

Invisibility of female participants in midlife and beyond in sport and exercise science research: a call to action

Kelly McNulty ¹, Alyssa Olenick,² Sam Moore,³ Emma Cowley⁴

As the number of females participating in sport and exercise has increased and moved towards parity with males, understanding the specific needs of sportswomen has become increasingly essential. Sadly, the imbalance between the representation of females and males in sport and exercise science research is well-known. For example, in 2021, we published *'Invisible Sportswomen': The Sex Data Gap in Sport and Exercise Science Research*, which conducted an exploration of the ratio of males and females as participants in sport and exercise science research.¹ Results revealed that within 5261 studies, across six popular sport and exercise science journals, females accounted for 34% of total participants, with as little as 6% of studies focusing exclusively on females. However, it is likely that these numbers would be further reduced when investigating the representation of women in midlife and beyond (ie, those who are perimenopausal or postmenopausal) within these female-only studies. While studies in midlife men as participants may also be similarly low and warrant further investigation, in this editorial, we examine the inclusion of female participants in midlife and beyond in sport and exercise science research, highlight the need to include female participants in the midlife and beyond and provide a call to action for researchers in this area to bridge the current data and knowledge gap for perimenopausal and postmenopausal women.

¹Department of Sport, Exercise and Rehabilitation, Faculty of Health and Life Sciences, Northumbria University, Newcastle upon Tyne, UK

²Department of Endocrinology and Metabolism, University of Colorado Anschutz Medical School, Aurora, Colorado, USA

³Department of Exercise and Sport Science, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina, USA

⁴Doctoral Training Alliance, University Alliance, London, UK

Correspondence to Dr Kelly McNulty, Department of Sport, Exercise and Rehabilitation, Faculty of Health and Life Sciences, Northumbria University, Newcastle upon Tyne, UK; kmcnulty@kynisca.com

MIDLIFE HORMONAL CHANGES

Females experience a variety of reproductive hormone profiles across their lifespan, from menarche to menopause. Menopause refers to the point in time when a female experiences 12 consecutive months of amenorrhoea as a result of the cessation of normal ovarian function, and that is not because of any other medical condition.² The transitional time between experiencing regular menses to the final menstrual period typically takes place over several years and is commonly referred to as 'perimenopause'.² Perimenopause is characterised by unpredictable fluctuations and gradual declines in endogenous sex hormones, namely oestrogen and progesterone, which can result in a variety of symptoms.² Indeed, research shows that most females will experience symptoms during this time, including physical (eg, hot flashes, insomnia, muscle/joint pain and changes in body weight/composition) and psychological (eg, mood changes, depression and anxiety) symptoms.³ Moreover, menopause is characterised by chronically low concentrations of endogenous sex hormones and, on average, females live one-third of their lives in this postmenopausal state.² The reduced concentrations of sex hormones that occur during this time can increase the risk of health-related conditions, such as osteoporosis, sarcopenia, cardiovascular disease and dementia.⁴ Moreover, it is important to recognise that some females will use hormonal replacement therapy (HRT) during this life stage, which alters the endogenous hormonal milieu.⁵

EXPANDING OUR RESEARCH FOCUS

These changing reproductive hormone milieus throughout perimenopause and postmenopause, alongside the subsequent symptoms and health-related conditions experienced during these life stages, are likely to influence not only a female's quality of life, but also their willingness to partake in physical activity, exercise and sport, and perhaps their performance

ability and training response. Thus, it is important to highlight the physical activity, exercise and sport considerations that might come with these physiological changes during midlife in females. For instance, the presence of symptoms might influence participation in sport, exercise and physical activity,⁶ whereas health-related conditions, for example, sarcopenia and osteoporosis, might have implications for training and injury risk.⁷ Moreover, changes in sex hormone concentrations could potentially shift exercise metabolism away from a lipid-based preference potentially impacting aerobic training and overall performance.⁸ Additionally, of the research available, there is evidence to suggest that changes in lifestyle factors, such as exercise and diet, might help reduce some of the adverse outcomes experienced during this life stage and beyond.^{9 10} However, the full consequences of these reproductive hormonal profiles on participation rates as well as health and performance outcomes, alongside strategies to overcome any negative effects, are relatively under-researched in comparison with other reproductive hormonal milieus experienced by females (eg, the menstrual cycle). Indeed, by extrapolating the data from 2021 (and updating this through 2022) to review the type of participants included in female-only studies (n=438), we illustrate that women in midlife and beyond account for only 9% of total participants, and only 16% of female-only studies were conducted exclusively in this cohort.^{1 11} Therefore, it seems apparent that sport, exercise and health science research on women who are perimenopausal and postmenopausal is lacking and there is a need for further studies to focus on this population. Examples of potential topics of interest for future research may include:

1. The influence of perimenopause and postmenopause on participation in sport, exercise and physical activity.
2. The role of exercise and diet changes to manage symptoms and optimise health and well-being outcomes during perimenopause and beyond.
3. The influence of perimenopause and postmenopause (as well as HRT use) on performance ability and training responses.

Furthermore, it is important to recognise that many prior studies have used poor methodological practices (ie, inconsistencies in the terminology used to describe menopausal status, pooling of premenopausal, perimenopausal and postmenopausal participants, and failure to

report other criteria, such as HRT use) which further limits the translational reach and impact of the current data available on women in midlife and beyond. As such, there is a need for future studies to address these methodological limitations and, where applicable/feasible, adopt high-quality practices.¹²

The 'typical 70kg male' is commonly considered the default body for studies in sport and exercise science; however, if we shift the focus to female-only studies, it appears that naturally menstruating women, between the ages of 18 and 40 years, have been considered as an adequate proxy to represent all females across sport and exercise science research. The inclusion of perimenopausal and postmenopausal women as participants in sport and exercise science research is key to understanding the magnitude and direction of changes at midlife and beyond on health and performance outcomes, as well as the role of strategies to reduce any negative changes. We hope that this commentary will act as a call to action for the sport and exercise science research community to bridge the current data and knowledge gap for perimenopausal and postmenopausal women. Ultimately, this will enable practitioners and researchers to better support female athletes and patients across the lifespan.

Twitter Kelly McNulty @kellymcnulty, Sam Moore @SamMooreStrong and Emma Cowley @emmacowley44

Contributors All authors contributed equally.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Not required.

Provenance and peer review Not commissioned; externally peer reviewed.

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To cite McNulty K, Olenick A, Moore S, et al. *Br J Sports Med* Epub ahead of print: [please include Day Month Year]. doi:10.1136/bjsports-2023-107165

Accepted 23 November 2023

Br J Sports Med 2024;0:1–2.
doi:10.1136/bjsports-2023-107165

ORCID iD

Kelly McNulty <http://orcid.org/0000-0001-6176-7983>

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