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Conference 2024

Book of Abstracts



*Moving Women: Shaping Victories*



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## “Looking back at it, it was definitely a concussion”, A Female Perspective of Head Injury in Community Rugby Union

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Approximately 50% of sport-related concussions go unreported (Ferdinand Pennock et al., 2023). Failure to seek medical attention and appropriately follow concussion guidelines may result in greater symptom burden and prolonged recovery times. Attempts to understand concussion reporting behaviours in rugby have focused on concussion knowledge and peer influence. To date, research has predominantly been conducted on male players and thus the extent of concussion injuries and subsequent reporting behaviours in female rugby players is limited. Reports of increased concussion incidence in female players may be driven by psychosocial differences.

The aim of the study was to explore perspectives of concussion in senior female rugby players, and the factors influencing their likelihood to report and follow concussion guidelines.

Twelve senior female players were recruited across three community clubs in North Wales. The study adopted a deductive-inductive approach whereby previous research was used to shape a semi-structured interview guide. Focus groups were conducted with groups of 3-5 players between June and August 2023. Reflexive thematic analysis was used to identify themes from the interviews.

Four major themes were identified: (1) Understanding and Knowledge of Concussion, (2) Perceptions of Concussion, (3) Concussion Management, and (4) Education and Prevention of Concussion. These were each further divided into categories and subcategories. Experiences of Concussion was also identified as a connecting theme.

The study highlighted that general awareness of concussion symptoms is sound, but there is a lack of knowledge on return-to-play protocols. Whilst peer pressure was not prevalent, players exhibited evidence of self-internalised pain normalisation. Future education should not solely focus on increasing knowledge of concussion but aim to improve perceptions in female players to combat self-inflicted pressure. Players identified barriers to accessing medical support, such as inconsistencies in provision. Future research should explore this and advocate for equal provision both between and within clubs.





## Key stakeholders' perspectives on the role of Sports Star Role Models in sport participation levels of young female Camogie players.

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**Background.** Athletes are identified as role models for sport participation among youth and policy makers. There is a dearth of evidence for the impact of sports star role models (SRMs) on PA and/or sport participation. Gaelic Games athletes have been identified as the most popular SRMs among young Gaelic games players (Horgan et al., 2023). Therefore, there is likely potential for a greater 'trickle down' effect to youth participation especially given the community-based context of role models in Gaelic sports.

**Aim.** To understand the perspectives of key stakeholders on the role/function of SRMs in maintaining or increasing participation in young female camogie players.

**Methods.** Five focus groups (N=31 participants) were completed in each province in Ireland with adolescent females (12-15years) and two focus groups (n=10 participants) with female SRMs. Adolescents were asked about their own sporting experiences and engagement with SRMs. SRMs were asked about their sporting experience and outline any role model duties they have or were willing to engage in. Focus groups were transcribed, and a thematic analysis was completed by the authors.

**Results.** Three themes emerged from the adolescent focus group (i) characteristics of SRMs ii) mode of impact, and (iii) gendered influence in sport. Adolescents admired SRMs who were local, successful and like them in some way, they motivated them to train more and inspired them to achieve success. No perceived gender differences between elite SRMs, except the coverage and support the male SRMs received. SRMs reported time as a restraint in engaging in additional SRM duties but noted the value and importance of this role to youth participation.

**Conclusion.** Adolescents admire and are inspired to be like elite Gaelic games players, and SRMs are willing to engage in role modelling functions. Future interventions should work towards minimising additional athlete time commitments and maximise opportunities where adolescents and athletes may be located at similar times.





## Exploring the Coach-Athlete Relationship in South African Women's Rugby: Perspectives from Coaches and Players

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This study explores the coach-athlete relationship, employing Attachment Theory to underscore its importance and significance within the sporting context. It emphasises how secure attachment fosters trust, support, and emotional connection between coaches and players, as revealed through qualitative analysis. The study highlights the critical importance of considering the specific requirements of female rugby players, particularly in emerging rugby nations like South Africa. In these contexts, where male coaches frequently oversee female teams, there is a pressing need to prioritise the establishment of effective coach-athlete relationships. Doing so not only fosters a supportive environment but also contributes significantly to the holistic development of female players within the sport.

Furthermore, the research stresses the significance of communication, trust, and mutual respect in nurturing a supportive bond between coaches and players. Practical recommendations are provided to enhance coaching practices and player performance, focusing on co-orientation, commitment, closeness, and complementarity. Coaches are guided to foster shared understanding, establish team culture, build emotional rapport, and address individual and gender differences. Implementing these strategies has the potential to increase satisfaction, motivation, and performance among Women Rugby players.





## Relative Energy Deficiency in Sport - Screening International Female Athletes in the UK

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**Background:** Relative Energy Deficiency in Sport (RED-S) is a complex syndrome which describes the vast quantity of physiological impairments associated with low energy availability (LEA). It was introduced in 2014 by the International Olympic Committee and encompasses the Female Athlete Triad (FAT); a combination of disordered eating, menstrual irregularities and musculoskeletal injuries. This is highly prevalent among elite athletes with studies demonstrating a greater rate of clinical and sub-clinical eating disorders among females. Early detection is imperative due to its subtle presentation and thus, screening questionnaires have been created to assist prompt diagnosis and indicate a full health screening where needed.

**Aims:** To assess the prevalence of RED-S, specifically the Female Athlete Triad, among international female athletes in the UK.

**Methods:** The study involved 58 athletes competing in 9 different sports who were screened for RED-S. Low energy availability and disordered eating were assessed using LEAF-Q and EDE-Q.

**Results:** Of those surveyed, 48% were at risk of the Female Athlete Triad (LEAF-Q  $\geq 8$ ) and 21% were at risk of an eating disorder (EDE-Q  $\geq 4$ ). Athletes using hormonal contraception reported higher LEAF-Q scores than non-hormonal contraceptive users ( $p < 0.01$ ). Shape and weight influenced the majority of athletes ( $n=27$  &  $n=30$ ) with 66% using a pathogenic method of controlling weight.

**Conclusion:** There was a high prevalence of LEA and disordered eating among international female athletes in the UK. Risk of RED-S was evident in this population and thus, standard screening and education is recommended.



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# Nutrition and Physiology



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## Nutritional Intake, Sports Nutrition Knowledge and Energy Availability in Female Football Players

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Study 1 aimed to assess the nutritional intake, sports nutrition knowledge and risk of Low Energy Availability (LEA) in recreational female football players. Players were recruited from Tier 4-5 clubs of the female domestic league in England (n=54) aged 22.7 years  $\pm$  6.1, weight 64.7kg  $\pm$  8.4, height 165.9cm  $\pm$  5.7. Nutritional intake was quantified using 3-day food diaries, sports nutrition knowledge was assessed using the 88-item Sports Nutrition Knowledge Questionnaire (SNKQ) and the risk of LEA was assessed using the Low Energy Availability in Females Questionnaire (LEAF-Q). LEA, assessed through dietary intake, was identified in 55.6% of the players using the cut-off of 30g/kg fat free mass (FFM). Mean energy intake (1730 kcal) was identified as significantly lower than the energy intake targets calculated (2195 kcal) ( $p < 0.001$ ). The mean score for the SNKQ was 55.6%  $\pm$  10.6 with 29.6% identified as having poor nutritional knowledge. Nutritional knowledge had a weak positive correlation with energy intake ( $r = 0.305$ ) and energy availability ( $r = 0.268$ ). The LEAF-Q questionnaire identified 42.6% of the players as above the threshold for risk of LEA. Players at risk of LEA had lower sports nutrition knowledge scores (53.7%  $\pm$  9.7) compared to the non-risk players (59.3%  $\pm$  11.3) ( $p = .042$ ). The at-risk players were significantly younger (21.2  $\pm$  5.1 versus 25.9  $\pm$  6.3) ( $p = 0.016$ ) heavier (67.1kg versus 59.9kg) ( $p = 0.002$ ) with higher percentage body fat (27.3  $\pm$  6.4 versus 23.7  $\pm$  5.4) ( $p = 0.026$ ) than the non-risk players. The results of the Study 1 suggest that recreational female football players are at a high risk of developing LEA. Study 2 involves a sports nutrition education intervention designed to help recreational female football players to understand their greater energy requirements to support playing and training. An update on the results of Study 2 will also be presented.



## The Prevalence of Risk Factors of Low Energy Availability in Female Gymnasts Across Jordan and the UK.

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**Background:** The difference between energy intake and exercise energy expenditure is known as energy availability (EA); this refers to the amount of energy remaining for physiological functions. Low energy availability (LEA) is a state that is triggered when EA is insufficient, to the point of physiological adaptation, routinely with negative consequences on health, performance and risk of injury (Mountjoy et al., 2023). Gymnasts have been highlighted to have one of the highest prevalence of risk factors related to LEA (Tenforde et al., 2017).

**Aims:** To assess the prevalence of LEA in female gymnasts across Jordan and the UK, and explore if there is an effect of geographical location, or level of competition, on this prevalence.

**Methods:** Following institution ethical approval, 60 female gymnasts in total (Jordan, n = 41; mean±SD, age = 15.93±2.32; UK, n = 19; mean±SD, age = 18.63±2.19) were evaluated using the LEAF-Q and the RST questionnaires. Current training location and performance level (elite or recreational) were collected. Prevalence was quantified as the percentage of participants rated at risk, based on validated LEAF-Q and RST scoring thresholds. Data were analysed using a 2x2 independent ANOVA to observe the influence of athletic level and location on LEA prevalence.

**Results:** Prevalence of LEA risk was 92% based on (RST) and 80% (LEAF-Q), with 75% being categorised as at risk by both questionnaires. There were no significant differences in LEA risk between competition levels (LEAF-Q, p=.340; RST p=.856), or locations (LEAF-Q, p=.379; RST p=.930). No significant interaction between these factors was observed (LEAF-Q, p=.385; RST, p=.968).

**Conclusion:** The high prevalence of LEA risk among female gymnasts indicates the need for uniform screening and preventative strategies, regardless of competition level or location. These findings underscore the importance of further exploration into the effects of LEA regarding gymnasts' health, performance and injury risk.

Mountjoy, M., et al., (2023). 2023 International Olympic Committee's (IOC) consensus statement on Relative Energy Deficiency in Sport (REDs). *British Journal of Sports Medicine*, 57(17), 1073. <https://doi.org/10.1136/bjsports-2023-106994>

Tenforde, A. S., et al., (2017). Association of the female athlete triad risk assessment stratification to the development of bone stress injuries in collegiate athletes. *The American Journal of Sports Medicine*, 45(2), 302–310. <https://doi.org/10.1177/0363546516676262>







Sweat, water, or oil.... can your underarms tell the difference? An investigation into the role of fluids' thermal conductivity on wetness perception in young women.

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**Background** : Experiencing wetness at the underarm from psychological- or exercise-induced sweating lead to discomfort and decreased self-confidence. Antiperspirant deodorants (APDO) are used to reduce sweating, but wetness perceptions may persist. The chemical composition of APDO fluid affects their thermal conductivity, potentially altering skin cooling rates. However, the relationship between a fluid's thermal conductivity and wetness perceptions, as well as its day-to-day variability is not fully understood.

**Aim:** To investigate how fluids varying in thermal conductivity impact day-to-day variability in underarm wetness perceptions in a cohort of healthy young women.

**Methods:** Fifteen women (28±5 years; 167.9±0.1 cm; 8±0.2 kg) completed a quantitative sensory test over two days. They continuously reported their wetness perceptions on a digital 100-mm visual analogue scale (i.e. dry to extremely wet) during 60-s contact with cotton patches (25cm<sup>2</sup>) saturated with 1mL of either water (0.60 W/m·K), propylene glycol (PG; 0.15 W/m·K), mineral oil (MO; 0.14 W/m·K), or dimethicone (PMX; 0.15 W/m·K). Each patch was applied during 10 repeats via a temperature-controlled probe (23°C) at the underarm. Peak wetness perception during contact was analysed using three-way repeated measures ANOVA.

**Results:** There was a main effect of fluid (F(3, 21),=13.6, p<0.001), repeat (F(9, 63) =4.10, p<0.05) and day (F(1, 7),=8.48, p<0.05) on peak wetness perception, yet no interaction effect (F(12, 84),=0.71, p=0.74). Specifically, greater wetness perceptions were reported during contact with water than MO (+22mm, 95% CI:+7, +36; p<0.01;) and PMX (+23mm, 95% CI: +4, +41; p<0.01;). Furthermore, peak wetness differed between days (Δ7.1mm), which was not accounted for by self-reported phase of the menstrual cycle (p=0.34).

**Conclusion:** Given the same volume and temperature, fluids with greater thermal conductivity increase wetness perceptions at the underarm, with small (~7%) day-to-day variations. This knowledge may impact future APDO fluid choice to minimise psychological- or exercise-induced wetness perceptions in young women.





## Identification of sports bra characteristics most suitable for long-duration wear during British Army Basic Training.

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**Background:** Female recruits in British Army Basic Training (BT) wear sports bras frequently and for long durations (>5 days a week; >8 hours per day). However, high support sports bras have historically been designed for short duration, high-intensity activities (such as running).

**Aim:** To identify a set of bra characteristics for long duration use that will inform the British Army's bra fit and issue service for female BT recruits.

**Methods:** Following ethical approval, 93 recruits volunteered and were fitted and issued with four sports bras encompassing a range of bra characteristics (Combination-padded [A], Combination-unpadded [B], Encapsulation [C], Compression [D]). Weekly questionnaires were used to monitor bra wearing habits and issues throughout BT. At the end of BT, a final questionnaire (n=54), and subsequent focus groups (n=33) were conducted to further investigate the suitability of bra characteristics relative to the demands of BT.

**Results:** Overall, bra A was most worn during BT, closely followed by bras C and D. Bra B was reported to be the least supportive, least comfortable, worst performing and least worn. Bras A and C were rated most suitable for military field tasks (loaded march, fire and movement, range activities), whilst bras D and C were rated most suitable for less-physical tasks (e.g. classroom sessions). Recruits prioritised the comfort of bras due to the duration and type of tasks undertaken; padding was important for recruits to ensure modesty in a heavily male-dominated environment. Ease of use was the most frequently reported issue; bras which are easy to independently don and doff quickly are essential for BT recruits.

**Conclusion:** Due to differing task demands, there is not one bra or set of bra characteristics that can be recommended for all aspects of BT. Therefore, recommendations on bra characteristics suitable for long-duration use were different across BT task categories.



**#LETGIRLSREST****The effects of congested games periods on women footballers' injury occurrences: A data science and machine learning approach****Dr Andria Procopiou<sup>1</sup>, Konstantinos Spyrou<sup>1</sup>, Rogerio Pessoto Hirata<sup>2</sup>**<sup>1</sup>University of Central Lancashire (Cyprus Campus)<sup>2</sup>Associate Professor, Department of Health Science and Technology, The Faculty of Medicine and Exercise Tech, Aalborg University

Recently, women's football experienced a significant growth. On the other hand, a newly observed number of congestion periods (Euro 2022, followed by WWC23) led to more injuries observed in elite women footballers. In this study, we use data science and Artificial Intelligence (AI) to investigate on whether and how these congested periods affected the injury occurrences of female footballers. We considered 175 players (48% injured at least once) who participated in Euro 2022 and their club team belongs to either the WSL, NWSL, La Liga, Ligue 1 and Bundesliga and either:

Their national team passed the group stages.

Their national team did not pass the group stages, but their club team participated in the UWCL.

Data is extracted from soccerdonna.de using Python. Based on the results we make the following conclusions:

More injuries (and more severe injuries) were observed in 22/23 and 23/24 compared to 21/22.

The severe injuries observed in 22/23 season had significantly more layoff time than the ones in 21/22 season.

The players who got re-injured in 22/23 (and 21/22) played approximately the same minutes as the players who were injured only in 22/23 even though the latter ones played significantly more minutes in 21/22.

Therefore, an injury observed in the previous season could lead to a higher risk of a new/recurrent injury. However, the players who injured themselves in 22/23 season had a significant higher layoff time than the players who themselves both in 21/22 and 22/23 seasons.

During these three seasons, knee injuries are the highest in number. Furthermore, ACL injuries were at their highest during the 22/23 season followed by ankle and hamstring injuries. During the 23/24 season, after knee injuries, upper leg and hamstring injuries were mostly observed.

Finally, using unsupervised machine learning, we observe that an upper limb/core injury could lead to a subsequent injury by 80%, a knee injury could reoccur by 36.36%, as well as an upper leg recurrent injury by 28.57%. Furthermore, a muscle, foot and ankle injury could increase the occurrence of a knee injury (28.57%, 23.81%, 21.74%). In addition, a foot injury increases the risk for a hamstring/knee/ankle injury (22.22%). A muscle injury increases the risk of a foot injury by 21.43%. Finally, an ACL injury increases the risk for a subsequent knee injury by 20%.



## Facilitators and Barriers to Postpartum Women's Return to Physical Activity

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**Background:** During pregnancy women experience many biomechanical and physiological adaptations, which can have prolonged effects into the postpartum period (Sung et al., 2021) and lead to pain and discomfort during physical activity. The benefits of physical activity are widely recognised (Bø & Nygaard, 2020), however returning to physical activity postpartum can be challenging and information relating to facilitating the return is limited.

**Aims:** The aim of this study was to investigate the facilitators and barriers to returning to physical activity for postpartum women.

**Methods:** 108 postpartum women completed an online questionnaire exploring women's physical activity habits, before, during, and after pregnancy, and their use of compression aids. Statistical analyses, including chi-squared tests, investigated the relationship between initiation of physical activity postpartum (before and after 12 weeks) and: delivery method, perineal trauma, active-wear purchase, and pre-pregnancy activity levels. Thematic analysis was applied to identify themes from participants' answers.

**Results:** A vaginal delivery was associated with a higher likelihood of resuming physical activity within 12 weeks postpartum. A high level of activity pre-pregnancy was associated with a high level of activity postpartum. A key theme identified for both the cessation of and a barrier to return to physical activity was discomfort, mainly in the pelvic region. Few women used compression aids, but of those who did the majority used them to alleviate pelvic pain. Another key theme highlighted was the misinformation surrounding physical activity when pregnant and the struggle to find information for returning postpartum.

**Conclusions:** This questionnaire highlights a crucial gap in education around return to physical activity in the postpartum period. As well as the awareness and utilisation of aids which may help the return to physical activity. Raising an awareness and understanding of these areas is essential in facilitating women to return to physical activity postpartum.

Bø, K., & Nygaard, I. E. (2020). Is Physical Activity Good or Bad for the Female Pelvic Floor? A Narrative Review. *Sports Medicine*, 50(3), 471–484. <https://doi.org/10.1007/s40279-019-01243-1/TABLES/4>

Sung, J. H., Kang, M., Lim, S. J., Choi, S. J., Oh, S. young, & Roh, C. R. (2021). A case-control study of clinical characteristics and risk factors of symptomatic postpartum pubic symphysis diastasis. *Scientific Reports* 2021 11:1, 11(1), 1–6. <https://doi.org/10.1038/s41598-021-82835-8>



## The effect of menstrual cycle phases and symptoms on rate of perceived exertion in aerobic and resistance exercise: A Systematic Review and research project.

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Interest into the effect of the menstrual cycle (MC) on exercise performance has rapidly increased over recent years, however there are still a substantial lack of data on MC effect on rate of perceived exertion (RPE) or menstrual symptoms (MS) effect on sports performance. Furthermore, research in this area has focused on aerobic exercise, with limited data on MC effect on resistance training (SantaBarbara et al. 2024).

This study firstly aims to conduct a systematic review investigating the effect of menstrual phase (MP) on aerobic RPE. A repeated measures study then explores the effect of MP on resistance exercise RPE, exploring whether there is a correlation between MS and RPE.

The systematic review focuses on MC effect on RPE in cycle ergometer exercise. The literature search identified 8 research papers. A modified Downs and Black quality appraisal tool (McNulty et al. 2020), identified studies as “moderate” to “very low”. Results were inconclusive, highlighting the need for standardised methodology within MC research and thorough phase identification procedures.

The repeated measures study measures RPE in submaximal squats and deadlifts at early follicular (EF) and ovulation (OV). MS were recorded prior to each test and participants performed 5 sets of 5 repetitions at 80% of 1 repetition maximum (1RM) with RPE recorded immediately after the 5th set.

No significant difference was found between MP and squat RPE. A significant difference was found for deadlift RPE between EF ( $M = 16.67$ ,  $SD = 2.25$ ) and OV ( $M = 13.58$ ,  $SD = 2.06$ );  $t(5) = 4.07$ ,  $p = 0.01$ . No correlation was found between MS severity and MP, except in deadlift RPE at ovulation ( $r = 0.85$ ,  $n = 6$ ,  $p = 0.03$ ). The results suggest that muscular fatigue may increase in EF, however further research should utilise recommended MP detection methods and larger sample sizes.

SantaBarbara, K., Helms, E., Armour, M. and Harris, N., 2024. Menstrual cycle characteristics, hormonal contraceptive use and perceptions of related effects in resistance-trained athletes. *International Journal of Sports Science & Coaching*. 0 (0).

McNulty, K.L., Elliott-Sale, K.J., Dolan, E., Swinton, P.A., Ansdell, P., Goodall, S., Thomas, K. and Hicks, K.M., 2020. The Effects of Menstrual Cycle Phase on Exercise Performance in Eumenorrhic Women: A Systematic Review and Meta-Analysis. *Sports Medicine*. 50 (10), 1813–1827.



## Swim, Bike, Mum: Exploring post-partum experiences of triathlete mothers.

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Athletes such as Serena Williams and Faith Kipyegon have justly dispelled the myth that motherhood is incompatible with elite sport. In parallel, we have seen an increase in post-partum return to sport research, which has guided specific post-partum guidelines such as Fallon et al. (2024). Whilst there has been an advancement in understanding the physical aspects (Donnelly et al., 2022), the psychological experiences are less well known and warrant further investigation to develop evidence-informed support that considers a holistic approach to return to sport post-partum. This is especially pertinent in sports such as Triathlon where athletes peak in their thirties, which coincides with the average age of motherhood (31 years, UK). Therefore, this research aimed to explore the psychological experiences of triathlete mothers, including investigating the key barriers and facilitators to postpartum participation. The qualitative study used a phenomenological approach grounded in social constructionism and ontological relativism to explore the lived postpartum experiences of 10 triathlete mothers ( $37.1 \pm 4.9$ ) using semi-structured interviews. The interviews were analysed using thematic analysis and the experiences of the participants were split into the nine sub-themes. Findings suggest that expectations of motherhood often differ to reality in part due societal construction of the superwoman façade. Women who were able to continue with physical activity adopted proactive behavioural changes such as increased organisation and time efficiency, had partner support and used goal setting strategies. Results also suggest most were influenced by 'ethic of care' and feelings of guilt, but those who remained most active navigated this by justifying physical activity was beneficial for their family unit as well as themselves. Structural and organisational barriers varied depending on athletic standard with childcare and access to facilities particularly problematic for recreational and developmental level athletes. The study demonstrates the complex and individual nature of the post-partum journey.

Donnelly, G. M., Rankin, A., Mills, H., DE Vivo, M., Goom, T. S., & Brockwell, E. (2020). Infographic. Guidance for medical, health and fitness professionals to support women in returning to running postnatally. *British Journal of Sports Medicine*, *bjsports-2020-102139*. <https://doi.org/10.1136/bjsports-2020-102139>.

Fallon T, Heron N, Moore IS, et al. (2024). What should be included in an Olympic Sports International Federations' pregnancy and postpartum policy and guidance? *British Journal of Sports Medicine* Published Online First: 04 March 2024. doi: 10.1136/bjsports-2023-107778





## Development of educational resources to enhance the support of female athletes - a step towards bridging the gender gap in sport and health science

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**Background:** Females are significantly underrepresented in sports science education and research and it is widely accepted that sports scientists should have a greater understanding of the female athlete to better support them. Indeed, research has called for the unique aspects of female physiology to be adequately addressed in university programmes<sup>1</sup>.

**Aims:** This project aimed to co-create female physiology based educational material with undergraduate students in a new University module “The Female Athlete”.

**Methods:** Over a period of one academic semester, 22 students in a BSc (Hons) in Sport Science with Exercise Physiology undertook a newly developed module “The Female Athlete”. During this 12-week module theoretical content was delivered covering specific aspects of female physiology (e.g. menstrual cycle, hormonal contraceptive use, exercise during pregnancy, post-natal return to exercise etc.). A one-day seminar “The Female Athlete: From Theory to Practice” was also delivered during which 5 global experts in female physiology shared their knowledge and applied experience. To enhance the digital skills of the project team, a marketing expert delivered two two-hour digital workshops on maximising the use of Canva.

**Results:** Draft infographics were developed by the undergraduate students on a range of female specific aspects of physiology (e.g. hormonal contraceptive use, the menstrual cycle, menstrual cycle symptomatology, perceived impact of the menstrual cycle etc). These drafts were refined and edited and final infographics on hormonal contraceptive use, menstrual cycle tracking and breast health were developed in consultation with project partners and experts in female physiology.

**Conclusion:** This project was undertaken as part of a newly designed female physiology undergraduate module, the first of its kind in Ireland. Due to time constraints involved the number of final infographics was limited. It is clear that future work should continue to develop additional resources to better prepare sports scientists and coaches for working with female athletes.

Hackney, A. C., & Elliott-Sale, K. J. (2024). Female Physiology–Endocrinology: Education Is Lacking and Innovation Is Needed!. *Women in Sport and Physical Activity Journal*, 32(1), wspaj.2023-0073

## Reviewing the Barriers and Facilitators to Pregnant and Postnatal Women's Engagement in Physical Activities: A Scoping Review Focusing on the Leisure and Fitness Industry

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<sup>3</sup> The Active Pregnancy Foundation

**Background:** It is recommended that pregnant and postnatal women engage in 150 minutes of moderate-intensity activity per week, including muscle-strengthening activities on two days of the week. Despite the associated benefits, engagement is typically low with only one in four women meeting the recommended levels. Various studies have been carried out to consider the barriers and facilitators impacting on physical activity (PA) behaviour during the childbearing years, however, there is a dearth of research involving the fitness and leisure industry specifically.

**Aim:** To identify the barriers and facilitators for pregnant and postnatal women's engagement in physical activities within the leisure and fitness industry.

**Methods:** Searches were carried out across four databases, reference lists and grey literature. Eligibility criteria were structured around the population (pregnant and postnatal women), concept (barriers and facilitators to PA engagement), and context (leisure and fitness industry) framework; 30 reports and publications were finally included.

**Results:** Key findings include: pregnant women commonly experience negative attitudes towards them when active in leisure and fitness settings; language matters - women can be put off by the terms 'exercise' and 'fitness' whereas the terms 'activity' and 'movement' were more positively received; support from others in the form of group classes help overcome barriers to participation; women lose confidence in their bodies and desire reassurance from exercise and fitness professionals; there is generally a lack of information with women finding advice conflicting.

**Conclusion:** A whole systems approach is warranted, which requires inter-professional collaboration between health and fitness professionals. Clear and consistent messaging is vital to reassure women and normalise PA engagement throughout the perinatal period. More research focusing specifically on the leisure and fitness industry is needed to fully understand how to best support pregnant and postnatal women to remain or become active in these settings.





## Investigating the change in UK bra size of breastfeeding women

Miss Katie Reeves<sup>1</sup>, Dr Ruth James<sup>1</sup>, Dr Aimee Mears<sup>2</sup>, Dr Katie Griggs<sup>1</sup>

<sup>1</sup> Nottingham Trent University

<sup>2</sup> Loughborough University

**Background:** The breasts undergo significant changes during pregnancy and breastfeeding with changes in breast structure, mass size and volume. Research on breast size changes during pregnancy and breastfeeding is limited and no previous study has investigated daily breast fluctuations of breastfeeding women.

**Aim:** This study aimed to investigate the change in UK bra size of breastfeeding women.

**Methods:** Women who were exclusively breastfeeding a baby of one to six months of age were asked to participate. At home, participants measured their underbust and overbust (n = 55), right and left breast bottom cup depth (BCD) and horizontal hemisphere (HH, n=26) using a tape measure before and after a breastfeed as many times as possible in one day.

**Results:** Overall average UK bra size was 34F ( $\pm 4$  underband sizes and 2 cup sizes). UK bra cup size, calculated as overbust minus underbust, decreased by 0.6 ( $\pm 0.8$ ) bra cup sizes after a single breastfeed. From the first to last breastfeed of the day, UK bra cup size also decreased by 0.6 ( $\pm 1.3$ ) bra cup sizes. The average time between individual breastfeeds was 154 ( $\pm 80$ ) minutes, whilst average time from the first to last breastfeed was 10 hours 30 minutes ( $\pm 5$  hours).

**Conclusion:** The reported changes in bra cup size after a single breastfeed and across a day, will likely result in changes in bra fit and therefore support and comfort. The findings provide important implications for nursing apparel to ensure products can adequately adjust to changes in breast size for breastfeeding women to ensure correct fit is maintained.



## The role of menstruation and menstrual pain in participation in non-elite sports: Further support is required for coaches to support young women

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**Background:** There is an association between onset of the menstrual cycle and opting out of sports in non-elite sports women, which has implications for women not achieving the recommended physical activity levels for health. What is unknown, is the role of the sports coach, in providing support to young women for performance and well-being around menstruation. Additionally, there is little understanding of how to overcome barriers to opting out of sports for women who experience significant pain during menstruation.

**Aim:** To understand how menstruation and menstrual pain affects participation in non-elite sports for young women.

**Methods:** Three exploratory cross-sectional surveys were carried out involving: 1). Sport Governing Bodies (n=17) 2). Coaches (Male and Female) (n=73) and 3). Non-elite sports women (aged 18-25) (n=81). The governing bodies survey covered material/courses/policies offered around the menstrual cycle. The coaches survey explored confidence and knowledge around the impact of menstrual cycle on training performance and sport participation. The survey of young women explored pain, psychological distress associated with menstrual pain, physical activity levels, well-being, and support from coaches relating to menstruation.

**Results:** Women reported high enjoyment of sport and sport enjoyment mediated the negative impact of menstruation on women's well-being. There is little education about menstruation available through governing bodies to train coaches as to how to support well-being of young women playing sport. Male coaches in particular would like more education/training/resources. Only 50% of sports women had conversations with any member of their coaching team about performance, well-being and/or training during menstruation. 88% of women, would like more support for sports participation during menstruation.

**Conclusion:** Sport Governing Bodies should consider developing psychoeducational programmes tailored for male and female coaches to facilitate women to enjoy sport and protect them from the negative impacts of menstrual pain and maintain their involvement in sport.



## A decade of bra testing: revolutionising the sports bra market

Mrs Brogan Jones<sup>1</sup>, Prof Joanna Wakefield-Scurr<sup>1</sup>

<sup>1</sup> University of Portsmouth

**Background:** Since 2009 the Research Group in Breast Health have published methods to assess three-dimensional breast biomechanics. These standard methods are beneficial for the bra industry, to provide evidence-based sports bra evaluation. As a result, the research group established a commercial Bra Testing Unit, offering bra testing packages to industry.

**Aims:** The aim of the Bra Testing Unit was to utilise published breast biomechanics methods to; enable industry to scientifically test sports bras, and to establish breast support categories.

**Methods:** Published breast biomechanics methods (Mills, et al., 2016; Norris, et al., 2020) were utilised to create a standard method to assess breast support. To test each sports bra, twelve volunteers, of the same bra size are recruited. Each volunteer completes a bare-breasted treadmill run and a run in each sport bra. Breast biomechanics data is collected to calculate the percentage reduction of breast movement in each bra, compared to no bra running. The ranking of results across the total sample of tested sports bras allows the calculation of tertiles (three equal groups), to determine high, medium and low support categories. Volunteers also provide feedback on the bras and the unit researcher provides evidence-based recommendations.

**Results:** The unit engaged in 79 bra testing packages with 38 different funders. Six hundred and seventy-one sports bras have been tested across 8,052 running trials. Overall sports bra breast movement reduction results have ranged from 36% to 81%.

**Conclusions:** The Bra Testing Unit has streamlined funder engagement through the sale of 'off the shelf' bra testing packages. The packages have generated relationships with different companies worldwide (start-ups to global brands). The data have informed publications; supporting impact case studies. Many clients have marketed their sports bra performance results to inform their consumer on the level of breast support provided. This initiative commercialises and translates breast biomechanics research to the consumer.

Mills, C., Sanchez, A., Milligan, A., & Scurr, J. (2015). Trunk marker sets and the subsequent calculation of trunk and breast kinematics during treadmill running. *Textile Research Journal*. DOI:10.1177/0040517515609257.

Norris, M., Blackmore, T., Horler, B. & Wakefield-Scurr, J. (2020). How the characteristics of sports bras affect their performance. *Ergonomics*, DOI:10.1080/00140139.2020.1829090



## The impact of female breast surface area on skin stiffness and tactile sensitivity at rest and following exercise

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<sup>1</sup>ThermosenseLab, Skin Sensing Research Group, School of Health Sciences, The University of Southampton

The skin is one of the breasts' intrinsic support systems. Differences in skin mechanical properties, such as stiffness, may influence this. However, whether stiffness varies with breast size, and how this relates to tactile sensitivity remains unknown. Furthermore, it remains unclear whether exercise decreases breast skin stiffness or tactile sensitivity. The aim was to investigate breast-size dependent differences in skin stiffness and tactile sensitivity pre- and post-exercise in a heated environment.

Twenty females with varying breast sizes were recruited (breast surface area (BrSA) range=147.2-502.2cm<sup>2</sup>). Skin stiffness was measured using a MyotonPRO device 3cm above and below the areola edge and at the superior and inferior areola edge. Tactile detection thresholds were measured using von Frey's monofilaments at the nipple and below nipple sites following the up-down method to find the smallest detectable monofilament. Participants were assessed pre- and post-exercise which consisted of a 50-minute run in a climatic chamber (32, 50% RH). Pearson correlation analyses were performed to assess the relationship with BrSA and 2-way ANOVA to assess the effect of exercise and skin site.

At rest, BrSA significantly positively correlated with skin stiffness 3cm above the areola edge ( $r=0.61$ ,  $p=0.005$ ) and at the superior areola border ( $r=0.54$ ,  $p=0.016$ ), but not below the nipple. No significant correlations existed between BrSA and tactile sensitivity. Dynamic exercise in the heat decreased skin stiffness by 72.6N/m (95%CI = +53.8, +91.4;  $p<0.001$ ) and increased tactile sensitivity thresholds by 0.21g ( $p<0.045$ ) across the breast, corresponding to a percentage reduction in skin stiffness of 24.7%, and tactile sensitivity by 44.9%.

These findings indicate that skin stiffness over the upper breast correlates with BrSA but did not correlate with tactile threshold detection. However, dynamic exercise in the heat significantly reduces skin stiffness and tactile sensitivity across the breast.





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# Women in preconception, pregnancy and postnatal life stages



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“I’m still training for a big event:” A qualitative case study exploring an elite athlete's physical identity journey into motherhood.

Miss Kelly Massey<sup>1</sup>, Dr Amy Whitehead<sup>1</sup>

<sup>1</sup>Liverpool John Moores University

**Background:** The perinatal journey can cause athlete identity to decline yet, with the return to training, athlete physicality, and performance, athlete identity reappears (Massey & Whitehead, 2022). Hence, emphasising the importance of the physical self in postpartum return to sport and the need to facilitate this through physical activity (PA). While advancements have occurred in PA recommendations, a need for enhancements in research, knowledge, and recommendations for the elite athlete mothers remains (Davenport et al., 2023).

**Aims:** To extend knowledge of physical identity and qualitative physical activity experiences across the pre-conception to postpartum period to better understand potential experiences and facilitate future elite athlete perinatal journeys.

**Methods:** Adopting a qualitative case study approach, an elite 400-meter sprinter took part in semi-structured interviews at 2-years preconception, retrospectively regarding seeking pregnancy, within the end of trimester 1 interview, at the end of trimester 2, and 3 and 6-months postpartum. All interviews explored the longitudinal experiences of physical identity and qualitative PA except for the first trimester interview which also covered retrospective experiences whilst trying to conceive. Interviews were analyzed using a reflexive thematic analysis and identity theory provided a suitable underpinning theory to understand how elite athletes negotiate physical identity and PA in response to pregnancy.

**Results:** Two themes; My body is going to change and Training for a big event with a total of five subthemes were presented. Although separated, it is acknowledged that these are not siloed, but interconnected in complex relationships, often reciprocal, and vary in magnitude and direction of influence across preconception to postpartum.

**Conclusion:** The findings demonstrate case studies allow for in-depth exploration of complex experiences of elite athlete physical identity and PA on the journey to motherhood to inform future research, provision, and practice and offer comfort of the possibility of achieving motherhood in elite sport.

Davenport, M. H., Khurana, R., Thornton, J. S., & McHugh, T.-L. F. (2023). “It’s going to affect our lives, our sport and our career”: time to raise the bar for pregnant and postpartum athletes. *British journal of sports medicine*, 57(14), 893-894. <https://doi.org/10.1136/bjsports-2023-107256>

Massey, K., & Whitehead, A. E. (2022). Pregnancy and Motherhood in Elite Sport: The Longitudinal Experiences of two Elite Athletes. *Psychology of Sport and Exercise*, 60. <https://doi.org/10.1016/j.psychsport.2022.102139>





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# Women in preconception, pregnancy and postnatal life stages



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## Exploring provision and impact of physical activity advice and guidance offered to women undergoing fertility treatment

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<sup>1</sup> Canterbury Christ Church University

<sup>2</sup> Sheffield Hallam University

**Background:** The relationship between physical activity and fertility has gained increased attention. Many women are aware of their fertility window and for some athletes, this overlaps with their peak performance window, forcing difficult decisions to be made. The effects of higher physical activity engagement on fertility mean athletes may require fertility treatments to conceive.

When looking for physical activity advice and guidance it can be confusing due to the conflicting information available and the absence of guidelines from trusted professional bodies. It is unknown what advice and guidance is offered to women throughout their fertility treatment cycle(s) and whether this impacts physical activity engagement.

**Aims:** Explore whether women are offered physical activity advice and guidance from their healthcare professional(s) during fertility treatment and evaluate impact on physical activity behaviour.

**Methods:** 258 participants completed an online survey and using purposive sampling techniques, 11 participants took part in a semi-structured interview. Quantitative data were analysed using SPSS, and NVIVO was used for qualitative analysis.

**Results:** 53% of participants were offered physical activity advice and guidance from their healthcare professional but 68% of participants had to initiate the conversation. A statistically significant relationship was found between participants who received advice and guidance and changes in activity levels ( $P < .05$ ). Cross-tabulation shows those who received advice and guidance did less physical activity. However, data suggests athletes are less, or not, influenced by advice and guidance received ( $p < .5$ ).

Group experiential themes (GET) were established which include the fertility treatment journey, physical activity during fertility treatment, individual beliefs, advice and guidance, effects of advice and guidance, and support for guidelines.

**Conclusion:** This study indicates that physical activity advice and guidance may not be a topic routinely covered during fertility treatment and often depends on women to initiate the conversation. Results suggest advice and guidance from healthcare professional leads women to reducing activity during treatment cycle(s), however athletes appear less affected. Qualitative data provides context to the decision-making process around physical activity during this unique timepoint.



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# Women in preconception, pregnancy and postnatal life stages



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## Just Making Do: Functional Sportswear Considerations for Pregnant and Postpartum Women

Dr Aimee Mears<sup>1</sup>

<sup>1</sup>Sports Technology Institute, Loughborough University

### Background

Engaging in physical activity (PA) during and post-pregnancy provides numerous benefits for mother and child and it is critical to support, facilitate or reduce barriers for women's PA participation during these periods. Sportswear has the potential to ensure the performance, safety, and comfort of women during PA (e.g. sports bra development). Whilst there are sportswear products aimed at pregnancy and postpartum populations there is limited understanding about women's use of sportswear during pregnancy and postpartum and how it meets their needs.

### Aims

The aims of this qualitative study were two-fold; i) to identify pregnancy and postpartum PA habits including experiences of discomfort/pain and ii) to collate the use/perception of sportswear during these periods and the role sportswear could play in minimising pain/discomfort.

### Methods

Following ethical approval, fifteen physically active postpartum women (up to two years) gave informed consent to take part in semi-structured interviews. Two areas were discussed: i) PA habits before, during and post-pregnancy including experiences of discomfort/pain and ii) the perception/functional role of sportswear. Analysis was based on the functional, expressive, and aesthetic (FEA) consumer needs model (Lamb and Kallal, 1992).

### Results and Conclusion

Common types of PA during and post-pregnancy included running, walking, yoga, Pilates, swimming, and cycling. Issues such as pelvic or low back pain/discomfort and the need for frequent urination were often mentioned. Sportswear's fit and comfort were essential functional considerations and all women indicated they wore some of the same sportswear before, during and post-pregnancy or "...sized up". Phrases such as "I just made do" or "...got by" were frequently used suggesting compromises in their choice of sportswear. Reasons for not purchasing specific pregnancy and postpartum sportswear included cost and longevity of a products use. Currently, it seems that sportswear options are insufficient to meet the needs of pregnant and postpartum women and this study has begun to identify areas sportswear which could facilitate engagement in PA.



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Lamb, J. M., & Kallal, M. J. (1992). A Conceptual Framework for Apparel Design. *Clothing and Textiles Research Journal*, 10(2), 42-47.



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# Women in preconception, pregnancy and postnatal life stages



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## Cold Water Swimming and Pregnancy: A Scoping Review and Consensus Recommendations

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1. Department of Rehabilitation and Sport Sciences, Bournemouth University, Poole, UK
2. Extreme Environments Laboratory, University of Portsmouth, Portsmouth, UK
3. EGA Institute for Women's Health, University College London, London, UK
4. University Hospitals Sussex NHS Foundation Trust, Brighton, UK
5. Sørlandet Sykehus, Kristiansand, Norway
6. Scottish Environment Protection Agency, Scotland, UK
7. Princess Royal Hospital, University Hospitals Sussex, Brighton and Sussex Medical School
8. University of Plymouth and Royal Cornwall Hospitals NHS Trust, Cornwall, UK
9. The Bluetits Chill Swimmers Ltd., UK

**Background:** Cold water swimming has increased in popularity, with the Bluetits Chill Swimmers growing from 5 informal community groups in 2020 to almost 200 groups worldwide in 2023 and over 100,000 members. With this increasing popularity, women who already take part in cold water swimming are becoming pregnant and want to continue to swim throughout their pregnancy. However, there is a lack of evidenced-based guidance to make decisions about the safety of immersion in cold water during pregnancy.

**Aim:** To find out what questions women have related to cold water swimming during and after pregnancy and to search the literature for answers using a scoping review.

**Methods:** Members of closed social media groups were asked what specific questions they had in relation to cold water swimming and pregnancy. Published data were examined via a scoping review process (Joanna Briggs Methods Manual for Scoping Reviews) and four academic papers and six reports were identified.

**Results:** Women in the social media groups highlighted questions related to water temperature, water quality, physiological responses of the women and fetus, and potential risks to women and fetus. This included women wanting information related to trimester specific advice and across specific health conditions of pregnancy. Recommendations were made based on the available literature and expert opinion with evidence graded (mostly grade 4 expert opinion).

**Conclusion:** Swimming outdoors, as with any activity, comes with both benefits and risks, so it is important to weigh up the balance of the two. There is a paucity of studies to answer the many questions women have about cold water swimming during pregnancy. Identified research gaps highlight the need for future research to provide evidence to enable accurate advice to determine whether it is safe for pregnant women to swim outdoors in cold water.





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# Women in leadership positions and media representation



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## The Underrepresentation of Women in Esports Leadership Positions: Exploring the Barriers and Facilitating Factors

Dr Stacie Gray<sup>1</sup>, Luzy Zhu<sup>1</sup>

<sup>1</sup>University of Northampton

**Background:** Increasingly, organisations (e.g., the International Olympic Committee) and leagues (e.g., English Premier League) within the sport industry are diversifying into esports. However, the development of esports was primarily driven by men, resulting in a highly masculine environment. Like traditional sport, women remain underrepresented in all facets of esports leadership (e.g., executive organisational and coaching positions), although few empirical studies have explored the underrepresentation issue.

**Aim:** Offering new theoretical and empirical insights, this article explored the perceived barriers to, and facilitating factors for, female representation in esports leadership positions.

**Methods:** This qualitative research utilised semi-structured, online video interviews to obtain rich insight into individual's experiences. Participants included female, organisational esports leaders, with representatives from the West and East. LaVoi and Dutove's (2012) ecological model of barriers and supports for female coaches was used to deductively develop individual, interpersonal, organisational and sociocultural context codes. To maintain flexibility, codes that could not be anticipated by the framework were inductively developed to capture the complexity of the phenomenon. Braun and Clarke's (2006) six phases of thematic analysis were followed to provide sound methodological and theoretical foundations for conducting thematic analysis.

**Results:** The preliminary results have informed a modified, socio-ecological model which captures the range of barriers and facilitators to women in esports leadership positions. Hegemonic masculinity and the 'glass ceiling' emerged as primary barriers, whilst key facilitators include affective characteristics such as resilience and perseverance.

**Conclusion:** Organisations must implement various strategies to enhance the representation of women in esports leadership positions. Practical recommendations are included to support the implementation of such strategies.

Braun, U., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101.

LaVoi, N.M., & Dutove, J.K. (2012). Barriers and supports for female coaches: An ecological model. *Sports Coaching Review*, 1(1), 17–37.



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# Women in leadership positions and media representation



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## Arts and Media Methods for Sport & Gender

Prof Kirsten MacLeod<sup>1</sup>

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This paper is a call to advocate applying an arts and media based lens to research methodologies and ways of enhancing women and girls' participation in physical activity and sport.

Phenomenological and feminist approaches (Wheaton et al ,2018) encourage an exploration of the experiential aspects of sport allowing for understandings of the embodied feelings, sensations and subjectivities of participants. These foreground the ways women and girls experience sport/exercise/physical activity and how they construct meanings and identities around these experiences as socially and culturally embedded human beings. This paper builds on the work of the Fields of Vision project (2019) and Froggett (2019) who acknowledge the power of cultural forms of expression of the experiences of physical activity and sport, acknowledging the personal as shared (cultural) and also communicable.

This paper will focus on the importance of foregrounding the lived experiences or not, of well-being and how using arts/media/ visual research methods & practices can help us understand and encourage participation through changing the language, discourse and assumptions around sport and physical activity. Arts based methods and approaches such as participatory filmmaking, video diaries, poetic enquiry, movement and podcasting have value as processes rather than as evidence (Phoenix, 2010) and necessitate collaborative and participatory approaches to research design. These approaches move beyond a science based dominance of the sporting research landscape opening up the discourses around sport to alternative ways of 'knowing' and 'seeing.' Here the opportunity is to embrace subjectivity, narrative and emotionality to find ways of constructing meaningful outcomes for women and girls who often fall out of love with physical activity.

Froggett , L. 2019. Participant experience in art-sport: Additive? Interactive? Transformative?, *Sport in Society*, 22:5, 754-771

Wheaton et al. 2018. "Feminist Epistemologies, Methodologies and Method" in L. Mansfield et al. (eds.), *The Palgrave Handbook of Feminism and Sport, Leisure and Physical Education*. London: Palgrave MacMillan



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# Women in leadership positions and media representation



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## 'Post it to Make it': The Way Female Professional Footballers Brand Themselves on Instagram and TikTok

Mrs Wan Atiya Wan Ibrahim<sup>1</sup>

<sup>1</sup>University of Gloucestershire

The research delves into the efficacy of Instagram and TikTok as pivotal platforms for self-branding among female professional footballers, utilizing Erving Goffman's theoretical underpinning which accentuates the strategic management of impressions to influence external perceptions. This inquiry appraises effectiveness through multifaceted lenses encompassing attention garnered, reach attained, and engagement with fans, pivotal for fostering personal brands and advancing professional aspirations within the realm of women's football. Employing a sequential method, this research initiates data collection from players' public social media profiles, scrutinizing self-branding endeavours pre, during, and post Women's European 2022 Championship. An exhaustive examination ensues, encompassing diverse facets of posts such as frequency, photographic subjects, shot compositions, poses, attire, fan interactions, and beyond. Captions undergo meticulous content analysis, unveiling nuanced insights into players' self-presentation strategies. Subsequent interviews with players, football journalists, and club media managers enrich comprehension of social media deployment for self-branding endeavours. Preliminary findings underscore a preference for Instagram over TikTok among players, with an average monthly posting frequency of three times. Selfies exhibit lower prevalence, with full body shots, standing stances and upright poses predominating. Notably, popular posts often feature modest attire and refrain from explicit portrayal of body parts or sexual connotations. The player herself typically stars in the most liked visual content, while follower interactions remain modest, with captions predominantly comprising emojis, hashtags, team mentions, reflections on WEURO 22, expressions of gratitude, and motivational discourse. Captions are leveraged as conduits for team promotion, expressions of appreciation towards fans, kin, and peers, as well as for fostering inspiration among future talent. Overall, this research contributes to understanding the role of social media in shaping the professional trajectories of female footballers, with implications for women's football development and the advancement of female players as professionals.



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# Women in leadership positions and media representation



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## Examining the design and facilitation features of a highly effective leadership development initiative for coaches and managers in women's professional football

Dr Abbe Brady<sup>1</sup>, Nic Evans<sup>2</sup>, Dr Katrine Kryger<sup>1</sup>

<sup>1</sup> St Mary's University

<sup>2</sup> University of Wales Trinity Saint David, Swansea

**Background:** The Coaching Excellence Initiative (CEI) is an innovative coaching and leadership professional development programme tailored to support the needs of football coaches and managers (C/Ms) to effectively meet the demands of the rapidly evolving women's professional game. Independent research has demonstrated that the CEI has been highly effective in its impact for the C/Ms' practice. What was considered most helpful for C/Ms' development related to the learning climate developed during the CEI associated with its unique design and facilitation features.

**Aims:** The aim of this presentation is draw upon the longitudinal qualitative research findings evaluating the CEI to illustrate selected design and facilitation features associated with its effectiveness as a leadership and coaching programme.

**Methods:** An action research methodology was adopted to evaluate the CEI at three time points i.e. during, after and at follow-up. Data comprised of observations of face to face events, individual interviews with C/Ms, and focus groups with facilitators and C/Ms. Thematic and narrative analyses were the analytical tools adopted.

**Results:** Findings illustrated the many distinctive characteristics in the design and facilitation of the CEI which contributed to C/Ms' views that it was the most effective professional development they had undertaken and unlike anything they had experienced before. This presentation will share insights relating to selected design and facilitation themes including: alignment to andragogic (adult learning) principles, a bespoke women's game focus, psychological safety enabling a stretch learning climate, personal disclosure and mutual sharing, scaffolded reflection, and the peer network created.

**Conclusion:** These findings provide considerable food for thought for organisations involved in supporting the development of coaches and managers in women's professional football, other professional sports or other settings which are also rapidly evolving creating a need to upskill present and future leaders.



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# Menstrual cycle and hormonal considerations



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## Auditing the representation of hormonal contraceptives in studies assessing exercise performance in women

Dr Tess Flood<sup>1</sup>, Emma Clausen<sup>1</sup>, Megan Kuikman<sup>2</sup>, Ella Smith<sup>2</sup>,  
Alannah McKay<sup>2</sup>, Louise Burke<sup>2</sup>, Kirsty Elliott-Sale<sup>1</sup>

<sup>1</sup> Manchester Metropolitan University

<sup>2</sup> Mary MacKillop Institute for Health Research, Australian Catholic University, Melbourne

**Background:** Hormonal contraceptive (HC) users have a different ovarian hormonal profile compared to eumenorrhic women. Due to the prevalence of HC use amongst sportswomen there has been increased research efforts to understand their impact on exercise performance.

**Aim:** To audit research investigating the effects of HC use on exercise performance.

**Methods:** Three databases (PubMed, SPORT discus, and Web of Science) were searched to identify studies on exercise performance in HC users aged 18-40 years. Studies were assessed for HC type, athlete calibre, performance outcome, study design, and quality of methodological control regarding ovarian hormonal profiles.

**Results:** 68 instances of HC use were reported across 61 studies. Monophasic combined oral contraceptive pills (OCP) represented 60% of HCs, followed by other pills [34%, phasic-combined, progestogen-only, and un-specified], phasic and long-acting reversible contraceptives [5%, vaginal ring, patch, implant, injection, intrauterine system] and unspecified HCs (1%). 11% of athletes using HCs were classified as highly trained or elite/international, with no athletes being classed as world class. Whilst the number of studies involving HCs has increased two-fold over the past decade, the number of studies employing gold standard methodological control has not improved (HC; 2003-57%, 2011-55%, 2022-43%. OCP; 2003-14%, 2011-17%, 2022-12%).

**Conclusion:** Studies investigating HCs and exercise performance have focussed on monophasic combined OCP, which highlights the need for greater diversity in the types of HC included in research. In addition, this audit highlights the importance of conducting research on all calibres of women including elite athletes. Whilst the number of studies on HC users has increased, the methodological quality of the research has not. Future research assessing HCs and exercise performance should adopt high-quality research designs and include a broader range of HCs among highly trained to world-class populations, therefore increasing the reach and impact of research in this area.



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## The menstrual cycle in German elite athletes: Preliminary findings from the in:prove project

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**Background:** Menstrual cycle characteristics (e.g., cycle length) are suggested to differ among elite athletes from non-elite athletes due to the high metabolic strain (Hakimi & Cameron, 2016). However, the majority of research on menstrual cycle symptoms in athletes involves only a non-elite population and primarily focuses on symptoms occurring premenstrual or during menstruation (Taim et al., 2023).

**Aims:** This investigation aims to obtain data on the prevalence and distribution of menstrual cycle symptoms and parameters in German elite athletes.

**Methods:** Data regarding menstrual cycle (e.g., cycle length, symptoms in different phases, menarche, etc.) was gathered over two years as part of the in:prove project through semi-structured interviews. The study included 205 elite athletes (mean age 18.0 ± 4.3 years) from various national squads (basketball, volleyball, ice hockey, table tennis, rhythmic gymnastics, artistic gymnastics, and modern pentathlon).

**Results:** In total, 49.3% reported a regular menstrual cycle, 14.6% were using hormonal contraception, and 15.1% had not yet experienced menarche (including five athletes older than 16 years). Several athletes (21.6%) reported not having a regularly cycle, e.g., high variance in cycle length, long or short intervals between menstruation, or absence of menstruation for longer periods. Despite experiencing irregularities, only a third of athletes in this group expressed having interest in menstruation as a topic. Among athletes with a natural menstrual cycle, 69.4% reported more than two regularly occurring symptoms (e.g., stomach cramps in 67.4%) with 14.6% experiencing six or more symptoms.

**Conclusions:** This investigation presents data on prevalence of symptoms and menstruation parameters in an elite-athlete population which might impact the quality of life of female athletes (Taim et al., 2023). Future research should address specific intervention strategies for female athletes to improve menstrual cycle symptoms.

Hakimi, O., & Cameron, L. C. (2016). Effect of exercise on ovulation: A systematic review. *Sports Medicine*, 47(8), 1555–1567. <https://doi.org/10.1007/s40279-016-0669-8>  
Taim, B. C., Ó Catháin, C., Renard, M. Elliott-Sale, K.J., Madigan, S., & Chéilleachair N. N. (2023). The prevalence of menstrual cycle disorders and menstrual cycle-related symptoms in female athletes: A systematic literature review. *Sports Medicine*, 53, 1963–1984. <https://doi.org/10.1007/s40279-023-01871-8>





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# Menstrual cycle and hormonal considerations



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## Resting oral mucosal immunity varies across the menstrual cycle

Dr Sophie Harrison<sup>1</sup>, Jamie Macdonald<sup>1</sup>, Samuel Oliver<sup>1</sup>

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**Background:** Secretory immunoglobulin A (SIgA) is the most abundant antimicrobial protein in saliva, with reductions linked to an increased risk of respiratory infection. Male-female differences in mucosal immunity are reported, but findings are contradictory, which may be explained by a lack of control over menstrual phase. Pregnant women, who have high circulating concentrations of oestrogen and progesterone, have higher saliva SIgA than non-pregnant women, providing preliminary evidence that female sex hormones modulate mucosal immunity. However, little is known about how oral mucosal immunity varies across the menstrual cycle.

**Aim:** To examine oral mucosal immunity across the menstrual cycle.

**Methods:** Twenty-six healthy naturally menstruating women with confirmed ovulatory menstrual cycles (age:  $27 \pm 5$  years, BMI:  $24 \pm 5$  kg/m<sup>2</sup>) visited the laboratory in their early follicular (EF; days 1-5 of their cycle) and mid-luteal phases (ML; days 5-10 post-ovulation). Participants had not used hormonal contraceptives in the last six months. Ovulation was confirmed using urine analysis for luteinising hormone. Participants arrived at the laboratory following an overnight fast, having avoided strenuous exercise, alcohol and over-the-counter medication for 24 hours before, and had not self-reported illness or infection in the prior seven days. Participants provided unstimulated saliva samples, which were analysed using ELISA for SIgA. Saliva collection was timed, and volume determined by weighing pre and post to calculate flow rate and secretion rate.

**Results:** Participants had higher saliva SIgA secretion rate during the ML than EF phase ( $57 \pm 40$  vs  $46 \pm 39$   $\mu$ g/min, respectively;  $P=0.04$ ). There were no differences in saliva flow rate or SIgA concentration between phases.

**Conclusion:** Resting oral mucosal immunity varied across the menstrual cycle in naturally menstruating women. Women may be more susceptible to respiratory infection in the early follicular than luteal phase. Researchers should account for menstrual cycle phase when measuring mucosal immunity.



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# Menstrual cycle and hormonal considerations



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## The Relationship between Menstrual Cycle Knowledge, Communication and Training Adjustments in Female Athletes

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<sup>4</sup> Department of Sport Psychology, Faculty of Sport Sciences, University of Leipzig, Germany

**Background:** The menstrual cycle (MC) is a process typically lasting 21–35 days that can affect exercise performance due to fluctuations in female hormone concentrations. Therefore, it may be beneficial for female athletes to make training adjustments according to the MC. To effectively plan and implement these adjustments into the training process, close communication between the athlete and her coach(es) is essential. However, communication about the MC can be challenging on several levels (Höök et al., 2021), including a low level of MC-related knowledge among both athletes and coaches (McGawley et al., 2023).

**Aims:** The aim of this study was to investigate the relationship between knowledge of the MC and both communication and training adjustments in female athletes.

**Methods:** In a single cross-sectional study, 562 female athletes (age:  $21.0 \pm 5.0$  years; training per week:  $17.6 \pm 7.3$  hours; 73% competing at international level) were surveyed using an online questionnaire about MC-related knowledge, communication and training planning. Analyses were performed using logistic regression with the MC knowledge score as the independent variable.

**Results:** The results indicate that each correct response to the MC knowledge questionnaire increased the relative likelihood of communicating about the MC with coaches by 11.5%. In addition, the likelihood of a training adjustment increased by 15.4% in cases of perceived performance decrease, and by 19.5% in cases of perceived performance increase, in relation to the MC.

**Conclusion:** These results suggest that improved knowledge of the MC is related to increased communication with coaches about the MC. Furthermore, improved knowledge could potentially promote greater willingness to implement training adaptations. Despite the observed effects being moderate, educational initiatives that improve knowledge of the MC among female athletes could have a positive impact on communication and training planning.

Höök, M., Bergström, M., Sæther, S. A., & McGawley, K. (2021). "Do Elite Sport First, Get Your Period Back Later." Are Barriers to Communication Hindering Female Athletes? *International Journal of Environmental Research and Public Health*, 18(22), 12075. <https://doi.org/10.3390/ijerph182212075>

McGawley, K., Sargent, D., Noordhof, D., Badenhorst, C. E., Julian, R., & Govus, A. D. (2023). Improving menstrual health literacy in sport. *Journal of Science and Medicine in Sport*, 26(7), 351-357. <https://doi.org/10.1016/j.jsams.2023.06.007>



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# Exploring governance in sport organisations



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## Thirty years on from *Sporting Females*: interpreting the past to inform the present

Prof Hanya Pielichaty<sup>1</sup>

<sup>1</sup> University of Lincoln

Jennifer Hargreaves' (1994) seminal text, *Sporting Females: Critical Issues in the History of Sociology of Women's Sports*, is celebrating its 30th year. This talk will analyse the key changes in the sporting landscape across the past three decades in connection with gender equity. The significant breakthroughs as well as the continued struggles will be highlighted and examined. The aim of the presentation is to encourage reflection on what has been achieved already and to instigate debate on enduring challenges. The role we have as educators and scholars to continue this fight for social justice will also be addressed. The sustained importance of this text as an opportunity to use sports history as a means for advancing equitable sporting futures will also be considered.

Hargreaves, J. (1994) *Sporting females: critical issues in the history and sociology of women's sports*. London: Routledge.



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# Exploring governance in sport organisations



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## A Marriage of Unequals: Review of Mergers between Male and Female Sporting Organisations

Mr Conor Meyler<sup>1</sup>, Aoife Lane<sup>1</sup>, Katie Liston<sup>2</sup>

<sup>1</sup>Technological University of the Shannon (TUS) Midlands

<sup>2</sup>Ulster University, Belfast

Governments have championed the idea of merging single-sex sports organisations into one national association for a number of reasons: as a means of achieving efficiencies and minimising duplication; as a way of achieving gender equality in sport and as a reflection of their commitment to the advancement of women in sport. Many of these mergers have occurred in the past 30 years or so. While various studies have examined these mergers, across a number of disciplines, few have specifically focused on the ways in which gendered norms, values and attitudes impacted the outcome of merger negotiations, nor on the role and impact of gender dynamics at the level of organisational leadership. This paper presents the findings of an appraisal of this literature on mergers of male and female sporting organisations. In doing so it offers a basis from which to advance understanding of gender-based mergers in sports organisations worldwide. A systematic review of peer-reviewed literature (articles, book chapters, reports) published between 1980 and 2023 was completed using key search terms in electronic databases (SCOPUS and SPORTdiscus). Following the PRISMA guidelines, four such studies met the inclusion criteria from a starting return of 3,315. Our thematic analysis identified five key themes: External drivers for mergers, Financial challenges, Strategy and Policy, Leadership and Gender Equality. These studies highlighted the challenges faced by women's sports organisations as the perceived (and often materially) 'weaker' party, and subsequent influences on post-merger outcomes. The review also highlights a range of conceptual and methodological issues, knowledge gaps and we suggest possible lines of future research. These will be of direct relevance to a live 'merger' now underway in Gaelic games in Ireland.



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## Understanding gendered networking for career advancement in international sport governance

Dr Jordan Matthews<sup>1</sup>, Dr Lucy Piggott<sup>2</sup>, Dr Johanna Adriaanse<sup>3</sup>

<sup>1</sup> University of Chichester

<sup>2</sup> Norwegian University of Science and Technology

<sup>3</sup> University of Technology Sydney

**Background:** Research has long demonstrated the barriers and challenges that women encounter in the senior leadership of sport (Burton, 2015; Elling et al., 2019; Evans & Pfister, 2021). This includes issues of access to networking opportunities (Katz et al., 2018; Wells & Hancock, 2017), with 'old boys' clubs' being highly prevalent across sport leadership and governance. These homophilous networks work to advance the careers of men whilst excluding women from key decision-making arenas. Building from the importance placed upon networking within broader management scholarship (Benschop, 2009; Berger et al., 2015), our aim was to expand insight about the mechanisms of gendered networking within sport organisations.

**Method:** In-depth interviews were conducted with 12 British senior postholders (six men and six women) across different international federations (IFs) to provide detailed insight into the role and workings of gendered networking for career advancement in international sport governance.

**Results:** We present a '5 P's typology' that represents participants' (gendered) reflections on the strategies and mechanisms that characterise networking in international sport governance: profile (building a strong networking profile); place (accessing influential networking spaces); personal (influence of gender and other social characteristics on networking experiences and outcomes); professional (agenda-driven networking on behalf of an organisation, nation, or social group); and power (knowing who key influencers are and focusing networking efforts towards these individuals).

**Conclusion:** There are complex and nuanced ways in which networking plays out in IFs across the '5 P's', which makes it a challenging and inequitable practice to effectively carry out. Underpinned by sociological theories, we provide practical advice for prospective networking training to not only benefit individual postholders and organisations, but also make international sport governance more inclusive as a whole.





## The Lived Experiences Of Football Coaches: The Impact Of Professionalisation And Governance On Coaches Working With Women’s Football Teams.

Miss Laura Grubb<sup>1</sup>, Dr Mike Rayner<sup>1</sup>, Dr Tom Webb<sup>2</sup>

<sup>1</sup> University of Portsmouth

<sup>2</sup> University of Coventry

### Aim and Theoretical Background:

In England, the Women’s Super League became a professional league in 2018, requiring players to be paid a full time salary and train for a minimum number of hours each week. This change required coaches to work full time to support the players with the transition requiring coaches to have appropriate qualifications to work within the requirements of FIFA’s club licensing. This study explores the lived experiences of these football coaches, to identify the impact of the professionalisation and governance of women’s football on the football coaches working in the top three tiers of women’s football in England.

### Methodology:

16 semi-structured interviews were conducted with football coaches of any gender, working within the top three football tiers of women’s football in England, who were required to hold a UEFA B licence coach qualification as a minimum requirement. The study was underpinned by a critical realist perspective, with Interpretive Phenomenological Analysis employed to analyse the data. Both IPA and critical realism seek to understand the social world and can be used together due to the need to consider the social, cultural and historical contexts in which individuals are situated (Smith, 2019). Critical realism provides a theoretical framework for understanding the social and cultural factors that shape the participants' experiences, whilst IPA provides a methodological approach for exploring and interpreting those experiences (Patomäki & Wight, 2000).

### Results and Conclusion:

The research has identified the resources and investment football coaches have received from their clubs and how this affects their role, their coach education and support networks and how these differ between different football tiers, and challenges they face. Findings around coach education have highlighted gaps in the education process, with some coaches unable to access the UEFA Pro Licence, or the content taught on coaching courses is not relevant to their coaching role. The findings may have implications for policy recommendations aimed at the support and development of football coaches working in professional environments.

Patomäki, H. & Wight, C. (2000) After Postpositivism ? The Promises of Critical Realism, *International Studies Quarterly* 44(2), 213–237. DOI: 10.1111/0020-8833.00156

Smith, J. A. (2019). Interpretative phenomenological analysis in sport and exercise: Getting at experience. In B. Smith & A.C. Sparkes (Eds.), *Routledge handbook of qualitative research in sport and exercise* (pp. 219-229). Routledge.



## Youth Female Athlete Perceptions on the Role of Sports Star Role Models in Sport Participation

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<sup>2</sup> School of Sport, Ulster University

**Background:** Athletes are identified as role models for sport participation by policy makers, and among youth with characteristics such as relevance, attainability and success deemed important features of a sports star role model (SRM). In Ireland, Gaelic Games elite athletes have been identified as the most popular SRMs among young Gaelic games male and female players, but no research exists on how these SRMs may impact young players experience of sport. This is particularly relevant for young females as lack of visibility of elite female athletes/sport is consistently identified as a barrier to their participation in sport.

**Aim:** To understand the perspectives of youth female Gaelic games athletes on the role of SRMs in maintaining or increasing their sport participation.

**Methods:** Five focus groups (n=31 participants) with adolescent females (aged 12-15 years) were completed in four regions across the island of Ireland. Adolescents were asked about their own sporting experiences and engagement with SRMs. Focus groups were transcribed, and a thematic analysis was completed by the authors.

**Results:** Three themes emerged from the focus groups (i) importance of characteristics of SRMs to youth ii) mode of impact of the SRM on youth, and (iii) gendered experiences of females in sport. Admired characteristics were being local, successful and like them in some way. Adolescents were inspired to achieve success and motivated to train more by SRMs. Adolescents liked interacting with the SRM and equally admired male and female elite Gaelic games athletes. However, adolescents recognized the gender inequality in sport, from support they receive to that experienced by elite players.

**Conclusion:** Female adolescent Gaelic games athletes admire and are inspired to be like elite Gaelic games athletes, suggesting an important influence on their engagement in sport. Future interventions should maximise opportunities of interaction between SRMs and adolescents in shared grass-roots settings.

## Breast health interventions have a positive impact in elite female soccer match officials

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<sup>5</sup> Research Group in Breast Health, School of Sport, Health and Exercise Science, University of Portsmouth, Hampshire, UK

**Introduction:** Many elite female athletes (83%) report below-average breast and bra knowledge. Interventions in elite female athletes can improve breast/bra knowledge, subsequently improving sport performance. However, there is currently no information regarding interventions in match officials. Therefore, the aim of this study was to understand the breast/bra knowledge and breast comfort of elite female soccer officials, and evaluate the impact of an education session and individual bra assessment.

**Methods:** Nineteen elite female soccer match officials (age:  $38 \pm 5$  y) attended a 1 h online breast/bra health education session and an individual bra assessment, followed by the provision of a new high-support sports bra. A questionnaire was administered before the intervention (PRE) and four weeks afterwards (POST). PRE assessed variables such as breast/bra knowledge (1=extremely poor, 5=excellent) and breast pain (0=no pain, 10=worst possible pain). POST repeated these assessments and also compared their old vs. new sports bra in terms of fit (0=does not fit at all, 10=perfect fit) and breast pain. PRE and POST data were compared using a paired samples t-test, with statistical significance set at  $p < 0.05$ . Data are shown as (mean  $\pm$  SD, range).

**Results:** Breast/bra knowledge increased from PRE ( $3 \pm 1$ , 1-5) to POST intervention ( $4 \pm 1$ , 3-5) ( $p < 0.05$ ). PRE found that 32% of elite match officials experience breast pain, with a severity rating of 4/10. POST demonstrated a 30% improvement in fit of the new ( $8.5 \pm 1.7$ ) vs. old sports bra ( $6.6 \pm 1.9$ ) and a 20% reduction in breast pain (old:  $2.6 \pm 2.5$  vs. new:  $1.1 \pm 1.7$ , all  $p < 0.05$ ).

**Conclusion:** The education session and individual bra assessment successfully improved the breast/bra knowledge of the elite female soccer match officials. Provision of a new high-support sports bra improved fit and support, subsequently reducing breast pain.

## Moving the goalposts: variance in defining 'elite women's football' prevents inclusion in research.

Ellen Boucher<sup>1</sup>, Freya Holdaway<sup>1</sup>, Julia Robathan<sup>1</sup>, Michael J. Grey<sup>2</sup>, Sarah Hanson<sup>1</sup>

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**Background:** The paucity of brain injury data from female athletes means that their risk following injury is poorly understood. For example, female athletes are more affected by sport-related mild traumatic brain injury and risk of neurodegeneration than males, yet they are largely excluded from the research that has investigated the link between contact sport and dementia (D'Lauro et al., 2022). Difficulties in recruiting thorough and representative samples from female athletes can be attributed in part to difficulties with defining elite level participation in cohorts of female athletes, where past professional status does not accurately reflect elite level performance as it does in men's sport. Without clearly communicated definitions, sex-difference analyses and stratification of level of exposure to sport are not consistent and prevent inclusion of female athletes in research.

**Aims:** Here, we examined the definitions of elite female cohorts in research by reviewing relevant literature to map definitions of elite using research in UK women's football as an example.

**Methods:** We conducted a scoping review to collate sources that defined participants as elite female footballers in the UK and mapped definitions over time.

**Results:** A search of databases from inception to February 2024 identified 52 eligible articles. Definitions of elite in the literature showed considerable variation at youth and adult levels, with a shifting pattern of definitions over time.

**Conclusion:** Our investigation identified the need for a unifying definition of the level of sport participation. We provide suggestions for a definition framework for elite women's football based on findings from this review and make recommendations for framework development in other sports or countries.



## The impact of Perimenopause and Menopause on Female Equestrian Riders performance and participation.

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**Background:** Understanding the impact of menopause (M) and perimenopause (P) symptoms with female equestrian riders is crucial as it potentially affects not only sports performance due to physiological and cognitive changes, but also psychological well-being. However, there is limited research relating to the impact and its implication for the future success of female equestrianism.

**Aims:** This study explored the perceived effect and influence of P and M on female equestrian rider participation and performance and identified the challenges they experienced to help improve coach awareness and support.

**Methods:** n = 1,629 female participants from a broad range of equestrian disciplines aged between 21 – 73 years of age ( $x \pm s$ ; age =  $51.86 \pm 14.95$  years) who were within or beyond P or M were recruited. An online non-validated questionnaire was administered via the Facebook platform. Descriptive statistics and thematic coding were used for further analysis and interpretation.

**Results:** Key themes included: (1) Physical discomfort and health changes, including joint pain (74%), weight gain (66%), and decreased physical strength (71%) affect riding ability and enjoyment. (2) Mental Health and emotional well-being, with sleeplessness (74%), anxiety (78%), and a loss of confidence (76%). (3) Riding confidence and ability, with a decrease in riding confidence (75%), particularly around jumping and faster work, with fears of injury and a longer healing process, with 50% jumper/eventers opting for less risky disciplines or reducing the intensity of their riding. (4) Support and awareness suggested there was a lack of support regarding M within the female equestrian community. Finally, (5) Hormone Replacement Therapy (HRT) had alleviated symptoms that interfere with riding and daily life.

**Conclusion:** The P and M experience for female equestrians is complex and can negatively impact performance and participation of female equestrians.





## The effect of operational equipment and bra type interaction on breast biomechanics in female police officers.

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<sup>1</sup> University of Portsmouth

<sup>2</sup> Cincinnati Reds

**Background:** Police duties include the requirement of wearing PPE whilst on shift, including body armour and tactical vests (PPE). PPE has been designed to fit the anthropometric characteristics of the male body, however, females represent over 34% of police officers. 67% of females report that wearing body armour with a bra is uncomfortable.

**Aims:** The aim was to explore the interaction of PPE with different bra types, and how this interaction affects breast biomechanics and the perception of comfort.

**Methods:** 13 female police officers (30.1 years, 67.1 kg, 1.65 metres) were fitted with eight light-weight electromagnetic sensors and sixteen reflective markers for kinematic and breast motion data. Participants completed a 60-second walk, jog and five counter-movement jumps in a low, medium and high support bra, with and without PPE, in a randomised order. A questionnaire to evaluate each condition was given after each trial. Breast positional data was exported into Visual 3D and MATLAB was used to determine displacement, velocity and acceleration. A two-way repeated measures ANOVA was used to compare conditions.

**Results:** Participants commented how the combination bra improved support, however, may include a play-off with comfort for a long shift. Exercise induced pain was greatest in the underwire bra in the run and smallest in the combination bra with PPE. Significant differences ( $p < .05$ ) were found for vertical displacement between the underwired and other conditions in the left nipple across the jog.

**Conclusion:** This study was the first to identify whether varying levels of breast support underneath PPE, for female police officers, altered breast biomechanics. The combination bra was frequently named as the most comfortable and supportive. However, comfort over a longer period of time is unknown. Therefore, future research should consider assessing the recommendations of a high support bra for police officers.



## Menstrual cycle phase and proprioceptive ability: A scoping review.

Dr Fiona Higgs<sup>1</sup>

<sup>1</sup> University College Birmingham

**Background:** Fluctuations in a range of measures have been reported throughout MC, including performance outcomes [1], and injury risk factors [2]. Proprioception is a key determinant of motor control and has been linked to reduced risk of lower limb injury and increased performance. While there have been some recent publications on the relationship between proprioceptive performance measures in the lower limb and menstrual cycle phase, not enough is yet known about the influence of MC on proprioception or potential underlying mechanisms including the influence of hormonal fluctuations associated with MC phase on proprioception. Such knowledge could improve decision-making in injury and performance management and strategies.

**Aims:** To map existing evidence and knowledge gaps regarding the effects of MC phase and proprioception in eumenorrheic populations.

**Methods:** This proposed review will utilise the updated Joanna Briggs Institute (JBI) methodology for conducting scoping reviews and preferred reporting items for systematic reviews and meta-analysis Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist. PubMed and EBSCOHost electronic databases will be searched, then websites of trial and study registries. Studies reporting outcome measures for proprioception alongside MC phase in eumenorrheic female populations will be included. Two independent reviewers with screen eligibility by title, abstract, and full text, respectively, before extracting data into PICO tables.

**Ethics and dissemination:** Ethical approval is not required for this review of existing literature. Output is intended for publication in an open access journal. As the first scoping review to extract and map key concepts and factors regarding the effects of menstrual cycle phase on measures of proprioception the questions and hypotheses generated for future research are hoped to generate information used in formulation of specific guidelines for injury prevention and performance in the eumenorrheic population and inform policy.

[1]. McNulty, K. L., Elliott-Sale, K. J., Dolan, E., Swinton, P. A., Ansdell, P., Goodall, S., Thomas, K., & Hicks, K. M. (2020). The Effects of Menstrual Cycle Phase on Exercise Performance in Eumenorrheic Women: A Systematic Review and Meta-Analysis. *Sports medicine (Auckland, N.Z.)*, 50(10), 1813–1827. <https://doi.org/10.1007/s40279-020-01319-3>

[2]. Zazulak, B. T., Hewett, T. E., Reeves, N. P., Goldberg, B., & Cholewicki, J. (2007). The effects of core proprioception on knee injury: a prospective biomechanical-epidemiological study. *The American journal of sports medicine*, 35(3), 368–373. <https://doi.org/10.1177/0363546506297909>



## Evidence-based coaching effectiveness framework: Perspectives from coaches and players in South African Women's Rugby

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Sports coaching is marked by inherent elements of complexity. Coaches constantly encounter ambiguity and uncertainty regarding the perspectives and expectations of stakeholders. An additional element of complexity that coaches must navigate is the dynamic nature of, and the intricate micro-political coaching environment. This study provides a distinct view of coaching effectiveness in the evolving context of South African Women's Rugby, which is still in its early stages of development. This exploration along with practical recommendations is essential due to the realities of a predominant presence of male coaches training female players and players originating from diverse sporting backgrounds, including a majority of those who commence their rugby careers at university level. Through semi-structured interviews with both players and coaches, the research delves into their perspectives of coaching strategies, methodologies, and outcomes, aiming to understand coaching efficacy and its impact on player development. The findings contribute to a nuanced understanding of coaching effectiveness and lead to the development of an evidence-based coaching effectiveness framework with recommendations to enhance coaching development and positively impact the sport's growth and success. It also provides insights that extend traditional notions, enabling a comprehensive understanding of coaching effectiveness and its implications in this evolving Women's Rugby landscape globally.



## Reliability of Critical Velocity during Standardized Treadmill Endurance Running

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<sup>1</sup> University of Glasgow

### BACKGROUND

Performance during high-intensity exercise is determined by the hyperbolic speed-tolerable duration (S-tLIM) relationship, defined by critical velocity (CV) and work (duration, D') above CV. However, multiple constant load time to exhaustion (TTE) tests are required to establish S-tLIM, introducing variability, but reproducibility is unknown. This study investigated test-retest reproducibility of CV in healthy controls (non-runners) and club-level runners.

### METHODS

Healthy participants volunteered; 5 female and 11 male non-runners; 10 female and 10 male active runners (running >5/week). Incremental exercise tests (IET) determined VO<sub>2</sub>max and V<sub>max</sub>. At least four individualized constant load TTE tests (range 3-15 mins) were performed to establish S-tLIM, then retested.

### RESULTS

Male runners showed 15-20% increased VO<sub>2</sub>max and V<sub>max</sub>, and 25% increased CV vs controls. VO<sub>2</sub>max obtained during IET were compared to TTE tests (all P>0.05). V-t and V-1/t relationships confirmed true exhaustion. Test-retest CV in runners: 14.4±0.4 km/h and 14.6±0.4 km/h (P=0.267); D': 903.3±112.1 m and 1010.5±95.3 m (P=0.116). Controls: CV 11.2±0.6 km/h and 11.8±0.6 km/h (P=0.003); D' 1269.0±117.6 m and 963.8±103.8 m (P=0.002). Runners test-retest differences were smaller. 8/10 runners vs 5/11 controls achieved test-retest agreement within 5%. Female data are being analysed and will be presented and discussed at conference.

### CONCLUSION

Protocols for determining CV and D' were more reproducible for runners but not controls, in which significant. The S-tLIM relationship during treadmill exercise should be used with consideration in non-running cohorts, whereas in athletes, it presents an accurate performance-based indicator of functional exercise capacity in the severe intensity domain for pacing and intensity control.



## The good, the bad, and the pretty: how female athletes access health information online

Molly Pocock<sup>1</sup>

<sup>1</sup> Nottingham Trent University

**Background:** The intersection of sports, medicine, and athlete health is a longstanding focus in the sociology of sport. In today's digital era, athletes increasingly turn to online sources for medical guidance, often prioritising experiential knowledge over scientifically validated evidence (Atkinson, 2012). With the ever-increasing prevalence of social media health influencers and content creators, athletes now commonly use social media for health information such as nutrition (Bourke et al., 2021), but little is known about how female athletes are engaging with gender-specific health advice in relation to their sporting bodies.

**Aim:** This study aims to explore how female athletes interact with gender-specific health advice, particularly through social media. Employing qualitative methods, the research seeks to uncover the impact of social media on athletes' health-related decisions, alongside influences from healthcare providers and social networks. By delving into these dynamics, the study aims to provide comprehensive insights into the challenges and opportunities faced by female athletes in accessing and interpreting health information. Ultimately, the goal is to inform strategies that enhance athlete well-being and promote informed decision-making in the digital age.

**Methods:** 20 semi-structured interviews were conducted with female athletes representing diverse backgrounds in individual sports (e.g., middle-distance running, tennis, dance) across various participation levels. Participants exhibited varying levels of knowledge regarding health information.

**Results:** After a preliminary analysis, I will report initial findings surrounding what constitutes health information and who provides this content; female athlete experiences with healthcare providers; the reliability of health information on social media; educating female athletes online; advocacy and sharing (ill)health experiences.

**Conclusion:** Understanding how female athletes navigate online spaces for health information is crucial for promoting their wellbeing and informed decision-making. This research contributes to athlete welfare by shedding light on these dynamics, offering recommendations to empower athletes, healthcare providers, and industry stakeholders in fostering evidence-based practices and holistic athlete health.

Atkinson, M. (2012) Doctors without degrees. The social organization of sports medicine: Critical Socio-cultural Perspectives. In: Malcolm D and Safai P(ed.) Routledge pp.277-294.

Bourke, B. E. P., Baker, D. F., & Braakhuis, A. J. (2019) Social Media as a Nutrition Resource for Athletes: A Cross-Sectional Survey, International Journal of Sport Nutrition and Exercise Metabolism. 29(4), 364-370.



## Sleep quality and menstrual symptoms in master female recreational runners after intensive and extensive protocols for training a half-marathon

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**INTRODUCTION:** An increasing number of female runners prepare for half-marathons with high weekly mileage. We introduced a HIIT regimen for recreational master runners, emphasizing intensity over volume, and including resistance exercises. Since addressing menstrual symptoms and sleep quality are crucial factors on athletic performance, we assessed these factors in HIIT and moderate intensity continuous training (MICT) protocols.

**METHODS:** Twenty women recreational runners (40±6 yr) followed MICT or HIIT training schedules (3 sessions/wk, 12wk). MICT trained a mean of 31±4 km/wk at an intensity below their 80% VO<sub>2</sub>max, while HIIT run 25±5 km/wk at 80-100% VO<sub>2</sub>max which combined with resistance training (1). All women were evaluated for rhythm in the long run, ratio of perceived exertion (RPE) and with an incremental test (1). The PSQI test for sleep quality evaluation and a menstrual Diagram to control the phases and symptoms of the menstrual cycle were assessed at the end of each training mesocycle. At the end of the training period, all women participated in the same half-marathon run.

**RESULTS:** Both MICT and HIIT showed a 3% decrease in their previous half-marathon finishing times, without significant differences between training groups. PSQI score was 5.5±1.6 (HIIT) and 5.1±1.1 (MICT) with no significant differences between groups. Both were classified as poor sleepers (PSQI>5). The mean bleeding days were 5.0±1.7 (HIIT) and 4.3±1.4 (MICT), and the mean days of menstrual symptoms experienced per cycle were identical in both groups (3.0±2.8). We detected 2 amenorrhea women in the group MICT.

**CONCLUSION:** HIIT exercise did not worsen sleep quality nor disrupted menstrual cycles compared to MICT. This indicates that an intensive protocol improved the anaerobic and aerobic capacity reducing training time but without affecting the well-being of the half-marathon runners.

## Measurement method comparability for breast volume calculation

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**Background:** The female population present a diverse range of breast shapes and sizes. These are typically distilled into two simple measures (bust and band), but it is more challenging to obtain breast volume or mass. Derivations of breast volume, from which breast mass can be derived based on an assumed density, have been reported based on anthropometric equations, water displacement and 3D scanning for cosmetic surgery applications (Choppin et al, 2016). An objective comparison of direct measures and derivations of breast volume is of interest to determine the validity of each measurement approach.

**Aims:** The aims of this study are to investigate the feasibility of a novel volume derivation from 3D scanning, assess its repeatability, and make comparisons to a previously published method.

**Method:** Four dimensions were taken of both breasts of six participants and volume was derived based on formulae published by Kovacs et al (2007). A 3D surface scan was captured of the same torso region using a EisScan HX (Go3DPro, US). Manual processing was repeated to identify regions of the torso that were not breast and a triangulation-based cubic interpolation using MATLAB (MathWorks, UK) was used to provide an estimate of the chest wall. The breast volume was derived from the volumetric difference between the two surfaces.

**Results:** Breast volume derivation from anthropometric measurements and 3D scanning allowed direct comparisons to be made. For an example participant, the novel method gave a left breast volume of  $902 \pm 114$  ml, and a right breast volume of  $949 \pm 70$  ml.

Anthropometric measurement gave a volume for the left at  $1198 \pm 132$  ml and right,  $1487 \pm 150$  ml.

**Conclusion:** This method demonstrated promising potential by effectively isolating differences between the right and left breast, unlike conventional methods, and showed agreement with alternative approaches.

Choppin, S. B., Wheat, J. S., Gee, M., & Goyal, A. (2016). The accuracy of breast volume measurement methods: a systematic review. *The Breast*, 28, 121-129.

Kovacs, L., Eder, M., Hollweck, R., Zimmermann, A., Settles, M., Schneider, A., ... & Biemer, E. (2007). Comparison between breast volume measurement using 3D surface imaging and classical techniques. *The Breast*, 16(2), 137-145.

## #Pelotonmumsuk- How connected fitness applications make leisure time physical activity accessible for mothers in the United Kingdom (UK)

Dr Joanne Mayoh<sup>1</sup>, Dr Juliette Hecquet<sup>1</sup>, Dr Ian Jones<sup>1</sup>

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Leisure time physical activity (LTPA) has been shown to have greater positive impact on health and wellbeing in comparison to physical activity undertaken as part of a job, domestic or caring responsibilities. Motherhood is a period, however, when leisure time physical activity (LTPA) reduces, often squeezed into tight schedules as short intentional bursts of activity. Consequently, mother's LTPA is less curative, has greater limitations placed on it, and generally requires more careful structuring, planning and negotiation of limited personal time and space. Existing research emphasises how mothers, manage and negotiate their maternal identities to engage in LTPA. Such practices are often spatially diverse and temporally unfolding, yet community focused and social.

The connected fitness sector (CFS), which involves the application of technology to LTPA using a combination of hardware, software and content, grew massively during the pandemic, as consumers were forced away from traditional LTPA practices such as gym-based fitness. Growth is set to continue with the introduction of AI enabled devices. Peloton, for example, saw huge success during the pandemic, growing into the largest interactive fitness platform in the world with 6.6 million members globally. Despite growing popularity, minimal scholarly attention has been paid to this sector and its post-pandemic potential for supporting LTPA that cultivates physical activity communities within virtual spaces. Research in this area is critical, especially considering the opportunities CFS holds to support fragmented LTPA practices, potentially allowing mothers to negotiate constraints imposed on them by traditional modes of exercise.

We aim to thematically analyse digital content to explore the role that the Peloton app and/ or technology has in supporting UK mother's LTPA. Specifically, the research will explore the digital photographic and text content of user-generated Instagram posts with the identifier #Pelotonmumsuk (n=444) to explore how the CFS can support the mother's LTPA.





## Lessons from sport psychology to help approach the maternity journey as a positive challenge

Carla Meijen<sup>1</sup>

<sup>1</sup> University of Amsterdam

**Background:** Giving birth is sometimes likened to a marathon, including endurance, pacing, and pain management. Considering the mind-body connection and the adaptive cardiovascular responses associated with a challenge state, there is scope for applying the Theory of Challenge and Threat States (Jones et al., 2009), and sport psychology more broadly, to the maternity journey. Practicing and implementing psychological strategies during the maternity journey can help reduce the intention-gap that women may experience.

**Aims:** To offer insights into how sport psychology can be considered during the maternity journey

**Methods:** Informed by a strength-based approach and interviews with athletes and exercisers, which formed part of the book *Empowered Birth* (Meijen, 2023), there will be a discussion of the role of sport and exercise experiences during the maternity journey. Examples of practical strategies or techniques to cultivate a sense of empowerment will be shared.

**Conclusions:** Most of the research on sport and the maternity journey has focused on physical activity guidelines and returning to sport, as well as the psychological demands associated with return to sport, yet there is scope for a strength-based approach to help empower those on their entire perinatal journey, as well as their support team, and better understand how they can move the demand-resource balance to a positive challenge. Importantly, a careful consideration of the purpose of each strategy is warranted.





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# Working with female athletes: S&C and biomechanics

“I don't have to worry about anything that wobbles or flops or anything like that”: A diary study of women's body image experiences during personal training

Phoebe Gray<sup>1</sup>, Dr Megan Hurst<sup>1</sup>, Prof Thomas Ormerod<sup>1</sup>

<sup>1</sup> School of Psychology, University of Sussex

**Background:** Research in sport and exercise settings suggests that physical activity leaders have the potential to influence body image for their athletes and exercisers; however, research is yet to explore this possibility in the context of personal training.

**Aims:** The present qualitative study sought to understand women's body image experiences of personal training, and how women perceive the language and behaviours of their personal trainers as influencing their thoughts and feelings about their bodies.

**Methods:** Seventeen women (aged 45-64) who had at least one personal training session per week sent qualitative diary entries via WhatsApp after each training session over a period of four weeks. Each participant then took part in a semi-structured interview, relating to their diary entries and their overall experiences of their body in the context of their personal training sessions. Data were analysed using reflexive thematic analysis from a critical-realist perspective.

**Results:** Five themes were generated, (1) protection from society's assumptions about exercise, (2) having someone in your body's corner, (3) supporting a deeper engagement with bodily experiences, (4) prioritising wellbeing, and (5) there's always room for improvement.

**Conclusions:** Findings provide further insight into how qualities of interpersonal relationships within sport and exercise might contribute to women's body image. The present study has important implications for educating personal trainers on how they can promote positive body image through their communication with their clients.



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# Working with female athletes: S&C and biomechanics

## Gender Diversity of Strength and Conditioning Coaches: A Participatory Action Research Approach

Rob Rowland<sup>1</sup>, Thierry Middleton<sup>1</sup>, Beth Clarkson<sup>1</sup>, Richard Thelwell<sup>1</sup>,  
Matthew Hiscock<sup>1</sup>

<sup>1</sup> University of Portsmouth

**Background:** Despite significant growth within the Strength and Conditioning (SC) industry over the past 15 years, there is much less demographic diversity amongst Strength and Conditioning Coaches (SCCs), compared to the wider coaching cohort in the UK. Within the UK, ~93% of SSCs are male. Women are expected to amend their behaviour to suit the male-dominated industry, experience regular incidents of prejudiced banter and gender stereotyping, with scarce advancement opportunities (Thomas et al., 2021). Despite publicly good intentions, there are still significant barriers for women surrounding accessibility, retention and role progression within SC.

**Aims:** This abstract collates two studies (Study 1: Gender Diversity of SSCs: The Perceptions and Experiences of Practitioners who are Women; Study 2: The characteristics and attributes of successful professionals in SC: Perspectives from students who are women). The primary aim is to support students who are women developing a career within SC. Secondary aims: (i) explore the experiences and perceptions of current UK SC practitioners, (ii) explore the characteristics and attributes students studying SC believe characterise a successful professional career.

**Methods:** These studies form a wider body of research using a Participatory Action Research (PAR) approach, involving three key stages of knowledge generation, implementation and evaluation. The researchers work with participants across all phases, who help drive the direction of the research and action. Study 1 uses a mixed methods design. First, an unstructured storytelling photo elicitation interview was undertaken with current SC practitioners to explore their experiences of education and industry. This will be followed up by a focus group with the same participants exploring the role of key stakeholders in SC career development (governing bodies; employers; training providers) Study 2 uses a semi-structured, photo elicitation interview approach with current university students.

**Results:** Whilst data collection is still ongoing (completion by May), results from both studies will be presented.



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# Working with female athletes: S&C and biomechanics

## Examining the Effect of External Force Applied to the Pelvic Region on Postpartum Women's Perception of Stability and RMS Values

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<sup>2</sup> Cardiff School of Sport and Health Sciences, Cardiff Metropolitan University

**Background:** Balance in the postpartum period is reduced (Rothwell et al., 2020). The posture of a women's body changes during pregnancy due to the anterior shift of the centre of gravity and an increase in body mass. This may cause the lower limbs to become overloaded and lead to discomfort and stability issues.

**Aims:** To examine the effect of applying external force supplied to the pelvic region, in the form of a pelvic belt, on perception of stability and stability metrics in postpartum women.

**Methods:** A preliminary study was completed with five postpartum women. Participants completed a series of balance tasks, with and without pelvic compression. One inertial measurement unit (IMU) was used to collect acceleration data and was positioned at L5 on the participants' lower back. Root mean square (RMS) acceleration data was measured with a reduction in this value indicating an increase in stability. After completing all balance stances, participants were asked to rate how supported and how stable they felt when wearing the pelvic belt. These were answered using a visual analogue scale (VAS), with anchors 'not supported at all' and 'extremely supported', and 'completely unstable' and 'completely stable' respectively.

**Results:** All women felt more supported when wearing the pelvic belt than without during the balance tasks, with 80% of women feeling that the belt positively affected their stability. All participant's RMS values decreased apart from participant four, who indicated they felt the belt did not affect their stability.

**Conclusions:** There appears to be an association between perceived and objective stability with both the perception of support and stability and RMS values indicating increased stability when an external force was applied to the pelvic region for the majority of postpartum women. Testing will continue with a larger cohort of postpartum women to statistically verify such associations.

Rothwell, S. A., Eckland, C. B., Campbell, N., Connolly, C. P., & Catena, R. D. (2020). An analysis of postpartum walking balance and the correlations to anthropometry. *Gait & Posture*, 76, 270–276. <https://doi.org/10.1016/J.GAITPOST.2019.12.017>



## Determining the need for female-specific inertial parameters when modelling and analysing trunk biomechanics of female golfers

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<sup>1</sup> Sports Technology Institute, Loughborough University

<sup>2</sup> PING Inc.

**Background:** Female golf biomechanics is limited to kinematic-only analysis and do not detail if biomechanical models are adapted for females (e.g. body segment inertial parameters (BSIPs)). BSIPs influence kinetic measures or centre of gravity (COG) estimates which warrants proper modelling.

**Aim:** To determine the difference between trunk COG when using different models with male vs female inertial parameters.

**Methods:** Two amateur golfers gave informed consent approved by Loughborough University's ethics committee to participate. A motion capture system and in-ground force plates collected biomechanics data as participants performed three golf swings with a 7-iron.

The trunk COG position, measured in meters (m) in reference to the lab (medial-lateral (ML), anterior-posterior (AP), superior-inferior (SI)), was estimated using i) mathematical model with density values from male cadavers (Dempster, 1955) and ii) density values from in vivo scans of females (De Leva, 1996), in anatomical position and at top of backswing in the golf swing.

**Results:** A change of 0.0%, 0.40%, and -0.1% in anatomical position and a change of 0.4%, 1.9%, and -0.0% at the top of the backswing in the ML, AP, and SI directions of the trunk COG were observed using model 2. An example of collected data, in anatomical position, participant 1 had a trunk COG position of (-0.6 m, -0.0 m, 1.2 m) using model 1, and (-0.6 m, -0.0 m, 1.2 m) using model 2. At the top of the backswing, participant 1 had a trunk COG position of (-0.7 m, 0.2 m, 1.2 m) using model 1, and (-0.7 m, 0.2 m, 1.2 m) using model 2.

**Discussion:** As a pilot study, the trunk COG position is similar between models. More research is warranted to confirm the influence of these models in female golf and further calculations of key biomechanical metrics in the golf swing.

De Leva, P. (1996). Adjustments to Zatsiorsky-Seluyanov's segment inertia parameters. *Journal of Biomechanics*, 29(9), 1223–1230.

Dempster, W. T. (1955). Space requirements of the seated operator: Geometrical, kinematic, and mechanical aspects of the body with special reference to the limbs (Vol. 159). Wright Air Development Center Wright-Patterson Air Force Base, Ohio.



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# Supporting the girls: Breast health considerations for active women



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## When and how does a sports bra work to reduce breast movement during treadmill running

Dr Nichola Renwick<sup>1</sup>, Jonathan White<sup>1</sup>, Brogan Jones<sup>1</sup>, Joanna Wakefield-Scurr<sup>1</sup>

<sup>1</sup>University of Portsmouth

**Background:** Breast biomechanics research has largely focused on reporting discrete measures of nipple displacement which only provides an indication of what is happening at a specific time point. Evaluating breast movement continuously across the gait cycle may help identify when during the gait cycle sports bras are most effective at reducing breast kinematics. This study aims to compare discrete and continuous breast kinematic variables between bare-breasted and sports bra condition to identify when during the gait cycle the sports bra is working to reduce breast kinematics.

**Methods:** Thirty-six females (mode bra size 34D) ran on a treadmill bare-breasted and in a sports bra. Electromagnetic sensors captured and calculated nipple motion relative to a torso reference system; Nipple displacement was reported as range of motion and peak values; nipple velocity and acceleration were calculated as first and second derivatives of nipple position and reported as peak values; discrete values were calculated over ten gait cycles and averaged. Shapiro-Wilk tests checked data for normality; Wilcoxon signed-rank or paired samples t-test compared between support conditions. One-dimensional statistical parametric mapping (SPM) compared time histories for relative nipple position, velocity and acceleration between support conditions.

**Results:** Nipple displacement, velocity and acceleration were significantly reduced in a sports bra for all discrete variables except peak lateral displacement ( $p=0.156$ ). SPM identified multiple points across the gait cycle where the bra significantly reduced breast kinematics; these points occurred when the nipple was furthest in position from the sternal notch. The bra was most effective at reducing displacement (87%), velocity (83%) and acceleration (55%) over the largest duration of the gait cycle in the superior-inferior direction.

**Conclusions:** Sports bras work to significantly reduce breast movement at multiple points across the gait cycle which coincide with the extremes of breast displacement which might have material implications for sports bra designs.



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# Supporting the girls: Breast health considerations for active women



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## Assessing current maternity/nursing sports bras and providing recommendations for future product development

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**Background:** Many pregnant and post-natal women do not meet physical activity (PA) guidelines. One barrier to PA for these women is finding suitable sports bras due to the numerous, and continuous, changes the breasts undergo which likely result in changes to bra fit. Some maternity/nursing sports bras do exist, but they do not meet the user groups needs as pregnant and post-natal women still struggle to find comfortable, supportive and functional sports bras.

**Aims:** The study aimed to (1) assess current maternity/nursing sports bras in terms of purchasing activity, likes and limitations of products and (2) determine the essential characteristics and features required for future product development guided by the user group.

**Methods:** A mixed-methods deductive sequential approach was taken utilising an online questionnaire and in-person focus group interviews. Three-hundred and eight participants who were pregnant, had given birth within the last 12 months or were nursing at the time of data collection completed the questionnaire and 13 participants also took part in focus groups interviews.

**Results:** Only 15% of maternity/nursing sports bra purchasers found exactly what they wanted with most problems relating to support, design and fit. Support and comfort were the most important characteristics with 94% and 98% of participants rating them as very important or absolutely essential. Easy nursing access, adjustability, availability (where products can be purchased and the range of sizes available), product longevity and value must also be considered.

**Conclusion:** There are a number of issues with current products including support, discomfort, design and bra fit. Easy nursing access, comfort and support must be balanced and adjustability, availability, product longevity and value considered in future products. Tackling these problems should provide suitable breast support and help reduce barriers to PA faced by pregnant and post-natal women.



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# Supporting the girls: Breast health considerations for active women



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## Breast and bra education can improve elite female athlete experience

Melissa Jones<sup>1,2</sup>, Brogan Jones<sup>2</sup>, Prof Joanna Wakefield-Scurr<sup>2</sup>

<sup>1</sup> Bangor University

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### Background

Most adult females rate their bra knowledge as average or below, which can lead to poor bra choice and poor bra fit. During exercise, sports bras are important to reduce breast motion and associated breast pain and discomfort. Multiple issues related to breast and bras have been identified in active cohorts, however, bra knowledge, use and issues in elite athletes are not well understood.

### Aims

To understand breast related issues experienced by elite female athletes and whether an educational intervention can improve athlete experience.

### Methods

One hundred and fifty-six national level athletes (Team GB, Football Association, England Netball) completed a survey regarding their knowledge of breast and bras, current bra use, and issues relating to breast and bras. Athletes then attended a one-to-one bra assessment where they were provided education on bra fit and selection and were able to select a new sport bra, with guidance from a trained bra fitter. Four weeks after receiving their new bra, 43 athletes completed another survey regarding their experiences with their new bra.

### Results

Prior to the bra assessments, 76% of athletes rated their knowledge of breasts and bras as average or below and 90% of athletes reported some problem with their breasts or bra during exercise. During the bra assessments 68% were found to be wearing an ill-fitting bra and 36% opted to try a new bra style. Ninety-one percent of athletes reported that they were still wearing the new sports bra and 74% said it was an improvement on their previously worn bra.

### Conclusions

Elite athletes report similar knowledge and breast and bra related issues as previously reported in active populations. Education can improve athletes' selection of breast support and reduce the pain and discomfort associated with poor breast support.



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# Supporting the girls: Breast health considerations for active women



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Addressing the two elephants in the room: busting booby traps with a physiotherapy approach to breast weight management integrating both active and passive support structures.

Siobhán O'Donovan<sup>1</sup>

<sup>1</sup> Posture Matters / PostureFitting

Breast weight and movement increase the load women and girls battle against gravity, affecting how we feel, move, look. It can influence posture, pain, ability or willingness to move, as well as self-confidence and self-image. Despite being a US-certified athletic trainer, a physio, an S&C coach, and having had substantive experience in international sports, as both player and healthcare professional, I was completely ignorant in this area, a knowledge gap I set about re-dressing.

Looking further into the consequences of poorly-supported breast weight resulted in me creating PostureFitting, a physiotherapy service empowering, enlightening and uplifting women and girls via the integration of postural and bra-fitting education. Combining both active and passive elements of breast support provides immediate, but, more importantly, sustainable support of breast weight.

Poorly-managed breast weight affects both performance and participation in sport and exercise, all the more so at life stages where activity should be a non-negotiable for the health and wellbeing of women and girls. The margins available in performance enhancement at the elite level can be very small, and the healthcare burden of poor breast control huge, yet the (2!) elephants in the room that scream breast weight optimisation still receive far too little recognition in terms of clinical application of academic research findings.

Outcome measures from breast reduction surgery are unequivocal in showing its benefits to a woman's life, including improved respiratory function, decreased pain, increased self-confidence. For a large majority of women, education in optimal breast weight management can provide similar outcomes, without the expense and significant trauma of surgery. Applying the findings of the excellent work being done academically in breast health via education and advocacy are our keys to making these vital differences. I would love to enlighten other professionals about how we can all do this together.



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**Thank you to all who  
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***Moving Women: Shaping Victories***