

Institution: University of Sunderland		
Unit of Assessment: 24 Sport and Exercise Sciences, Leisure and Tourism		
Title of case study: Enhancing performance in elite sport through better understanding of gender differences		
Period when the underpinning research was undertaken: 2015-2020		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Eddie Bradley	Senior Lecturer	2012-date
Paul Davis	Senior Lecturer	2010-date
Roberts Hogg	Senior Lecturer	2003-date
David Archer	Senior Lecturer	2005-date
Lisa Board	Senior Lecturer	2010-date
Ian Whyte	Principal Lecturer	1999-2019
Period when the claimed impact occurred: 2016 to December 2020		
Is this case study continued from a case study submitted in 2014? N		
<p>1. Summary of the impact (indicative maximum 100 words)</p> <p>The Unit's research examining the characteristics of women's sport and the relationship between menstruation and player performance has influenced the preparation and improved the performance of an elite women's rugby team. Since the coaching staff incorporated the research findings into training, the team has risen from last (10th) to 6th in the Premier 15s league and the players are fitter and better prepared. Since 2020 the research supports the training session programming of the USA national women's rugby team.</p>		
<p>2. Underpinning research (indicative maximum 500 words)</p> <p>As female sport grows and develops, greater knowledge of the physical determinants of players and the implications of these on performance is of increasing importance. Research on the subject undertaken at the University of Sunderland incorporates three related topics.</p> <p>a) Gender differences in sport</p> <p>The research team at the University of Sunderland has investigated the influence of gender on sport, extending the modes examined to female eligibility in athletics [R1], mixed-sex football [R2] and tennis [R3]. The work conceptualises the rationale for sex-based differences in sport through philosophical discourse, highlighting inconsistencies in governing-body approaches and suggesting unfairness in the treatment of female athletes, evidenced by differences in playing standards, regulations and prize monies. The research suggests that governing bodies should consider removing disparities between male and female sports and competitions. The work provided an umbrella of evidence that supported the need for specific female-based sport research that parts (b) and (c) went on to address.</p> <p>b) Match characteristics</p> <p>Bradley's research identified improved scrum outcomes in the Six Nations as a consequence of World Rugby rule changes [R4] and described match characteristics and player workloads in the Tyrrell's Premier15s women's league using 10 Hz Global Positioning System (GPS) and accelerometer technology. This provided objective data on match performance parameters including total and relative distances at threshold speed zones, player loads and work:rest ratios [R5]. Positional differences exist in these parameters and these are not the same as those previously presented in the male game, which are usually applied to the women's game for the purpose of deriving training programmes. Such sex- and position-specific data should be considered when designing conditioning programmes in female rugby union, developing fitness tests and benchmarking physical performances during competitive games.</p> <p>c) Menstrual cycle</p> <p>Complex relationships exist between the menstrual cycle (and associated hormonal fluctuations) and various aspect/markers of health, wellbeing and sporting performance.</p>		

Previously, research has focused on amenorrhea (recently classified as Relative Energy Deficiency in Sport), usually in athletic populations. However, this affects a much wider sphere of female sports. Working alongside Scottish RFU, qualitative research into female rugby players' experiences of the impact of the menstrual cycle on training and performance was conducted through semi-structured interviews and thematic analysis [R6]. This demonstrated that negative symptoms were more significant than those experienced by the general population. Players indicated that the physical and psychological symptoms include increased worry and heightened emotional state, physical pain and tiredness/lack of energy. This rugby-specific knowledge points to the need for increased player support during the menstrual cycle, through the development of training scheduling and match selection.

3. References to the research (indicative maximum of six references)

R1 Davis, Paul and Edwards, Lisa (2015) The new IOC and IAAF policies on female eligibility: old emperor, new clothes? *Sport, Ethics and Philosophy*, 8(1). pp. 44-56.

R2 Davis, Paul, Edwards, Lisa. and Forbes, A. (2016) Challenging sex segregation: A philosophical evaluation of the Football Association's rules on mixed football. *Sport, Ethics and Philosophy*, 9(4). pp. 389-400.

R3 Davis, Paul and Edwards, Lisa (2017) Is it Defensible for Women to Play Fewer Sets than Men in Grand Slam Tennis? *Journal of the Philosophy of Sport*, 44(3). pp. 388-407.

R4 Bradley, Eddie, Hogg, Robert and Archer, David (2017) Effect of the PreBind engagement process on scrum timing and stability in the 2013 to 2016 Six Nations. *International Journal of Sports Physiology and Performance*, 13(7). pp. 1-21

R5 Bradley, Eddie, Board, Lisa, Hogg, Robert and Archer, David (2019) Quantification of movement characteristics in women's English Premier elite domestic rugby union. *Journal of Human Kinetics*, 72, pp. 131-140.

R6 Findlay, Rebekka, Macrae, Eilidh, Whyte, Ian, Easton, Chris and Forrest, Laura (2020) How the menstrual cycle and menstruation affect sporting performance: experiences and perceptions of elite female rugby players. *British Journal of Sports Medicine*. ISSN 0306-3674

Quality indicators

All outputs are peer-reviewed journal articles. **R1**, **R2**, **R4** and **R6** are published in Q1-ranked journals.

4. Details of the impact (indicative maximum 750 words).

The Unit's work on gender differences in elite sports, and particularly on women's rugby, has enhanced the performance sustainability of the Darlington Mowden Park (DMP) Sharks, an elite rugby team that competes in the Premier 15s, the top tier of the women's English rugby union league. The team includes former England captain Katy Daley-McLean MBE, six other England internationals and an Ireland international, and is coached by former Samoan international Mike Umaga.

Since 2016 Bradley has been the Sharks' sports scientist and his contributions to the team's success have been underpinned by the body of research undertaken by Bradley and other researchers in the Unit. This close relationship has benefited the team through Bradley's dissemination of the research to team management and the application of his findings to training and match strategies. The team's participation in the research itself has also given players and management staff access to specialist equipment that they would not otherwise have had [S1].

Improved training and performance

Prior to the Unit's research, data on the women's game was scarce. When the research began, only two published articles and data existed on female 15-a-side rugby, none relating to the English leagues. This obliged coaches to apply data derived from the men's game in designing women's training programmes, with it the danger of increasing women's work rate. Work rate is a metric in rugby union that relates to the intensity of play relative to rest, and training intensities are often based on how hard the players need to work in a match. If this is based on male data, it leads to overtraining.

Sunderland's research enabled the DMP Sharks to tailor training to the characteristics of the women's game, which has mitigated risk (through closer monitoring of players health to prevent overtraining and injury) and improved performance. The team's Head Coach says that the Unit's research *"has been invaluable to us as a coaching team and has had a significant impact on how we prepare the team to perform on a match day."* Two key changes to training regimens have been implemented as a direct result. First, training has been tailored to improve players' high intensity running. This has improved repeatability of high-speed movements, which has increased the number of high-speed movements in-match to a mean of 19 efforts per play and a mean distance of 496m [R5]. This is an important outcome since the number of high-speed movements predicts whether a team will win or lose a match. Second, the team now focuses on reducing player's drop-off in work rate to ensure that players can maintain performance levels throughout the full 80 minutes of the game. The Head Coach confirms that these improvements have resulted in stronger and more sustainable performances [S1]. Team performances continually improved over the course of the time the research was conducted. In the 2016/17 season, the team won a single game and finished last in the league (10th place). In the second season and third seasons (2017/18/19) as the research was being conducted, the team improved to 8th place. In the final season (2019-20) after the research was completed and fully integrated into the coaching approaches, the team finished in their highest league position of 6th with five wins [S2]. A former England captain and current member of the England squad has praised Bradley's work, and expressed her gratitude for the support he gave to the players [S3].

Improved player health and welfare

Having high quality data about player performance gives the club a better insight into whether players are over- or underworked so they can train accordingly. Overworked players are more likely to sustain injuries, meaning that they may be unable to play, and injuries are more likely to be long term. Equally, underworked players risk injury by being insufficiently prepared. The team have also benefited from regular fitness and strength testing sessions across each of the 2017-2020 seasons. Mean sprint times significantly improved from 3.55 s to 3.28 s and aerobic fitness test run performance times significantly improved from 6 minutes 3 s to 5 minutes 32 s, and significant improvements in strength for the bench press (mean: 38.8 kg to 50.7 kg) and back squat (61.6 kg to 78.4 kg) were observed [S4]. Additionally, lower than league average injury incidence in the 2017-18 season, and a 27% decrease in total injuries and a 21% decrease in match-related injuries from the 2018-19 to the 2019-20 seasons occurred [S5]. The club now uses this data to identify and respond to individual players' needs in training, and when making match selections, resulting in fitter players and stronger teams [S1].

Differences in women's and men's games are more widely understood

An exclusive article in the Daily Telegraph reported on Bradley's research and its implementation at the DMP Sharks during the 2018/19 season [S6]. The focus of the article, on differences in women's and men's games [R5], has improved understanding of these distinctions among the Telegraph's 317,817 print and 335,399 online readers, as well as the 38,000 people it was shared with across Twitter, including the former England Women's captain [S7]. The story was picked up by the North-East Chamber of Commerce, who commissioned an article exploring the application of the data to understand how female players perform [S8]. The research came to the attention of the USA Women's National rugby team, who began using the research to support training session programming in December 2020 [S9].

DMP Sharks stand out for their use of state-of-the-art sports science and technology

Through their involvement in Bradley's research, the team has access to specialist equipment such as GPS monitors and speed gates. The team uses GPS monitors to understand the amount of work a given player puts in during training and matches, measuring the proportion of running vs. walking, and how far they run. The monitors offer improved accuracy over the traditional method of visual observation. Speed gates have replaced stop watches, giving a more accurate measurement of player speed. Access to this

technology has given the team a competitive advantage, since until recently no other team in the league had such unlimited access to GPS monitors [S1]. At the beginning of the 2016-17 season, the team had to apply for special dispensation from the RFU to allow players to wear GPS devices in game as this was previously prohibited in the domestic league. This led to the RFU amending their regulations in January 2017 to allow GPS monitoring during matches across the league. Individual players in the league have since opted to wear devices for personal monitoring, and the RFU provided GPS to teams in the league play-offs and final in the 2017-18 and 2018-19 season. However, the Sharks remained unique in using GPS monitoring across the whole team and extensively benefit from the monitoring [S10].

5. Sources to corroborate the impact (indicative maximum of 10 references)

S1 Statement of support, DMP Sharks Head Coach. Corroborates the use of Dr Bradley's research by an elite level female rugby team in developing evidence based training programs and match protocols used in the RFU Premier15s competition to enhance development and performance, and his involvement in successful tenders for the Tyrrell's Premier 15s.

S2 [Premier 15s league tables](#)

S3 Former captain, England women's rugby team. Corroborates the use of the research in preparing and developing international standard players by identifying the demands placed on players and understanding the influence of menstrual cycle on performance and health. (Corroborator identifier 1)

S4 Bradley, Eddie (2021) 'Seasonal changes in physical and performance characteristics in elite women's rugby union'. International Network of Sport & Health Sciences Conference

S5 DMP Sharks Physiotherapist (Corroborator identifier 2) and [RFU Women's Rugby Injury Surveillance Report \(WRISP\) Season Report 2017-18](#)

S6 ['Exclusive: DMP Sharks study sheds light on why women's rugby is different to men'](#), *The Daily Telegraph*, 25/10/2019

S7 [Social media traffic arising from original tweets and retweets, with a combined reach of c. 38,000.](#)

S8 ['Are women working harder than men?'](#) NE Chamber of Commerce 29/09/2019

S9 Head Coach, USA Women's Rugby. Corroborates use of research to support training session programming. (Corroborator identifier 3)

S10 RFU Women's Head of Strength and Conditioning. Corroborates changes to RFU regulations on the use of GPS devices in-game, provision of GPS devices to teams in league play-offs and 17-18 and 18-19 final, and use of GPS by individuals and teams across the league. (Corroborator identifier 4)