by the criterion metric used to calculate 5-minute HIP demands. and 2) identify the timing of 5-minute HIPs for criterion metrics (total distance (TD), high-speed running (HSR), and sprint distance (SD)) After institutional ethical approval, twenty female university soccer players (age 20.0 ± 1.3, mass 64.9 ± 12.9 kg) were monitored over 6 competitive fixtures using Global Positioning Systems (GPS; Catapult, Australia). Players were required to play >60 minutes to be included in the analysis, totalling 53 observations with 5-minute HIP based on TD, HSR and SD. Speed zones were calculated as HSR; 15.6-20.0km/h, sprinting >20.0km/h. Two-way repeated measures ANOVAs were calculated using Jamovi (version 2.3.28) to determine differences between metrics and occurrence time based on the criterion metric and position. Where appropriate post-hoc Tukey pairwise comparisons were calculated. Differences were observed for TD ($P<0.001$), HSR ($P<0.001$), SD ($P<0.001$), and time ($P=0.001$) depending on the criterion metric. Interaction effects between metric and position did not show differences (TD $P=0.386$; HSR, $P=0.843$; SD, $P=0.334$), similarly for time and position ($P=0.189$). Post-hoc testing showed TD phases yielded greater TD ($P<0.001$) than HSR ($d=1.14$) and SD ($d=1.34$) and HSR TD was greater than SD ($P < 0.036$; $d = 0.28$). Defenders had lower TD than attackers ($P = 0.025$) HSR phases produced greater HSR ($P<0.001$) than TD ($d=0.68$) and SD ($d=0.39$) and TD was lower compared to SD phases ($P=0.006$; $d=0.22$). Attackers had greater HSR values than defenders ($P<0.001$) and midfielders ($P=0.002$). SD phases contained greater SD ($P<0.001$) values compared to TD ($d=0.85$) and SD ($d=0.32$) and HSR contained greater SD compared to TD ($P<0.001$; $d=0.53$). Attackers had greater SD values than defenders ($P<0.008$) and midfielders ($P=0.011$). Timing of the TD phase was different to HSR ($P<0.001$; $d=0.62$) but not sprint distance ($P<0.095$; $d=0.36$). HSR and SD did not appear different ($P<0.77$; $d=0.25$). Positional differences were not observed ($P=0.644$). These data show that the criterion metric used to determine HIPs will alter the amount of high-intensity running for the phase. Further, these phases can occur at different time points which can have implications for the replication of HIPs.

D1.P5 Disentangling Gender and Relative Age Effects in Women's and Girls' Rugby Union

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Relative age effects (RAEs) within sports refer to the over-representation of athletes born earlier in the selection year and the underrepresentation of those born later in the selection year. Research examining RAEs in women's and girls' rugby union remains limited in comparison to the male literature, whilst the impacts of RAEs on the youth-to-senior transition are yet to be explored in a female sport context. As such, the purpose of this study was to examine RAEs during entry into the women's and girls' premiership and international rugby union pathways in England, as well as to compare them to their respective senior cohort (n = 1367): (a) U18 England Rugby Centre of Excellence Player (n = 325) vs. Senior Premiership Player (n = 868), and (b) U18 England Player (n = 49) vs. Senior England Player (n = 125). This study was authorized by England Rugby and gained ethical approval from the Health, Education, and Life Sciences Faculty Academic Ethics Committee at Birmingham City University (reference code: Kelly/6263/R(V)/2020/Mar/HELS FAEC). Chi-square ($\chi 2$) analyses compared birth quarter (BQ) distributions against expected distributions. The findings revealed no significant difference in BQ distributions at either youth or senior levels, as well as no significant differences in the BQ distributions of those who were likely to transition from youth to senior levels (all $p > 0.05$). Importantly, though, descriptive statistics showed a skewed birthdate distribution in both U18 England Rugby Centre of Excellence Player (BQ1 = 30% vs. BQ4 = 20%) and U18 England Player cohorts (BQ1 = 33% vs. BQ4 = 18%). We highlight the gender-specific mechanisms that potentially explain the variations between male and female RAEs in rugby union, including developmental differences, sport popularity, and sociocultural norms. We also warn against a 'copy and paste' template from the male provision to ensure the recent growth of female rugby union does not fall victim to the same RAEs in the future (Kelly, A. L. et al., 2024, J Funct Morphol Kinesiol, 9, 61).

D1.P6 Multidimensional perfectionism and sport performance: A systematic review and meta-analysis.

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Evidence regarding the relationship between perfectionism and sport performance is inconsistent, leading to an ongoing debate about whether perfectionism helps or hinders athletes in achieving their best performance and future success. To address this, we provide a systematic review and meta-analysis of research examining the relationship between multidimensional perfectionism and sport performance. Following PRISMA guidelines from Page et al. ([2021]. BMJ, 372), a search was performed through five different databases (PsycINFO, PsycARTICLES, MEDLINE, SPORTDiscuss and ProQuest Dissertations & Theses), google scholar, and contact with corresponding authors for unpublished data. Primary studies that quantitatively examined the relationship between multidimensional perfectionism (perfectionistic striving and concerns) and sport performance were included. Random-effects models were used to derive effect sizes (r+) and confidence intervals (95% CI). Partial correlation (Cohen, J., Cohen, P., West, S. G., & Aiken, L. S., 2003, Applied multiple regression/correlation analysis for the behavioral sciences. NJ: Erlbaum), total unique effects from Hill et al. ([2021]. Personality and Individual Differences, 183), and moderating factors (perfectionism subscale, sport type, sample type, gender, age, study quality, PC) were also examined. A literature search returned 28 studies with 45 samples (N = 6,068). The results of the systematic review suggest that research varies considerably in methodological approach and provided mixed findings for perfectionistic strivings and perfectionistic concerns. For objective performance in the meta-analysis, perfectionistic strivings were positively related to sport performance (r+ = .21; CI = .16, .26), while perfectionistic concerns were unrelated (r+ = .04; CI = −.01, .09). After controlling for the relationship between the two dimensions of perfectionism, partialled perfectionistic strivings showed a similar relationship (r+ = .22; CI = .17, .28), whereas partialled perfectionistic concerns had a small negative relationship with sport performance (r+ = −.06; CI = −.10, −.02). When the two effects were combined, the total unique effect revealed that perfectionism, overall, was positively associated with sport performance (TUE = .19; CI = .14, .23), with perfectionistic striving being most responsible for the effect. Moderation analyses suggested that the relationship between perfectionistic strivings and performance was stronger as athletes got older. There was also tentative evidence that the relationship was not evident for some subdimensions of perfectionism (e.g., self-oriented perfectionism), in team sports, or with adolescent athletes. Important questions still remain regarding this relationship over time (e.g., longitudinal), with other performance outcomes (e.g., selection), and the degree to which the relationship is confounded by other constructs (e.g., excellencism).

D1.P7 Countermovement Jump Force-Time Curve Analysis in Female Athletes at Risk of REDs

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Relative Energy Deficiency in Sport (REDs) syndrome can result in reduced muscle strength and power output which can decrease sporting performance in athletes. Such neuromuscular qualities are of key importance to female athletes since they underpin many sporting tasks that they are required to

complete during training and competition. Recently, the International Olympic Committee (Mountjoy et al., 2023) highlighted the need for further research into how REDs may impact neuromuscular qualities with the countermovement jump (CMJ) listed as a preferred method to assess decreased power performance. Therefore, this study investigated if CMJ performance differed in female athletes at risk of REDs compared to those not at risk. 88 female team sport athletes (20 ± 6.0yrs) volunteered to participate in the study. With institutional ethics approval, all participants completed the LEAF-Q and EDE-Q and were defined as REDs Mild Risk (n = 17) or REDs No-Risk (n = 71) as per recent IOC recommendations to indicate primary and secondary indicators of REDs, such as impaired reproductive function, gastrointestinal function, and mental health. Following this, all participants performed the CMJ in which discrete force-time analysis of CMJ subphases (unloading, eccentric, concentric) was completed. Additionally, statistical parametric mapping (SPM) was used to assess differences between groups for force–, power–, velocity–, and displacement–time curves. For all discrete force-time measures, differences between groups were not statistically significant ($p > 0.05$) with trivial to small effect sizes observed (g* range with 95% CI = 0.00 – 0.47 (–0.96-1.02)). SPM analysis also found no statistically significant ($p > 0.05$) differences between groups for continuous curve measures. The findings from this study suggest that acute neuromuscular qualities may not be different in female athletes who are at mild risk of REDs. This may be because short duration, maximal performance may not be sensitive to the negative effects of REDs symptoms. Future research is needed to establish the usefulness of the CMJ as a method to study the outcomes of REDs on power performance whether this is influenced by the risk/severity of REDs symptoms.

D1.P8 The effects of student-athletes' global sleep quality on intrusive visual imagery

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Sleep plays a significant role in maintaining our physical, emotional, and cognitive health across the lifespan (Illingworth, Interface Focus, 2020, 10, 1-8). When optimal sleep outcomes are disrupted these same processes can be adversely affected. One such cognitive process concerns reported higher frequencies of disruptive spontaneous thoughts (Cardenas-Egúsquiza & Bernsten, Consciousness and Cognition, 2022, 105, 103401). With evidence that student-athletes exhibit a high prevalence of undesirable sleep characteristics (Wilson et al. Scandinavian Journal of Medicine and Science in Sports, 2024, 34, 1-11), there is a need in this population to explore negative psychological factors associated with mental health related issues and determine whether they become exacerbated by poor sleep quality. Thus, the aim of this study was to explore student-athlete differences in self-reported global sleep quality and spontaneous levels of intrusive visual imagery. After institutional ethics approval, 126 undergraduate student-athletes (Mage = 19.2 years, SDage = 2.07, males = 52%, females = 48%) completed a measure of intrusive visual imagery (McCarthy-Jones et al., Consciousness and Cognition, 2012, 21, 1375-1381), and the Pittsburgh Sleep Quality Index (Buysse et al. Psychiatry Research, 1989, 28, 193-221). Using the PSQI global subscale, three sleep quality cut-off groupings distinguished between disturbed (>8), poor (>5), and good (≤5) quality sleepers. A One-way ANOVA was calculated to ascertain differences between sleep quality groupings and recorded levels of intrusive visual imagery. Test of homogeneity of variances between groups was violated, therefore Welch's F-ratio was used. There was a significant effect of sleep quality grouping on levels of intrusive visual imagery scores ($P = .012$, $r = .28$). There was a significant linear trend ($P = .001$, $r = .28$), indicating that as the PSQI global grouping scores increased, intrusive visual imagery scores increased also. Planned contrasts demonstrated student-athletes recording PSQI global scores of 5 or less experienced significantly less intrusive visual imagery than student-athletes reporting PSQI global scores of >5 and >8 respectively ($P = .004$, $r = .36$). However, no significant differences between student-athletes in groups reporting PSQI global scores of >5 and >8, ($P = .244$, $r = .14$) were found. Our results suggest student-athletes experiencing poor sleep quality are more prone to report higher levels of intrusive visual imagery. As recurrent episodes of intrusive images can be disruptive and distressing, future investigations and practitioners working with student-athletes should consider the implication of this link from an emotional and cognitive health perspective.

D1.P9 Psychosocial Outcomes of Participation in Sport

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Youth participation in sport has the potential to facilitate positive youth development (PYD). Life skills (LS), a form of PYD, are defined as skills that individuals develop allowing them to be successful in the different environments in which they live (Danish et al., 2004, World Leisure Journal, 46(3), 38-49). Within existing sport psychology literature, there have been calls to explore correlates of LS development in sport, such as wellbeing, sport enjoyment, and sport engagement. By building an understanding of the correlates of LS developed by young people in sport, this can contribute to the PYD evidence base. Therefore, the aim of the current study was to examine the relationships between LS youth athletes perceived they have developed through sport and their perceived mental wellbeing, sport enjoyment, and engagement in sport. Following institutional ethical approval, a cross-sectional questionnaire study was conducted. In total, 182 athletes (female n = 71; male n = 111; M age = 13.70, SD = 1.38) who took part in individual (n = 26) and team (n = 156) sports completed a questionnaire measuring LS development in sport (teamwork, leadership, social skills, emotional skills, interpersonal

communication, time management, problem solving and decision making, and goal setting), mental wellbeing, sport enjoyment, and sport engagement. Results of correlation analyses indicated significant, positive, moderate associations between youth athletes' perceptions of the eight LS measured and mental wellbeing (r's = .53 - .67). Similarly, significant, positive, moderate correlations were found between youth athletes' perceptions of all LS and sport engagement (r's = .42 - .59). There were also significant, positive, weak-to-moderate associations between sport enjoyment and teamwork, goal setting, interpersonal communication, social skills, and leadership (r's = .21 - .31). Overall, findings of the current study indicate that youth athletes' perceptions of LS developed through sport demonstrate positive associations with their mental wellbeing, enjoyment of, and engagement with sport. This supports previous research outlining associations between LS development and greater psychological wellbeing (Cronin & Allen [2018]. International Journal of Sports Science & Coaching, 13(6), 815-827). Findings add understanding to existing literature of associations between sport engagement and enjoyment, and perception of LS development. This could form a consideration within the design of LS development interventions, if levels of sport engagement and enjoyment appear beneficial for the development of LS. Future research could explore how and why young people perceive these outcomes might be associated with the LS development and transfer processes.

D1.P10 The effects of the menstrual cycle and oral contraceptive use on women's football performance and performance related outcomes: a systematic review

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Women's soccer has seen increases in participation, popularity and professionalisation in recent years (Datson et al., 2017, The Journal of Strength & Conditioning Research, 31(9), 2379-2387) subsequently, resulting in an increase in scientific research in women's soccer (Okholm Kryger et al., 2022, Science and Medicine in Football, 6(5), 549-558). Although previous systematic and narrative reviews have been published on the menstrual cycle (MC) and exercise performance (McNulty et al., 2020, Sports Medicine, 50(10), 1813-1827) the MC and athletic performance, (Carmichael et al., 2021, International journal of environmental research and public health, 18(4), 1667; Meignié et al., 2021, Frontiers in physiology, 12, 654585) and the effects of oral contraceptive pills (OCP) on exercise performance (Elliott-Sale et al., 2020a, Sports Medicine, 50(10), 1785-1812) at the time this systematic review began, a systematic review on the effects of the MC and/or OCP use on soccer performance was yet to be published. Therefore, this review aimed to determine the effects of the MC and/or OCP use on soccer performance and performance-related outcomes and provide evidence-based, practical, performance recommendations which could help to enhance performance, training adaptations and reduce injury risk/injury rates. Institutional ethical approval was not required for this systematic review. Five databases (SportDiscus, PubMed, CINAHL, MEDLINE and Scopus) were searched for published studies which had assessed match physical performance, football performance-related physical or physiological outcomes, biomechanical measures or injury in two or more defined MC phases (McNulty et al., 2020, Sports Medicine, 50 (10), 1813-1827). Study quality was assessed using a modified Downs and Black checklist (Downs & Black, 1998, Journal of epidemiology and community health, 52(6), 377–384) and a strategy based on the recommendations of the Grading of Recommendations Assessment Development and Evaluation (GRADE) working group. Twelve studies and 404 participants were included. Six studies (50%) were classified as very low quality, three (25%) were classified as low quality, three (25%) were classified as moderate quality. Results suggested the impact of MC/OCP use on soccer performance is inconclusive. No significant differences were observed in anaerobic performance while significant differences were observed in some aerobic and match physical performance outcomes but not in others. Similarly, findings from studies assessing biomechanical outcomes and injury incidence were also conflicting. Overall, it is difficult to form definitive conclusions on the effects of MC phase/OCP use on soccer performance or

soccer performance-related outcomes. Therefore, further, more high-quality research is needed.

Posters Day 2

D2.P1 Effects of strength and endurance training on conditional motor capacities: strength, speed, and endurance in youth athletes.

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Strength and endurance programs (SEP) have demonstrated significant effects on the synthesis of contractile proteins responsible for muscle hypertrophy, as well as proteins involved in oxidative metabolism (Coffey & Hawley, 2007, Sports Medicine, 37, 737-763). These adaptations are particularly relevant for developing conditional physical capacities in children and adolescents (Kolb, S., Burchartz, A., et. al. 2021, International journal of environmental research and public health, 18(20), 10711). The present study aims to evaluate the effect of SEP on the physical capacities of endurance, strength, and speed in children and adolescents. This quantitative research utilized a non-probabilistic random sample of 24 athletes (11 females and 13 males, mean age 12.5 ± 3.7 years). Participants were divided into two groups: experimental (EG) and control (CG). Baseline measurements included anthropometric characteristics, strength (assessed using the 1RM test), and endurance (evaluated using the cyclic Luc Leger test for VO_2Max). The SEP intervention was conducted over eight weeks with four sessions per week, incorporating strength training at 50% of 1RM and varying aerobic and anaerobic endurance training. Lower body power was assessed using Vertical Jump (VJ) and Horizontal Jump (HJ) tests (Gutiérrez-Dávila et al., 2012). Lactic anaerobic power was measured with the 300m test, upper body power with a 4kg medicine ball throw test, and speed with a 50m flat test to measure Reaction Speed (RS) in the first 20m and Maximum Cyclic Speed (MCS) in the last 20m. Post-intervention results showed significant improvements in the EG compared to the CG. Specifically, strength gains in the upper body (chest 34%, shoulder 14%) and lower body (quadriceps 20%, hamstrings 9%) were higher in the EG. VO2Max increased by 5% in the EG, surpassing the CG. The EG also showed a 2% advantage in the 300m test, a 7% greater improvement in RS and MCS, and a 4% higher Average Ascent Speed (AAS). Additionally, the VJ test revealed a 9% difference favoring the EG. A t-test was conducted to examine the relationship between mean values in the control and experimental groups. The analysis revealed no significant relationship between VO_2Max and 1RM chest ($P<0.05$). Overall, the findings suggest that while all participants improved across all conditional capacities, the experimental group, which underwent the 8-week SEP at 50% of 1RM, exhibited a greater percentage increase in endurance (AAS, VO_2Max), lower body power (VJ, SAPJSI), lactic power, and upper body power capacities compared to the control group.

D2.P2 Investigating the sleep behaviours of international equestrian event riders

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Eventing is a high-risk sport that demands optimal cognitive functioning for both performance and safety. Despite the known relationship between poor sleep and impaired cognitive performance (Fullagar et al., Sports Medicine, 2015, 161-186), there is no existing research on sleep in international equestrian athletes. Therefore, the aim of this study was to investigate sleep behaviours in this population. The study received institutional ethical approval and consisted of two components. First, the Athlete Sleep Screening Questionnaire (ASSQ) was used as an athlete-specific sleep-screening tool (Samuels et al., British Journal of Sports Medicine, 2016, 50, 418-422). A total of 230 participants (18-24 years = 43%, 25-29 years = 18%, ≥30 years = 39%, females = 80%) completed the ASSQ in an online survey from August 2023 to February 2024. Sleep difficulty scores (SDS) were calculated from the ASSQ, and participants were categorised into none/mild (SDS ≤ 7), moderate (SDS 8-10), and severe (SDS ≥11) sleep difficulty groups. Second, sleep during a four-day competition in August 2023 was assessed using wrist-worn actigraphy (GENEActiv, Activinsights) in 20 participants (Mage = 26.6 years, SDage = 8.5, females = 50%). Raw accelerometer data were analysed using the GGIR R-package and the van Hees algorithm (van

Hees et al., PLoS ONE, 2015, 10, e0142533). The mean SDS was 6.8 (SD = 3.2), with 22% and 14% of participants classified as having moderate and severe sleep difficulties, respectively. The average actigraphy-derived total sleep time during the competition was 6.1 ± 1.1 hours, with notable intra- and inter-individual variation in sleep outcomes. A Mann-Whitney U test revealed that total sleep time was shorter in male (Mdn = 5.6 hours, IQR = 5.1 to 6.5 hours) than female (Mdn = 6.8 hours, IQR = 6.1 to 7.2 hours) competitors ($Z = 4.17$, $P < 0.001$). These results indicate a high prevalence of poor sleep among international event riders, with characteristics exceeding those of other athlete populations assessed with the ASSQ. Furthermore, short sleep durations were also common during competition, particularly in male eventers. Therefore, understanding the factors underlying these findings, implementing structural changes, and designing targeted interventions to improve sleep practices in eventing is essential.

D2.P3 An evaluation of the soccer talent ID workforce in England: life histories and learning journeys

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Developing and understanding the workforce is essential in being able to adapt, refine, and deliver continuing professional development for that workforce (Thistlethwaite et al., 2019, Journal of Interprofessional Care, 33, 361-368). Sport organisations that have well-managed training and development programmes can more easily retain employees and provide future leaders for the organisation. The aim of this study was to gather and analyse the perspectives of those within the soccer Talent ID profession. With institutional ethics approval 85 participants from men's, women's, and disability soccer were invited to complete an online survey consisting of demographic data, work history, learning history as well as barriers and facilitators to development within the workforce. Within the 5-point Likert scale positive responses were classified as 'likely' and 'very likely'. Differences between full-time and part-time employers were examined using independent sample t-tests. Statistical significance was set at $p < 0.05$. The workforce is male dominated (91%) with few under the age of 30y (14%) and over half part-time (54%). There were no statistically significant differences in demographics between part-time or full-time roles ($p > 0.05$). Over two thirds of the workforce (68%) see a pathway for them to progress within the workforce and a large percentage feel valued in their workplace (85%). Nearly all participants (94%) have an FA TID qualification, with most of these at level 1 and 2. Differences in education and skills between full time and part time roles were non- significant ($p > 0.05$). Technical knowledge is perceived as the most important skill required to be successful in TID but playing experience and qualifications least important. A range of informal learning was identified with 11% of using the FA Learning portal and 30% seeking knowledge gain via podcasts and webinars. Only 45% felt confident identifying psycho-social qualities but nearly two thirds were confident that they could predict future talent. As the workforce is predominantly part-time they are hard to reach, and male biased with small female and disability sectors. The workforce feels valued but a third cannot see a career pathway. The main perceived barriers to progressing in the workforce were holding a strong network in soccer, the potential to take qualifications that prepare for higher roles, and a lack of full-time opportunities. Establishing 'pods' to share knowledge regarding working in the TID job market through the talent ID courses and mentorship programmes could be one solution to development within the workforce.

D2.P4 Relationship between fundamental movement skills, fitness and ACL injury risk in grassroots footballers aged 11-13 years

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Anterior Cruciate Ligament (ACL) injury during childhood can cause significant long term negative impact on physical activity and health. Although pediatric ACL injuries have historically been uncommon, there has been a distinct increase in pediatric ACL injury prevalence since 2005 leading to calls for research examining correlates of knee injury risk in children (<14 years). Lack of competence in fundamental movement skills (FMS) has been suggested as a possible contributor to increased ACL injury risk (Heering et al., 2023, Physical Therapy in Sport, 61, 37-44). This is because well developed FMS could lead to better motor control during specialised movement performance resulting in lower likelihood of injury. No study to date has examined the association between competence in FMS and ACL injury risk. This study addressed this issue. Following ethics approval and informed consent, 34 boys, 11-13 years of age (Mean ± SD = 11.7 ± 1 years, 154.4 ± 10.4cm, 43.5 ± 9.9kg) took part in the study. To be eligible, children had to be registered (and playing) with a grassroots soccer club with at least 1 year playing experience prior to participation. Maturity offset was determined using the Moore et al (2015, Medicine and Science in Sports and Exercise, 47, 1755-1764) prediction equation. ACL injury risk was determined using the landing error scoring system (LESS, Padua, et al., 2015 Journal of Athletic Training, 50, 589-595) and FMS was assessed using the Test of Gross Motor Development-3 (Ulrich, et al., 2020, TGMD-3 examiner's manual. Indianapolis, ProEd). Sprint speed (5,10,20m), counter movement jump height and change of direction speed (5-0-5 test) were determined. To

examine the relationship between LESS scores, FMS, fitness variables, and maturity offset, backwards stepwise multiple linear regression were employed. Pearson's product moment correlations were also calculated. Pearson's product moment relationships were significant between maturity offset (r = -.273, P = .001) and FMS (r = -.713, P =.001) and LESS. Fitness variables were not (all P>.05). Backwards linear multiple regression indicated a parsimonious model (F 1,23 = 19.388, P = .001, Adj R2 =.44) which explained 44% of the variance in LESS scores with only FMS (β = -.601, P = .001) significantly contributing to the model. The present study provides empirical evidence to support suggestions that FMS may be important in reducing high risk movement patterns associated with subsequent ACL injury. Promoting a broad range of competence in FMS through physical education or sport during childhood may therefore have benefit in reducing ACL injury risk.

D2.P5 Estimating exercise intensity thresholds using predicted versus measured peak values: a reliable approach for domain determination?

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The accurate determination of exercise intensity domains is crucial for both athletic and clinical settings, particularly within cardiac rehabilitation (CR) (Mezzani et al, 2013, European Journal of Preventive Cardiology, 20(3), 442-467). Gold standard methods for these estimations are based on cardio-pulmonary exercise testing (CPET), which is not always available as it requires specialist staff and facilities. The aim of this study was to determine if using predicted peak heart rate (HR) and work rate (WR) equations can provide exercise intensity thresholds that correlate to those obtained from CPET. With institutional ethical approval, a total of 155 participants between the ages of 9-65 (mean 35±16) years undertook incremental ramp protocol (5-30 W*min-1) maximal CPET testing on a reclined cycle ergometer, as part of a cardiac imaging study. Gas exchange threshold (GET) was identified using the V-slope and ventilation equivalent for O2 methods. Three methods of determining or predicting HR and WR at high and moderate exercise intensity domains were evaluated: 1. Based on GET values (Method A – Gold standard) 2. Based on peak exercise observed HR and WR (Method B). 3. Based on age and sex predicted peak HR and WR (Method C). The accuracy of measured HR and WR at high and moderate thresholds was tested, ensuring significant differences between each threshold, respectively. Agreement between methods were assessed using Lin's concordance coefficient and Bland-Altman mean difference and limits of agreement. Method B demonstrated the highest overall agreement with Method A in predicting WR and HR thresholds, particularly for high work rate thresholds (WR: concordance correlation, r=0.976; HR: concordance r=0.904). Method C, while showing no systematic bias compared to Method A (mean difference average of 0 for both HR and WR), exhibited lower concordance (average concordance r was WR=0.647, HR=0.387). For estimating HR there was also proportional bias, indicating less reliable predictions at low and high values. This study showed that exercise intensity domains are best estimated based on peak observed parameters, rather than estimated via age and/or gender. This has important implications for practice in supervised CR, emphasising the value of maximal exercise testing, even without gas exchange measurements. These findings can be translated into a framework where modality specific, patient individual peak HR or WR (watts, speed, body mass etc) can be translated into more accurate exercise intensity domains, potentially improving CR efficacy and adherence.

D2.P6 The effect of external load position on patellar tendon kinetics during the Spanish squat

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The Spanish squat (SPS) is an exercise that places high demands on the patellar tendon compared to a bodyweight squat (Needham, R.A., Corns, A., Bodden, J., Walker, P., Carter, R. (2019, July 31–August 4). A biomechanical investigation of the Spanish squat: The effect of trunk inclination and load on quadriceps activity and patellar tendon force [Poster presentation]. International Society of Biomechanics, Calgary, Canada). In the corresponding study, an increase in peak patellar tendon force (PTF) was noted when trunk posture moved from a 45° angle to a 90° angle relative to the horizontal. When an external load was included, a 20 kg dumbbell held anterior to the upper sternum, there was a further increase in peak PTF. Therefore, the aim of this study was to assess the effect of different external load positions on peak PTF during the SPS. With institutional ethical approval, 10 male participants (mean age: 33.2 ± 8.2 years; stature: 1.76 ± 0.05 m mass: 87.5 ± 13.2 kg) (mean ± s) performed the SPS under three conditions; (SPS) bodyweight with no additional load, (SSG) both hands holding a 20 kg dumbbell anterior to the upper sternum; (SSLW) holding a 10 kg dumbbell in the left and right hand. All SPS conditions were compared to the single leg decline squat (SLDS). Motion capture and force plate data were collected. A metronome was used to standardise a three second count for the eccentric and concentric phase. Patellar tendon force was determined by dividing the knee extensor moment by the estimated patellar tendon moment arm. The mean from three trials were analysed. Mean peak PTF was significantly different between the

squat conditions, F(3, 27) = 23.328, p < .001. Post hoc analysis with a Bonferroni adjustment revealed that mean peak PTF increased significantly during the SLDS in comparison to the SPS (M=1287N, 95% CI [722, 1852], p < .001), SSG (M=1154 N, 95% CI [514, 1794], p = .001), SSLW (M=1100N, 95% CI [317, 1883], p = .006). There was no significant difference in mean peak PTF between the SPS, SSG and SSLW. However, there was a subtle incremental increase in mean peak PTF as external load was introduced (SSG) before moving posteriorly and laterally to the body (SSLW). This study has provided further guidance on the progression and regression of the SPS exercise via an understanding on the position of external load.

D2.P7 The quality of the coach-athlete relationship predicts objective performance in elite cricket

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The purpose of the study was to investigate the links between interpersonal aspects of coach-athlete relationship (CAR) quality and performance in elite cricket. Understanding how objective indicators of performance associate with interpersonal relationship aspects can provide new insights about the role and significance of the coach-athlete relationship. Upon university ethical approval, 25 male and 28 elite female cricketers completed questionnaires assessing CAR quality (closeness, commitment and complementarity) along with shot data for 28,215 balls faced across the 2021 county championship and in the Rachel-Heyhoe Flint trophy held in United Kingdom. Significant correlations were recorded between all three CAR subscales and performance. It was also found that CAR quality predicted cricket skill execution performance (middled%), with commitment and complementarity shown to be significant. This research is the first of its kind in providing an empirical link between CAR quality and on-field performance in an elite environment, suggesting its importance in providing a potential physical competitive edge. This study opens new avenues for future research and should encourage more multidisciplinary research which brings together sport psychology and performance analysis.

D2.P8 A comparison of world best times in athletes with and without solid-organ transplant: What can they tell us about performance limitations?

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A complex interaction exists between genetic, motivational and sociological factors in the development of champion athletes, which goes far beyond those of physiology alone (Joyner and Coyle, 2008, J Physiol, 385, 33-44). One group of athletes who demonstrate a significant challenge to their physiology, as well as a myriad of psychological and sociological factors, are solid-organ transplant recipients (SOTR). This study examined world best performances in track and swimming events for SOTR and non-SOTR competitors to determine potential performance limitations. Following ethical approval (Ref. P178447) world best times for female and male track athletics (100m, 200m, 400m, 800m, 1500m and 3000m or 5000m, respectively) and swimming (50m, 100m, 200m and 400m long course, n=1 per event) were obtained from World Transplant Games Federation (https://wtgf.org/wp-content/uploads/2023/07/Records-Athletics-updated-July-2023-1.pdf), World Athletics (https://worldathletics.org/records/by-category/world-records) and World Aquatics (https://www.worldaquatics.com/swimming/records) websites. Performances between groups were age matched. The difference in performance times (sec) between groups for each event were calculated and expressed as a percentage (%) of the non-SOTR performance. For track events up to 1500m (~10 to 340 sec) the SOTR performances were slower with differences in performance between groups relatively consistent at 21.7 ± 3.4% for males (range: 16.0 to 26.0%) and 36.4 ± 8.4% for females (range: 26.8 to 46.2%). When longer events of 3000m (females) and 5000m (males) were considered the difference between SOTR and non-SOTR athletes was greater (74% and 46% for females and males, respectively). For swimming events between 50m to 400m (~24 to 330 sec), performances for SOTR were similarly slower for males (21.6 ± 1.8%, range: 18.8 to 22.9%) and females (36.7 ± 3.2%, range: 29.9 to 44.1%). Slower performance times for SOTR in track and swimming events of similar exercise durations parallel established reductions in exercise capacity post-transplant, i.e. maximal oxygen uptake (McKenzie et al, 2014, British Journal of Sports Medicine, 46, 76-78) and both muscle mass and muscle quality (Williams and McKenna, 2012, Comprehensive Physiology, 2, 1937-1979). Furthermore, chronic daily use of immunosuppressant medication, which affects mitochondrial function (Williams and McKenna, 2012), could explain greater differences between SOTR and non-SOTR best performances in longer events with greater aerobic requirements. Future research should consider the integration between traditional performance components of aerobic capacity and muscle function, performance components for specific event distances in trained SOTR and the influence of age and sex. The results of the current study help explain performance reductions and guide expectations of competitive SOTR experiencing severe deconditioning prior and post-transplant.

D2.P9 Relationship between cardiorespiratory capacity and the practice of physical activity in students of vulnerable communities in Barranquilla, Colombia

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About 80% of adolescents worldwide do not comply with the World Health Organization (WHO) recommendation of performing at least 60 minutes of moderate to vigorous physical activity per day (WHO, 2020, Guidelines on physical activity and sedentary behaviour: at a glance. Geneva). Additionally, their unhealthy lifestyles, including the inappropriate use of technology, have shown an increasing risk of chronic noncommunicable diseases (Nqweniso et al., 2021, International Journal of Environmental Research and Public Health, 18(4), 2080). Low cardiorespiratory capacity (CRC) during adolescence is associated with low levels of physical activity and greater morbidity in adulthood (González-Gálvez, Ribeiro, and Mota, 2022, International Journal of Environmental Research and Public Health, 19(23), 16262). The aim of this study was to establish the relationship between CRC and the practice of physical activity in students from vulnerable communities in Barranquilla, Colombia, with a monthly family income of less than a minimum wage. A cross-sectional study was conducted with 242 students (57.9% girls) randomly selected from two public schools in low socioeconomic areas of the city. Under institutional ethics approval, the International Physical Activity Questionnaire for Children (IPAQ-C) (Craig et al., Medicine and Science in Sports and Exercise, 35(8), 1381-1395) was applied, and CRC was evaluated using the 20-meter course navette (Legger) test (Tomkinson et al., 2003, Sports Medicine, 33, 285-300). Maximal oxygen consumption (VO_2 max) was calculated to classify the students as either in the healthy or risk zones. Results showed that 51.7% of the participants in the sample did not comply with the WHO recommendation for physical activity, and 77.7% of these were classified in the risk zone according to their CRC level. The probability of being classified in the risk zone according to CRC is greater for those without an active lifestyle (Odds ratio (OR) 3.17 (1.63-6.17)). When classified by gender, the risk was greater in boys (OR = 3.41 (1.40-8.26)) than in girls (OR = 2.89 (1.07-7.82)) in a region with food insecurity of 35.8% (DANE, 2023) and coverage of the School Feeding Program (PAE) of 61.27% (MEN, 2024). Results suggest that engagement in physical activity is related to CRC levels in adolescents and malnutrition in this population, which could be used to assess the probability of developing morbidity in adulthood. Therefore, assessing physical activity at a young age in vulnerable populations could inform governmental policies aimed at reducing the risk of chronic noncommunicable diseases, leading to a healthier society.

D2.P10 Relationship between grip strength and metabolic syndrome markers in solid organ transplant recipients: a cross-sectional study

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Grip strength (GS) acts as a health marker and an independent predictor of morbidity and mortality risks in healthy individuals and those with various pathologies (Ramírez-Vélez et al., 2017, Scientific Reports, 7(1), 42622). This study aimed to investigate the connection between GS and metabolic syndrome markers (MS) in adult solid organ transplant recipients, since they present metabolic alterations due to the immunospressive medications they must consume, for this reason low-cost strategies that can improve these alterations should be sought. The cross-sectional analytical study involved 31 participants (23 men and 8 women, with a mean age of 36.0 ± 11.3 years and an average time since transplant of 4.5 ± 2.8 years) from the Colombian Association of Transplanted Athletes. Aged 18 to 50 years, all participants had undergone a solid organ transplant over a year ago without experiencing graft failure. The transplant procedures included 19 kidney, 7 liver, 3 pancreas, and 2 bone marrow transplants. Ethical approval was obtained from the Fundación Universitaria del Área Andina. The presence of MS was determined using the National Cholesterol Education Program (NCEP) Adult Treatment Panel III (ATP-III) criteria (Lipsy, 2003, Journal of Managed Cared Pharmacy: JMCP, 9(1 Suppl): 2-5). Biochemical markers (triglycerides, total cholesterol, HDL, LDL, and glucose levels) were evaluated through capillary samples. Blood pressure was measured with a digital sphygmomanometer, and waist circumferences were obtained following techniques and anatomical points established by the International Society for the Advancement of Kinanthropometry (ISAK). GS was assessed using a calibrated digital dynamometer (5-100 kg). The protocol involved three attempts for each limb, with arms fully extended, exerting maximum force for three seconds. Elbows were positioned close to the body, ensuring parallel arm movement. To evaluate GS differences between participants with and without MS, a t-test for independent samples was conducted, and Cohen's d was calculated to estimate the effect size between groups. The results revealed that the MS prevalence was 58.6%. Notably, transplant recipients with MS exhibited significantly

lower GS performance compared to those without this condition ($p < 0.001$, and $d = 1.2$). The findings reveal a critical link between GS and MS in solid organ transplant recipients, influenced by the limited sample size. The inverse relationship indicates that muscle-strengthening interventions could mitigate metabolic risks. Consequently, personalized post-transplant care emphasizing muscle strength improvement is recommended to address potential metabolic complications in transplant recipients, helping to manage their long-term health more effectively.

D2.P11 The menstrual cycle: barriers to football and rugby participation, with interventions to maximise perceived sporting performance and participation.

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Purpose: The female perspective in sports has been neglected in research and practice. This study aims to spotlight female sports participation, focusing on barriers related to the menstrual cycle (MC) and unhealthy behaviours leading to Relative Energy Deficiency in Sport (RED-S). The goal is to identify and promote interventions to enhance the healthy participation and performance of female athletes. Method: A survey was disseminated to female athletes investigating the nexus of sports and the MC. 416 respondents completed the survey, one of the largest sample sizes of its kind, including athletes from 'grassroots' to semi-professional and elite levels. Focus groups were hosted to engage further in understanding the female experience across all levels of sport.Results: 81% of participants say their performance is negatively impacted due to menstrual symptoms. 39% of people will avoid training/matchdays when menstruating. Example barriers to participation include kit, facility access, discomfort around discussing the menstrual cycle, and lack of education. 17.3% of participants experienced amenorrhea, with 61% of those exercising excessively or following a poor diet during this time. Importantly, 75% of survey respondents had never heard of RED-S before. Fatigue was ranked the most impacted element of physical performance, while irritability was the most impacted element of psychological performance. Conclusion: There's a significant problem with equality and accessibility in female sports. The lack of basic facilities, comfortable gear, and education seriously affects female participation and comfort. To tackle this, the first step is to boost education and collaboration at all levels to develop interventions that enhance accessibility to sports for females. Benefits to Society: This research highlights the necessity of actively developing and disseminating effective, female-informed education about the MC to enhance accessibility and reduce inequalities in female sports participation and performance. The findings are already sought by professionals from national governing bodies to inform policies related to female health, wellness, and elite performance, underscoring the importance of further research in female health education and sports participation to pave the way for increased research in these areas. Ethics: This study was approved by the Faculty of Biological Sciences ethical review Committee at the University of Leeds (BIOSCI 20-005).

D2.P12 Acute and chronic hydrogen-rich water intake on 5km cycling time-trial performance

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Hydrogen-rich water (HRW) is a promising ergogenic aid for exercise performance (LeBaron et al., 2019, Canadian Journal of Physiology and Pharmacology, 97(9), 797-807). In response to exercise, HRW reduces blood lactate (Botek et al., 2019, International Journal of Sports Medicine, 40(14), 879-885) and supresses exercise-induced oxidative stress (Dobashi, Takeuchi and Koyama, 2020, Medical Gas Research, 10(1), 21-26). While there is growing research investigating the effects of HRW across a range of exercise modalities (Zhou et al., 2024, Frontiers in Nutrition, 11, 1387657), the effect of HRW on cycling time-trial (TT) performance is unknown. The aim of this study was to investigate the effects of an acute and chronic intake of HRW prior to a 5km cycling TT. With institutional ethics approval, 20 recreationally active males (mean ± SD; age: 37 ± 11 years, height: 175.8 ± 7.4 cm, body mass: 77.7 ± 12.0 kg, VO_2 max: 44.2 ± 8.6 ml.kg-1.min-1) were familiarised to a 5km cycling TT. In a randomised double-blind crossover design, participants received either a single (1 litre) or daily (14 litre total) intake of HRW or placebo (0.8ppm and 0ppm hydrogen concentration, respectively) for 14 days before completing a 5km cycling TT. A week wash-out period was used between trials. The four experimental trials consisted of acute HRW (AH); chronic HRW (CH); acute placebo (AP); and chronic placebo (CP). Average power and time to complete (TTC) was recorded. Venous blood samples were collected at rest in the chronic conditions only to determine total antioxidant capacity. A two-way repeated measures ANOVA revealed no significant difference in TTC (AH: 506 ± 79s, CH: 504 ± 67s, AP: 507 ± 77s, CP: 504 ± 66s, $P > 0.05$) or average power (AH: 184 ± 62W, CH: 191 ± 66W, AP: 186 ± 62W, CP: 188 ± 62W, $P > 0.05$) across the conditions. A paired samples t test revealed that total antioxidant capacity was similar between CH and CP (7.93 ± 1.31 vs 6.67 ± 1.47 mmol/L d-mannitol equivalent, respectively, $P = 0.07$, $g = 0.57$). These findings suggest that 1 litre of HRW when taken as a single dose and for 14 days may not provide an antioxidant effect nor improve a 5km cycling TT. Future research could investigate the effect of a range of doses and timings of HRW intake on performance.

Disclosure statement

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