

Women in Powerlifting – Is it really just ‘You vs You’?

Reviewing the literature detailing how the physiological and psychosocial pressures faced by Female Raw Powerlifters are obstacles to them excelling in the sport.

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2108165

BSc (Hons) Health, Nutrition, & Lifestyle

Word count 6,476

Undergraduate Dissertation Certificate



Name of the Programme of Study: BSc (Hons) Health, Nutrition, and Lifestyle

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I certify that the whole of this work is the result of my individual effort, and that all sources have been acknowledged.

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I am satisfied that this work is the result of the Student's effort.

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Acknowledgments

This dissertation was inspired by my love of Powerlifting, along with the example, guidance, support, and mentorship of the incredibly strong women who compete alongside me.

It is through our relatedness that I have found my own definition of what it means to be feminine.

I am also grateful to the men who have not only made space for me at the bench, but they have also actively supported my growth, and been some of the loudest voices of encouragement next to the platform.

The most shining example of this is the late Phil Richard; without the allyship of men like you, women in Powerlifting would have found it much more difficult to achieve what we have. You were eager to hear the findings from this dissertation, and you'll very be dearly missed by the Powerlifting community.

Thank you to my lecturers and fellow students at University of Wales Trinity St David, specifically to Chris Cashin and Tracy John, without support from you both I would have without doubt gone (even more) insane, and this dissertation would have stayed a puddle of 'word soup'.

Special gratitude goes to my dear friends. Whose support during the periods where I seemingly fell off the face of the earth, whilst I went through what has undoubtedly been the most trying 3 years of my entire life, has not gone unnoticed.

Lastly, it takes a very strong family to love a very strong woman. So, to mine I am eternally grateful.

Without you, there's no doubt I wouldn't have achieved half of what I have; I owe it all to you.

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Abstract

Female participation in the competitive sport of Powerlifting (PL) is rapidly growing, but the body of evidence surrounding their experiences in the sport is still lacking. Despite the little evidence that exists there are some commonalities within, showing physiological and psychosocial factors affecting women in PL to varying degrees, making a case for more in-depth research. Several peer-reviewed and some seminal articles were identified for use in this review exploring the pressures affecting women in the sport.

Physiologically speaking, there are textbooks and various papers dedicated to how to optimally perform each lift, along with guidance on how to nutritionally fuel to rapidly lose or gain weight prior to competitions, in efforts to improve performance outcomes. But much of this research is based on the physiological functions of men. For women there exists the Female Athlete Triad (FAT), a condition that can develop in women who have lost weight in the interest of their sport. Whilst the FAT is typically a risk to women at low body weights, there is also evidence to show sub-clinical disordered eating practices (DE), clinical eating disorders (ED), issues with body esteem (BE), and muscle dysmorphia (MD) in those competing in PL, regardless of body weight.

Psychosocially, much of the same is true; the social perception of competitive Powerlifting is a masculine one; weights rooms and competitive displays of strength have long been thought of as the domains of men. In fitting with this social norm, some evidence shows there is an internalised dichotomy of what is a 'Powerlifters' Body' versus what is a 'Feminine Body'. Whilst for some this is empowering and brings a sense of agency to training in the sport, this defiance of a long-held social norm is leading some women to develop DE and have declining BE as they engage in PL. This mental conflict and declining BE appears to be more prevalent in women on the higher end of the BMI scale, however more research is needed.

This review aims to explore the varying physiological and psychosocial factors affecting women in competitive PL and add to the body of evidence showing need for change. Whilst a lot of the historic literature tells a story of female oppression through lack of research and advocacy in the sport, more recent literature written within the last two years suggests that through persistent, increased engagement times are already changing for the better. To fortify these progressions, this review suggests there are certainly aspects of the sport and its relationship with women that warrant further exploration and intervention.

Introduction

Women and their bodies have always been strong (Coen *et al*, 2018; Nichols *et al*, 2024), but through rise of the patriarchy and the use of socially assigned gender-oppressive norms, women have long been perceived as weaker than men, when they are in fact just different (MacShane, 2014; Pereira Vargas *et al*, 2021; Foyster *et al*, 2022; Richardson *et al*, 2022; Amawi *et al*, 2024). Throughout history there are numerous examples of women embracing and displaying their strength, but this has repeatedly been seen as a non-conformist quirk as opposed to a positive health behaviour (Foyster *et al*, 2022; Richardson *et al*, 2022; Nichols *et al*, 2024), despite extensive evidence that physical activity of any kind is a positive behaviour for all genders to maintain optimal health into their later years (Ayotte *et al*, 2010; Reel *et al*, 2013; Ruegsegger *et al*, 2018; Amawi *et al*, 2024). Further evidence also exists to support engagement with resistance strength training, to bolster efforts preventing conditions such as sarcopenia, osteoporosis, heart disease, type II diabetes, and stroke (Martel *et al*, 2006; Ayotte *et al*, 2010; López-Torres Hidalgo, 2019; Alvarez-Pitti *et al*, 2020). Despite the research already in existence, the evidence surrounding some alternative health and psychosocial implications for female Powerlifters in particular needs further exploration (MacShane, 2014; MacPhail *et al*, 2021; van den Hoek *et al*, 2022; Nichols *et al*, 2024).

PL carries a very masculine reputation and history (Brace-Govan, 2004; MacShane, 2014; Pereira Vargas *et al*, 2021; Nichols *et al*, 2024), with the inception of PL initially developed as a compilation of ‘odd lifts’ (Flinner, 2018) - a tangent developed from Olympic Weightlifting (van den Hoek *et al*, 2022). This involved athletes lifting the heaviest weight they possibly could in the Squat, Bench Press, and Deadlift (Flinner, 2018). Of each lift they have 3 attempts, with each attempt made heavier than the one before it (Flinner, 2019; van den Hoek *et al*, 2022). Initially, much like in Olympic Weightlifting, PL was a sport for men making displays of physical strength (Flinner, 2018) and was first sanctioned by the International Powerlifting Federation (IPF) in 1972 (Campbell *et al*, 2023). The following year, with the development of more supportive apparel, there was a distinction made between ‘Equipped’ (using thick supportive squat suits, bench shirts, deadlift suits, knee wraps, and wrist wraps) and Raw/Classic (permitted to wear knee sleeves and wrist wraps, but of a much thinner and less supportive material) divisions in the sport, to allow for the fact that the more supportive apparel made it easier for competitors to lift a heavier weight (Ferland, 2019). It wasn’t until 1981 however that women were first allowed to have their own championship (Flinner, 2018; Pereira Vargas *et al*, 2021; Campbell *et al*, 2023), so it could be argued that not only have women missed out on nearly ten years of competing, but they’ve also missed out on nearly ten

years of research, investment, engagement, and guidance (Reel *et al*, 2013; MacShane, 2014; Foyster *et al*, 2022; Nichols *et al*, 2024).

At each IPF competition regardless of equipped/classic division, the process on competition day remains the same (Austin *et al*, 2022; Foyster *et al*, 2022). Athletes arrive at the competition venue at a specified time before they are due to compete, they then have their kit checked to ensure compliance with the approved kit list for their division, and they are weighed to ensure they have entered the correct category for their body weight (BW) (Flinner, 2019). These weight categories detailed in table 1 are the current IPF standard.

Table 1 detailing the weight categories for IPF PL competitions (Flinner, 2018).

Women	Men
47kg	59kg
52kg	66kg
57kg	74kg
63kg	83kg
72kg	93kg
84kg	105kg
84+kg	120kg
	120+kg

It is worth noting that the average BW for male powerlifters in the IPF is 89.5kg (van den Hoek *et al*, 2022, and the average BW for female powerlifters is 69.5kg (van den Hoek *et al*, 2022) thus making the upper weight category for men more than 40kg above average lifter, whilst the upper weight category for women starts at only 11kg above the average lifter (van den Hoek *et al*, 2022; Hall *et al*, 2023). These weight categories are a result of a restructure in 2010, with the upper weight categories previously being higher in weight than what they are today (van den Hoek *et al*, 2022). Evidence shows that generally global populations are growing in stature and changing in body composition (Ezzati, 2016; Fryer *et al*, 2018; Ferland *et al*, 2020; Mona, 2021) so the shrinking of weight categories in a high muscle mass sport seems an odd decision, especially considering the IPF have never officially published their reasons for doing so (van den Hoek *et al*, 2022; Campbell *et al*, 2023). Any athlete not

weighing within the category they entered will have 2 hours to attempt to rectify this, or they may lift as a ‘guest’ who will not achieve a qualifying place in the competition (Flinner, 2018; Flinner, 2019; Richardson *et al*, 2022). After weighing-in, athletes then have time to prepare before competition commencement or ‘lift off’. Generally, this preparation involves consuming caffeine and fast-release carbohydrates such as bread, sweets, jams, and cereal bars to ensure proper fuel for the maximal effort lifting ahead (Reel *et al*, 2013; Richardson *et al*, 2022; Amawi *et al*, 2024).

For their first Squat, the athlete stands underneath the barbell loaded with a weight they specified at their weigh-in, and places themselves in contact with the bar such that the weight rests across their upper back (Austin *et al*, 2022). When ready to perform the lift, the athlete must un-rack the barbell, take two steps back, and listen for two cues. The first cue; ‘Squat’ – a command for the athlete to lower themselves into a squat position, such that at the bottom of the squat the crease of their hip sits lower than the top of their knee joint, then return to a standing position (Austin *et al*, 2022). The second cue ‘Rack’ – is a command for the athlete to re-rack the weight that they have just lifted (Flinner, 2019; Austin *et al*, 2022). In the event of an unsuccessful lift, the ‘Rack’ command is also a direction for the ‘spotters’ (volunteer powerlifters in place to the rear and side of the athlete for their safety) to assist the athlete safely back to the starting position in the rack (Austin *et al*, 2022). The athletes then take turns in order of increasing load weight to perform their next two lifts, with everyone’s attempts heavier than the one they performed previously. This process of making attempts is also followed by the Bench Press and Deadlift (Austin *et al*, 2022).

After three squat attempts, the athlete must perform their Bench Press attempts (Flinner, 2018; Austin *et al*, 2022). For their first Bench Press, the athlete must lie down with their back on the bench and their feet on the floor, then grip the barbell with both hands (again loaded with the weight specified at weigh-in) that is in the rack overhead (Austin *et al*, 2022). When the athlete is ready, they un-rack the barbell and hold it above their chest with arms outstretched, then listen for three cues. Firstly, they are told to ‘Start’, which is when the athlete is to lower the barbell to a stationary position at their chest, with the elbow joint sitting lower than the deltoid muscle in the top of the shoulder joint (Austin *et al*, 2022). They are then instructed to ‘Press’, which is when the athlete must push the barbell back to the starting position with their arms fully extended above their chest. Thirdly, they are instructed to ‘Rack’, which is when they are to return the barbell back into the rack overhead (Austin *et al*, 2022).

After three Bench Press attempts the athlete must then perform their three Deadlift attempts (Austin *et al*, 2022). For the Deadlift the athlete must approach the platform, and

whilst remaining in a standing position lower their upper body to grip with both hands the loaded barbell that, for this lift, now rests on the floor (Flinner, 2018; Austin *et al*, 2022). The athlete must then lift the barbell upward in one smooth continuous movement, returning themselves to an upright position, with the barbell resting at around hip height off the floor at ‘full lock-out’ – meaning that the athlete’s knees are fully extended, and the shoulders are back at the completion of the lift (Austin *et al*, 2022). If the referees are satisfied that the lifter has ‘locked out’, and that the bar is at rest in the position, they will then give the only command given in Deadlift – ‘Down’, an instruction for the athlete to return the bar to the floor in a controlled manner (Austin *et al*, 2022).

Throughout the Squat, Bench, and Deadlift, a successful lift is determined by visible markers on an athlete’s body such as hip crease, elbow depth, and knee lockout (Austin *et al*, 2022). There also exists in textbooks advice on how to best achieve these markers using technique adaptations such as grip width, shoe height (within IPF approved kit), placement of feet on the ground, and where to place the bar on one’s back (Austin *et al*, 2022). Whilst these adaptations allow for individuality in achieving success, research on which adaptations are optimal has currently only been conducted on men (Ferland *et al*, 2019; Ferrari *et al*, 2020; Langan-Evans *et al*, 2021; Austin *et al*, 2022; van den Hoek *et al*, 2022), further arguing that research on women in this field is lacking.

In conjunction with meeting these technical rules, success in PL is ultimately determined by an athlete achieving a high IPF Point Score (Reel *et al*, 2013; Flinner, 2019; Pereira Vargas *et al*, 2021; Austin *et al*, 2022). Whilst winning the weight category involves simply lifting the most in that category, winning the competition overall is dependent on the IPF Points (MacPhail *et al*, 2021). The IPF Score is the result of a calculation made based on the athletes BW against their ‘Total’ – the combined weight of the highest successfully lifted Squat, Bench, and Deadlift weights (Mancine *et al*, 2020; MacPhail *et al*, 2021; Austin *et al*, 2022). As defined by Flinner (2019) the IPF score is found using an athlete’s weight and gender to determine a coefficient number, then the athlete’s successfully lifted total is multiplied by that coefficient to find their IPF score (Flinner, 2019; van den Hoek *et al*, 2022). The theory behind the IPF score being that there are adjustments made to create the coefficient number based on BW and gender, that can then determine the ‘Champion of Champions’ at competition, with the highest IPF points determining the winner (van den Hoek *et al*, 2022).

The IPF score was developed in 2019 after 25 years of using the ‘Wilks’ points calculation, and whilst the Wilks formula was determined using a cohort of lifters involving much fewer women than in the federation today, and was therefore deemed in need of an

update, that formula has since been found to be more accurate than the now-used IPF scoring system. It was also speculated by Ferland *et al* (2020) that the move to a different calculation had political reasoning; the change in calculation used coincided with Robert Wilks stepping down from Chairman of the IPF and leaving for the World Powerlifting Federation (WPF), however this speculation has never been confirmed as reasoning by the IPF or Robert Wilks. Considering this, it could be argued that the Wilks' calculation could have just been modified to ensure inclusivity using the now much larger female cohort (Ferland *et al*, 2020), arguably leaving the need for such formulations up for discussion when there is still margin for error (Ferland *et al*, 2020; van den Hoek *et al*, 2022).

Despite the formula system being somewhat flawed, it is due to the use of this calculation that many athletes engage in Rapid Weight Loss (RWL) to get a better coefficient number by which to multiply their competition total and 'optimise their points' (Reel *et al*, 2013; Artioli *et al*, 2016; Ferland *et al*, 2020). This RWL can vary in nature, with some athletes engaging in the short term before competition (acute), some engaging long term (Chronic), and some engaging with RWL cyclically (MacPhail *et al*, 2022), sometimes alternating with Rapid Weight Gain (RWG) (Kirk *et al*, 2020) in efforts to maximise both muscle gain and fat loss (Pettersson *et al*, 2012; MacShane, 2014; Logue, 2020; Richardson *et al*, 2022; Travis *et al*, 2023). Be it with acute or chronic engagement, undertaking RWL can reach a point where the athlete develops physiological complications; in women there exists the Female Athlete Triad (FAT) (Nazem *et al*, 2012; King *et al*, 2023). The aetiology of FAT includes low energy availability (LEA), a disordered or absent menstrual cycle, and/or low bone density, and whilst all 3 of the symptoms don't often appear in one athlete, if any element of the FAT is left unaddressed it can have lasting effects such as the development of sarcopenia, osteoporosis, and infertility (Nazem *et al*, 2012; Mountjoy *et al*, 2018). Since the existence of the FAT further evidence of negative interactions have come to light such as poor mental health, decreased cardiac function, immunosuppression, and a slowed metabolism (Nazem *et al*, 2012), leading to the classification of the Relative Energy Deficiency in Sports (RED-S) syndrome, which also includes men. Whilst the number of these cases in men is on the rise (Campbell *et al*, 2023), it is still not as high as the rates of women with FAT (Lakicevic *et al*, 2021). Despite this, research into the Female Athlete Triad and its long-term indications is lacking (Reel *et al*, 2013; Mountjoy *et al*, 2018; Pereira Vargas *et al*, 2021; Campbell *et al*, 2023).

Regardless of length of engagement with a sport, placing an importance on someone's weight as an indicator of success immediately creates a possibility for the further development of sub-clinical DE, Mental conflicts such as low BE or MD (MacShane, 2014), and clinical ED

such as Bulimia nervosa (BN) and Orthorexia nervosa (ON) (MacShane, 2014; Pereira Vargas *et al*, 2021). There is evidence to show that these conditions are already more prevalent in women than men even outside of a sporting arena, with women on the higher end of the weight scale being even more likely to engage in DE and experience low BE outside of sport (Brennan *et al*, 2010; Reel *et al*, 2013; Olchowska-Kotala, 2018; Tsekoura *et al*, 2021; Campbell *et al*, 2023), potentially placing them at higher risk of these conditions worsening as they engage in a weight-focused sport (Ruiz-Castellano *et al*, 2021; MacPhail *et al*, 2022; Wood *et al*, 2022). RWL and RWG can be undertaken by anyone, and DE or EDs are something that develop in anyone at any time (Brennan *et al*, 2010). However, the mental interactions involved with RWL and RWG in sport can be quite different between the genders, due in part to historical societal attitudes to women and the size of their bodies (Brace-Govan, 2004; Brennan *et al*, 2010; Westcott, 2012; Reel *et al*, 2013; Artioli *et al*, 2016; Coen *et al*, 2018; Flinner, 2019; Walters *et al*, 2022; Wood *et al*, 2022). This is further suggested by the level of research into these interactions differing between men and women (Byrne *et al*, 2002; Cleather, 2006; Chevan, 2008; Striegel-Moore *et al*, 2009; Brennan *et al*, 2010; Ferland *et al*, 2019; King *et al*, 2023).

Arguably, the lack of research into the physiological and psychological experiences of women within PL are an extension of societal issues as a whole (McGannon *et al*, 2019; Pereira Vargas *et al*, 2021), and by not giving women the dedicated attention and exploration they deserve as an entity separate from men, they are being done a disservice (MacShane, 2014). This is to the extent that it is not only impinging on women's' competitive success in PL, but also impinging on their likelihood to engage with resistance training even in a casual manner (Silva *et al*, 2020; Foyster *et al*, 2022), due to the perception of the practice being a hyper-masculine male pursuit (MacShane, 2014; Aleksovska-Velickovska;2019; Wood *et al*; 2022). In conjunction to this there is already a long-standing negative misconception that women will 'bulk' or appear less feminine if they strength train (Rosdahl, 2014; Galli *et al*, 2017; Periera Vargas *et al*, 2021; King *et al*, 2023), with 'femininity' being something that women have been conditioned to think means a smaller, weaker, less-capable but more desirable frame (MacShane, 2014; Aleksovska-Velickovska; 2019; Pereira Vargas *et al*,2021; Wood *et al*; 2022), a view that is also already applied to women on the higher end of the weight scale (Olchowska-Kotala, 2018).

When these societal issues are viewed alongside the physiological processes and behaviours indicated by the sport, it is certainly arguable that the sport of PL is still not a level playing field between the genders, or even between the weight category subgroups. Because of this imbalance in research, this literature review will explore the evidenced interactions

between women and PL. It aims to show a need for further research and interventions, to ensure not only athlete's wellbeing as they engage, but also to get closer to achieving an equity with men in the sport, enabling them to fulfil their uninhibited potential.

Method

Notably, the author of this review has been a competing Powerlifter in the Welsh Female Open 84+kg category since 2021, and the author acknowledges that this immersion in the sport, with first-hand experience and awareness of others' experiences with disordered eating and negative body esteem, has influenced the interest in this topic. Past casual conversations with fellow female competitors during training blocks and competitions, as well as personal experience of attempts to 'make weight' prior to competition have certainly presented popular anecdotal standpoints worth fortifying with evidence. However, this can potentially place a bias on opinions expressed and thought processes followed, especially with the consideration that the author is also a consummate feminist who has first-hand experience of facing gender-based oppression. Therefore, in the interest of scientific transparency all research articles used in this review have been studied thoroughly for relevance, and each paper used has itself been peer reviewed prior to publishing. Considering that this review is not conducting any new research, no ethical approval was needed prior to commencement of the study.

In order to collect relevant articles for this review, searches were conducted between October 2023 and March 2024; a wider time span than initially planned, however due to the rapidly growing popularity and awareness of women in PL the most recent literature was certainly desirable. Using PubMed, Cochrane Library, the University of Wales Trinity St David Library online, and Google Scholar, searches were conducted first using the words 'Powerlifting', 'Competition', and 'Women'. During these initial searches it was deemed pertinent to include only those specifically assigned female at birth (cis-gender/cis-female), excluding those who identify as transsexual or gender fluid. Whilst the irony of writing about gender-based oppression at the same time as excluding gender minorities is not lost on the author, this decision was not taken lightly. The purpose of this review was to examine the experiences of cis-women, and so exclusions were made based on the acknowledgment that the physiological and psychosocial experiences of those who identify as trans-women or gender fluid are experiences that would be oversimplified, and unfairly generalised, if they were to be included under the same umbrella of the cis-gendered woman, despite them identifying as such (Raiya Taha-Thomure *et al*, 2022). Powerlifters in the non-gender-normative community deserve qualitative study tailored to their unique experiences, and that is far too important to be only a small part of this review. In light of this, throughout this review the term(s) 'woman/women' should be taken to mean those Powerlifters who are cis-gendered and assigned female at birth, and not taken to mean 'women' in wider definition.

Further to this, the decision was made to also exclude the psychosocial experiences of women in sports other than PL. Whilst other sports have been included to show a fuller picture of the physiological interactions with RWL and RWG, not all resistance or weight categorised sports are equal in their psychosocial response; as shown by Byrne *et al* (2002), Brace- Govan (2004), Petterson *et al* (2012), Westcott (2012), Artioli *et al* (2016), Mountjoy *et al* (2018), Kirk *et al* (2020), Mancine *et al* (2020), Thomas *et al* (2021), Foyster *et al* (2022), Richardson *et al* (2022) Amawi *et al* (2023), and Nichols *et al* (2024), whilst there is certainly an importance placed on bodyweight in sports such as figure skating and gymnastics, none have quite the same level of masculine psychology as PL does (Mancine *et al*, 2020). Even bodybuilding, although almost identical in movement and physicality, has different motivations, with success determined by aesthetics as opposed to sheer strength and power (Brace- Govan, 2004; Mountjoy *et al*, 2018; Macphail *et al*, 2022).

Additionally, it was also decided that only articles surrounding ‘Raw/Classic’ IPF PL would be used. Other federations do exist, however the IPF is the federation with the most-subscribed countries globally (Ferland, 2019), and therefore deemed to have a fuller picture of the sport worldwide. Research papers using participants in PL were also discounted if they were written before the year 2012, as before this year there were no sanctioned and drug-tested federations for Raw/Classic PL (Flinner, 2019). It could be argued that including papers involving non-drug-tested athletes potentially includes those using performance enhancing drugs (PEDs), and therefore may skew the resulting evidence as their experiences and mental interactions would differ to those not using PEDs (Reel *et al*, 2013; MacShane, 2014)

After these initial search terms, and following themes of similar studies by MacShane (2014), Pereira Vargas *et al* (2021), Kwan *et al* (2022), Richardson *et al* (2022), and Campbell *et al* (2023) the search terms then expanded to include ‘BMI’, ‘Rapid Weight Loss’, ‘Body Esteem’, and ‘Disordered Eating’, using combinations of the aforementioned words and phrases to optimise the retrieval of relevant literature.

On conclusion of the search using these parameters, it became clear that very little research existed specifically on the interactions between women and resistance training, with even less evidence on women in PL (Reel *et al*, 2013; Walters *et al*, 2020). Additionally, the evidence that did exist was often seminal, or had a small/flawed study sample (Mancine *et al*, 2020; Walters *et al*, 2020; Lakicevic *et al*, 2021; van den Hoek *et al*, 2021; Pereira Vargas *et al*, 2021; Wood *et al*, 2022). In light of this, the resulting evidence that was to be used in this review had to be critiqued with nuance; whilst the psychosocial interactions with body building wouldn’t be the same as with PL, the physiological interactions with RWL, load bearing, and

strength adaptations wouldn't be too dissimilar, and so that sport could be used in that context (Brace-Govan, 2004; Reel *et al*, 2013; Mancine *et al*, 2020; Lakicevic *et al*, 2021). Additionally, whilst the physiological interactions with combat sports wouldn't be the same, the psychosocial attitudes might give greater insight into the experiences of women within male-orientated sports (Reel *et al*, 2013; Mancine *et al*, 2020), so might also be of use for this context.

Discussion

The aim of this review was to find links between dietary behaviours in PL, societal and mental interactions with women in the sport, and poor mental and physical health outcomes following engagement. Following the sourcing of supporting evidence surrounding women in the sport, it was the authors hope that this review would provide validation to athletes experiencing such negative outcomes, as well as provide evidence of a need for change within governing bodies, coaching practices, media, and societal expectations of femininity.

The literature resulting from the aforementioned searches provide great insight into the dietary behaviours of not just Powerlifters, but also the broader sports community, with Rapid Weight Loss shown to be a prevalent behaviour pattern across a variety of weight categorised sports; from combat sports to Olympic Weightlifting, to body building, to Powerlifting (Brace-Govan, 2004; Artioli *et al*, 2016; Kwan *et al*, 2022; Wood *et al*, 2022; Nichols *et al*, 2024). Due to the known short and long-term (and the little-researched irreparable) negative health implications of the FAT, and the fact that RWL meets two points on the World Anti-Doping Agency's criteria to ban a substance or behaviour pattern, by endangering athlete health and violating the spirit of sport (Artioli *et al*, 2016; Lakicevic *et al*, 2021), this review of literature found that there is very little evidence to support engagement in the practice at all.

In addition, despite its cross-sport prevalence and the wide range of methods to achieve RWL such as fluid loading, fluid restriction, fasting, increased cardiovascular activity, diuretics, laxative use, sauna use, and the wearing of rubber suits, multiple studies involving a range of sports show that the practice of RWL brings no benefit to competition-day performance outcomes and can actually make injuries such as bone fracture and muscle tears more likely (Flinner, 2018; Kirk *et al*, 2020; Logue *et al*, 2020; Mancine *et al*, 2020; Wood *et al*, 2022). This brings further question to the validity of the practice, especially when one considers the negative mental processes brought on by lack of proper nutrition and dehydration such as feelings of isolation, anger, anxiety and fatigue (van den Hoek *et al*, 2022; Kwan *et al*, 2022; Wood *et al*, 2022; Amawi *et al*, 2024). Furthermore, Kirk *et al* (2020) have written currently the only paper to find any benefit to RWL; detailing the mental placebo effect on the athlete themselves believing they had heightened influence on their performance. Considering this, it could be argued that although in terms of muscle strength output the athlete may perform the same with or without RWL, mentally it may bring some small benefit, when the athlete feels they have increased control over competition performance outcomes. This idea is supportive of the conclusion drawn by MacPhail (2022) showing that Powerlifters – out of all

strength-based sports – showed the highest prevalence of MD, ON, and obsessive-compulsive tendencies with regards to their dietary intake and nutritional behaviours.

Despite this evidence, very little of this research is conducted on women. The research conducted by MacPhail (2022), similar to the research by Kirk (2020), is conducted entirely on men in the sport, whilst the evidence from Pereira Vargas *et al* (2021) was provided by just 17 women, evidence from Campbell *et al* (2023) was derived from just 33 women, and evidence from Wood *et al* (2022) was derived from just 18 women. Whilst the research conducted by van den Hoek *et al* (2022) was conducted on 10,000 participants, less than a third of these were women. This supports the conclusion drawn by Langan-Evans (2021) stipulating that women are severely underrepresented in sports research, despite participation being rapidly increasing. Furthermore, the mean body weight of the women participating in any study used in this review was under 70kg. This completely excludes the heavier categories of women in the sport; a population of women arguably one of the most likely to suffer poor BE and struggle with DE (Byrne *et al*, 2002; Logue *et al*, 2020; Tsekoura *et al*, 2021; Pereira Vargas *et al*, 2021; Nichols *et al*, 2024).

Notably, research from Reel *et al* (2013) showed that as the longevity of engagement with the sport increases with progression from novice to professional, weight lost prior to competition decreases; speculatively showing that over time athletes develop a performance mindset that is not dependant on their body weight. However, this study was also conducted on women not in the classes above 73kg, again excluding the heavier weight classes who arguably may have had more fat mass to lose in the first instance (Pereira Vargas *et al*, 2021). Despite this interesting conclusion, a later study by Thomas *et al* (2021) showed the opposite, finding that professionals engaged with RWL practices more militantly and severely than their novice counterparts. Once again this argues that more study is needed on women in this field.

Due to the emphasis of how important low overall body weight is in weight-categorised sports, RWL has become almost an entry requirement, and a demonstration of utmost commitment made by athletes to their craft. As explained by Pereira Vargas *et al* (2021), and supported by Wood *et al* in 2022, if an athlete does not engage with RWL it is seen as not taking the sport as seriously as they should. This pressure is not only applied by coaches, but also family members, teammates, and wider society to be as lean as possible to demonstrate their dedication (Brace-Govan, 2004; Pettersson *et al*, 2012; Reel *et al*, 2013; Pereira Vargas *et al*, 2021; Wood *et al*, 2022). Furthermore, evidence shows that many athletes either believe themselves to be a failure or have been outright told they are a failure by coaches if they do not engage with RWL (Reel *et al*, 2013; Richardson, Wood *et al*, 2022). Ironically, whilst this

intense dedication is expected and often seen as an indication of excelling in the sport, it can also ignite feelings of isolation, inadequacy, and exacerbate low BE (Pereira Vargas *et al*, 2021; Campbell *et al*, 2023).

The internal mental conflicts of powerlifters are echoing the common mental experiences of women, which have been created and perpetuated by wider society for years (Walters *et al*, 2020; Pereira Vargas *et al*, 2021; Nichols *et al*, 2024), arguably making the pressure felt by women in the sport stronger than the pressures felt by men. The act of hypertrophy and building muscle does gain mass, be that water retention in muscles, an increase in muscle tissue, or an increase in bone density (Austin *et al*, 2022), and so some size growth and weight gain is to be expected (Austin *et al*, 2022; MacPhail *et al*, 2022). Despite this, the fact that the current weight categories in PL stop at 84kg for women arguably perpetuates the societal notion that women should not be over 84kg at all, regardless of body composition or dimensions (Olchowska-Kotala, 2018; Richardson *et al*, 2022; Nichols *et al*, 2024), or evidence that populations are growing in overall stature (Ezzati, 2016; Fryer *et al*, 2018; Ferrari *et al*, 2020). Because of this, it is certainly arguable that weighing athletes is not the best way to determine competition classes, with other methods such as muscle mass percentage measuring being a more accurate show of athlete competition. In addition, this could certainly argue that the mental experiences of women competing in the higher weight category are even more convoluted than their lighter counterparts, whilst they navigate the fine line between the dichotomy on what is deemed a 'Powerlifters body' and what is widely defined as a 'feminine body' (Brace- Govan, 2004; MacShane, 2014; Olchowska-Kotala, 2018; Ferrari *et al*, 2020; Pereira Vargas *et al*, 2021; Richardson *et al*, 2022), bringing the fact that very little research has been conducted on this cohort further into necessity.

Despite this these mental complexities associated with the practice of RWL and its entwinement with PL, the stigma of speaking out means that these afflictions had been almost completely ignored in research until very recently (Pereira Vargas *et al*, 2021; Foyster *et al*, 2022; Richardson *et al*, 2023; Nichols *et al*, 2024), with a pioneering interview question-set not being available to investigate such interactions in the PL community until Campbell *et al* created one in 2023. Their interview template built upon the Weight Pressures in Sport for Females (WPS-F) questionnaire created by Reel *et al* in 2010, which although seminal at the time, was still too vague to properly capture the experiences of women within such a hyper-masculine sport as PL, once again supporting conclusions that women and their experiences are under-researched and under-represented.

As explained by Coen (2018), Walters *et al* (2020) Pereira Vargas *et al* (2021), Richardson *et al* (2022), Foyster *et al* (2022), and Nichols *et al* (2024), the gym and displays of physical strength have long been the dominion of men, which has for years been to the detriment of women and their wellbeing, with women's' participation in sport rapidly decreasing after school years (Reel *et al*, 2013; MacShane, 2014; Flinner, 2018; Olchowska-Kotala, 2018; Foyster *et al*, 2022; Richardson *et al*, 2022). The awareness of the physical and mental benefits of resistance training to women have never been highly publicised, as a by-product of stronger women is the challenge posed to the status quo of men being the stronger of the genders (Brace-Govan, 2004; MacShain, 2014; Walters *et al*, 2020; Foyster *et al*, 2022).

In contrast to this, there is evidence that some women report to be spurred on by taking agency of their own capabilities and unapologetically taking up space in a male domain (Walters *et al*, 2020; Richardson *et al*, 2022). Whilst this shows a welcome progression, this mindset is still very much in the minority and mostly existing at a professional level (Richardson *et al*, 2022; Wood *et al*, 2022), with most novices reporting a feeling of intimidation in 'masculine' gym areas unless accompanied by peers (Foyster *et al*, 2022).

This still-felt intimidation could be taken as a negative, however this author instead argues that getting a foot in through the door of the gym at all is still progression towards fitter, healthier, more confident women. This would not only improve health outcomes in both short and long term, but it would also lessen the dependency on health service and social service provision as we reach our later years with the reduction in obesity and inactivity co-morbidities (Richardson *et al*, 2022). Additionally, if you can get a friend to come with you to the gym, that's surely even better (Ayotte *et al*, 2010; Walters *et al*, 2020; Pereira Vargas *et al*, 2021; Foyster *et al*, 2022). Afterall, the idiom does say: "there is strength in numbers".

Conclusions

Whilst this review has demonstrated a long-standing oppression of women in PL, together with an under-representation of their physiological and psychosocial interactions with sport overall, this review has also found that the future appears to be bright. There is growing evidence surrounding women in all sports, and there is hope that with the rise in participation will come an acceptance of a new definition in what it means to be ‘feminine’.

Even though we cannot change the behaviours and thought processes of generations before us, we can certainly strive to improve the attitudes of the generations that succeed us. To do this we need not only advocacy within our peer groups, but also allyship across genders to help create the space needed for women to flourish in their chosen sports. With more specific research into women in PL the awareness of common experiences will improve, leading to an improvement in not only performance strategy but also improvement in damage limitation and overall wellbeing.

Due to the fact that there is currently no nutritional component to a personal training qualification (Pereira Vargas *et al*, 2021; Amawi *et al*, 2024), and even a more specific strength and conditioning qualification is still bereft of nutritional guidance, it is certainly worth facilitating an improvement in the knowledge held by coaches. Evidence from Pereira Vargas *et al* (2021) and Richardson *et al* (2022) shows that many athletes consider the advice of their coaches to be gospel truth, feeling pressure from them to adopt disordered eating behaviours in the interest of losing fat mass, if that is what the coach has told them to do. Following this review, the author believes that these questionable practices are carried out due to a lack of knowledge on how to lose fat mass safely, as opposed to any malicious intent to harm their athletes. It is hoped that with the implementation of better nutritional education for coaches and their athletes, together with developing an improved recognition of DE behaviours and symptoms (and not ignoring them in the name of ‘dedication’), the creation of more stringent measures from governing bodies such as the IPF to discourage extreme RWL, and an improvement in attitudes to what it means to be feminine, there will be no limit to what women can achieve.

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