TITLE
Elite female football players' perception of the impact of their menstrual cycle stages on their football performance. A semi-structured interview-based study.

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ABSTRACT

This study assesses how female footballers perceive their menstrual cycle impacts their physical and psychological performance, informing future research and intervention. Semi-structured interviews, developed using piloting and peer review, took place with fifteen elite female footballers from two English WSL clubs (age:25.2 [18-33]). Data was audio recorded, transcribed verbatim and analysed thematically using NVivo. All players (100%) perceive their menstrual cycle to negatively impact performance. Analysing 27,438 words of data revealed five themes: A) symptoms, B) preparation, C) performance, D) recovery and E) management. Over half (53%) of players experienced decreased appetite and sleep quality prior to performance during menstruation. Competitive performance was perceived most negatively impacted during menses (54 references) following by the pre-menstrual stage (23 references). During menstruation the most impacted physical performance indicators were power (93%) and fatigue (87%). Psychologically, confidence, focus and reaction to criticism were commonly affected (66.7%). Players reported missing training (13.3%) and matches (13.3%) due to severity of impact. Recovery was affected during the pre-menstrual (26.7%) and menstrual (66.7) stages. Players self-manage symptoms using over the counter (66.7%) and prescription (26.7%) medication, some prophylactically prior to competition (46.7%). This first attempt to ascertain player perception in football exposes clear negative impact on performance. Complex interplay of biopsychosocial and logistical factors, lack of awareness and education highlight the need for further research. Intervention is necessary and immediate initiation would be prudent, starting with simple measures such as basic self-management advice, education, and provision of sanitary products.

Keywords: professional; women; soccer; period; qualitative

INTRODUCTION

Football has fast become the world's most popular female sport[1]. Despite this, research populations either exclude female participants, or only include those at specific stages of their menstrual cycle to avoid hormonal variation confounding results[1,2]. Conclusions therefore fail to address sex-specific or cyclical variations in exercise physiology[3]. Whilst research is increasing[4], including studies into the risks of menstrual dysfunction and relative energy deficiency[5], the effect of hormonal fluctuations on ability to perform in football remains underreported.

The complex interplay between ovarian, hypophyseal and hypothalamic hormones triggers diverse physiological and psychological changes, manifesting as symptoms such as abdominal cramps, bloating and irritability[6]. Research into subsequent physiological impacts found a variety of cardiovascular, haemodynamic, metabolic and musculoskeletal effects[6], from increased heart rate and haemodynamic response to stress[7], to decreased diastolic blood pressure[7]. There are further cyclical changes in body weight, temperature and metabolism[8,9], whilst cyclical variation in oestrogen levels have been linked to strengthened skeletal muscle contractility[10]. These cyclical disparities in human capabilities potentiate major effects on sporting performance[6].

Psychological impacts of menstruation vary, consisting of over 100 psychosomatic potential changes, such as anxiety and low mood[6]. Fluctuating levels of steroid hormones can alter performance in tasks of spatial ability and cognition[11], whilst progesterone can have sedative effects[12]. Varying in severity, these can prevent athletes from performing at their maximal capacity[6].

Objective evidence shows that menstrual stage could affect athletic performance; Julian et al. found variation in endurance test results in the mid-luteal and early follicular phases[13]. However, limited assessment methods, large variation between participants, and lack of

concordant results emphasises need for further research. Questionnaire-based studies found that 31.7%[14], 77.4%[15] and 55.4%[14] of exercising females and elite athletes perceive menses to negatively impact performance, with one study suggesting that 4.1% of athletes avoid training/competition as a result[15]. Symptoms associated with diminishing performance are varied; one study found 24 different impactful symptoms, some so extreme contraceptives are used to induce amenorrhea[15]. Yet, only 24.1% sought medical help[14], highlighting need for increased awareness and support.

Until recently, research had not included effects of menstruation in team sports. In 2020, Findlay et al. used semi-structured interviews to assess perception of elite female rugby players, where 67% of participants experienced negative impact on performance[16]. In 2021, Martin et al. found that muscle and tendon injuries are almost twice as likely to occur in international footballers in the late follicular phase compared to other cyclical stages[17]. Higher player availability has been shown to potentiate better results in elite male football,[18] thus menstruation related decrease in availability – be it through pain, decreased performance or increased injury rate – will inevitably affect results. Findlay et al. recommended introducing menstrual cycle profiling, player monitoring, individualised support and improved educational awareness[16], which could differentiate between winning and losing. The US Women's National Team (USWNT) publicly associated their World Cup win with menstrual cycle tracking and individualised support, and manager Dawn Scott voiced desire to 'end the taboo', enabling players to discuss their cycle with coaches and medical personnel[19]. It is possible to track a player's menstrual cycle, providing opportunity to predict and prevent negative impacts[6]. The 2019 Women's World Cup initiated increased attention on the female game, providing an opportunity to capitalise through research, minimising impacts and making all-important marginal gains.

Utilising semi-structured interviews, the objective of this study was to assess elite players perception of the impact of the menstrual cycle stages on their performance.

MATERIALS AND METHODS

Ethical consent was approved by [blinded for review].

Interview development

The interview was formed based on literature; peer reviewed by expert collaborators to ensure face validity (Appendix 1). The agreed template was piloted using three amateur players to assess timing, effectiveness of questioning style and quality of content discussed. Reviewed once more by authors, a further five amateur players were interviewed as part of a student research project. The interview was semi-structured and additional questioning was permitted where appropriate.

Participants

Participants were recruited via club medical staff, allowing inclusion of elite senior female footballers currently playing in one of two Football Association (FA) Women's Super League (WSL) clubs. Club one used medical records to identify players not using HC, who were recruited via WhatsApp (Mountain View, California, US). Of fourteen players contacted, the response rate was 71.4% (declined n=3, time restraints n=1). Club two recruited players via email, following up with face-to-face conversation (response rate 80%, no response n=1).

Neither club had previously introduced menstrual cycle education, tailored training, or recovery schedules for the players. All players had regular menstrual cycles and >5 years of competitive experience. Players were excluded if they had been oligomenorrheic, amenorrhoeic in the past three months, were currently pregnant or using HC. Participants

included one goalkeeper, five defenders, three midfields and six forwards with an average age of 25.2 (18-33). Four players were recruited from club 1, whilst 11 were recruited from club 2. Seven competed at senior national level at the time of interview, whilst five competed at youth level, totalling eight different nationalities. The average cycle length reported by players was 28.95 days (26-42). (Table 1).

*****Table 1 inserted near here*****

Interview process

To prevent group-thinking bias, interviews were individualised, and participants were asked not to discuss content. Sample size was estimated using saturation point methodology, with the aim to interview ≥15 players, to illicit range of opinion throughout a squad.[20]

Interviews were carried out virtually via Zoom (San Jose, California, US), by one female researcher to reduce rate of inter-interview discrepancy. The stages of the menstrual cycle were numbered to allow for ease of discussion: stage 1 (premenstrual, approximately days 24-28 in a 28-day cycle), stage 2 (menstrual, days 1-4), stage 3 (midcycle, days 13-15) and stage 4 (rest of cycle), according to knowledge of expert collaborators. Stages were explained verbally, and visual aids (Figure 1) were shared via Zoom throughout the interview, allowing participants to reflect on each stage in their answers. Players confirmed they understood the figure prior and recorded verbal consent was obtained.

*****Figure 1 inserted near here*****

Analysis of Data

Individual interviews were audio recorded via Zoom and transcribed verbatim for thematic analysis using the Braun and Clark framework, supported by NVivo software (V12.6.1; NVivo 12, QSR international Pty, Australia). Data was coded into nodes of similar meaning and formatted into themes and sub-themes using NVivo mind mapping. Themes were agreed between [blinded for review]. No disagreement was seen between researchers.

RESULTS

A total of 27,438 words were transcribed for thematic analysis. Analysis uncovered five themes: A) symptoms, B) preparation, C) performance, D) recovery and E) management. A total of 627 references were organised into 17 sub-themes containing 49 codes (Appendix 2).

Theme A: Symptoms

Negative symptoms in the pre-menstrual stage were reported by 93% of participants (Table 2), most commonly appetite change (46.7%), fatigue (40%) and stomach pain (33.3%). All participants experienced symptoms in the menstrual stage (stomach pain 80%, fatigue 40%). The severity ranged from mild symptoms to severe:

> *"There are some days where it's so much worse than others than no matter the painkillers you take your crippled over with cramps"*

*****Table 2 inserted near here*****

Theme B: Preparation

Impact on preparation was categorised into four sub-themes: sleep, appetite, readiness, and travel (Table 3). Eight players described decrease in appetite during menses, linking this to decrease in performance. Two players discussed having to force-feeding themselves before a match during the menstrual stage: *"my mum forced me to eat…I didn't want to eat".* Four players reported increased appetite in the premenstrual stage, craving '*bad*' foods.

Eight players reported difficulty sleeping during menses, attributed to stomach pain (n=6), leg pain (n=1), decreased sleep quality (n=1). Pre-menstrually, six players sleep less well, citing stomach pain (n=4), feeling hot (n=1) and agitation (n=1). Two players need more sleep during menses due to fatigue. Hot flushes reduced sleep quality in the mid-cycle stage for one player.

Travelling long distances to matches in the menstrual stage negatively affected nine players, attributed to low quality facilities (n=3), fatigue (n=4), pain (n=2), stiffness (n=2) and psychological impact (n=2).

*****Table 3 inserted near here*****

Theme C: Performance

Impact on performance was reported by all 15 players, organised into physical, psychological, and social impacts (Table 4). Physically, fatigue (pre-menstrual n=8, menstrual n=13) and power (pre-menstrual n=6, menstrual n=14) in the menstrual stage (number of references=54) were most affected, followed by the pre-menstrual (n=23) stage (Table 4). Psychologically, players were most affected in terms of reaction to criticism (premenstrual n=4, menstrual n=10), followed by their confidence (premenstrual n=2, menstrual n=10; Table 3) and focus (premenstrual n=1, menstrual n=10). Two players compared the menstrual stage to *"going to bed late"* or *"[getting] two hours sleep"* (Table 4).

*****Table 4 inserted near here*****

One third of players perceive menses to affect them mostly in matches, attributed to lack of breaks (n=1), lack of control over exertion (n=1), distraction (n=1) and intensity (n=1; Table 4): "*training not everybody's watching and it's not as bigger deal as matchday where you need to perform and show why you're at the club".* Five further players (33%) perceive menstrual cycle impact to be worst during training, with two players reporting that matches distracted them. Three players discussed how the importance of a match and their performance meant they were able to overcome negative impacts, "*putting it to the back of my mind*".

Two players discussed having missed training due to stomach pain during menses. Two players reported missing matches, one describing severe migraines in the past during her menstrual stage, rendering her unable to train or play during these episodes: *"I wouldn't be able to go. I couldn't get out of bed due to the pain"*. Four players discussed other players experiencing severe symptoms: *"I know my [anonymised] suffers with it and has missed games and training sessions."*

Theme D: Recovery

Recovery was negatively impacted in the pre-menstrual (n=4) and menstrual (n=10) stages (Table 3), most commonly recovery time and fatigue during menses (both n=8). Only five players alter their recovery strategy throughout their cycle: increasing stretching/foam rolling (n=3), earlier bedtime (n=1), completing a lighter post-match session (n=1). One player described post-match headaches in the menstrual stage. Post-match appetite was affected during the premenstrual (increased cravings n=2) and menstrual stages (decreased appetite =5).

Theme E: Management

Players described various strategies of symptom management (Table 5). Seven players reported taking painkillers as prophylactic pain relief prior to competition during menstruation.

*****Table 5 inserted near here*****

DISCUSSION

This study marks the first attempt to determine how elite female footballers perceive their menstrual cycle to affect their performance. Using thematic analysis, five themes were uncovered: symptoms, preparation, performance, recovery, and management. A staggering 100% of participants experienced a spectrum of biopsychosocial negative impacts on their performance at the elite level, at times so severe players have been forced to miss matches or training. Rarely, players experience minimal impact in the mid-cycle stage.

Symptoms

Negative symptoms were experienced pre-menstrually (93%) and menstrually (100%) by participants, representing a large proportion of their cycle. Symptoms can be severe, described as "crippling[sic]" and making players feel like they're "carrying bricks". Abdominal pain was the most common complaint (80%), and whilst 'illness' in elite football is not associated with major time loss,[21] playing with pain is associated with decreased availability to train and compete[22]. Interestingly, only one player reported leg pain, contrasting the general population (64%).[23] It is possible that the nature of football means players frequently experience leg pain, disassociating leg pain from their menstrual cycle. In elite rugby, players were found to experience less back pain than the general and athletic populations,[16] and our data follows this trend (6%). Whether these findings are random effects or a population specific

finding due to impacts of high levels of exercise [24,25] or supporting the hypothesis that elite players are more accustomed to pain[16,26] remains for further research to investigate. Players also experience cyclical appetite changes (46%), altering their nutritional regime, a key component of optimal performance.[27]

Preparation

Exploring travel, sleep, appetite and feeling of readiness, the menstrual cycle is perceived to negatively impact competition preparation, an important factor in performance optimisation. Nine players expressed negative experiences travelling large distances to matches during menses. Careful consideration in schedule (overnight stays to avoid matchday travel, increased toilet stops) dietary advice to avoid *"bloating"*, provision of painkillers, sanitation, hot water bottles, could decrease such negative experiences, enabling players to be physically and psychologically ready to compete. Financially there may be a barrier, whilst male teams can afford the luxury of overnight stays, female teams have less funding. Research aiming to track menstrual stage against preparation factors and subsequent performance may lead to increased investment from clubs into menstrual cycle management[28]. The FA may be prudent to invest here, targeting improved player wellbeing. Players associate lack of readiness to compete with decreased warm-up quality. A key component of maximal performance, warm-ups are negatively impacted by menstrual symptoms[29]. Intervention could include longer focused warm-ups for players at key cyclical stages.

Ongoing research suggests that negative physical impacts may be prevented using cyclical training schedules: speed and reaction sessions, or reduced training load to reduce fatigue during menses[22]; Chelsea, in 2020 becoming the first club to tailor training according to menstruation, have since won the past two league titles[30]. Research supports tailoring training: suggesting the optimal time for high intensity work is during the mid-cycle stage, and

that decreasing load in the late luteal and early follicular phases can decrease inflammation to aid recovery[31]. Female hormones have also shown to affect resistance training responses[32]. Theoretically a no brainer, difficulty implementing this in practice may be due to limited research, resources, and finance. Players cycles vary in symptomology, time scale and impact, thus an individualised approach by specialists may be the gold standard. Coaches have shown willingness to learn, specifically in terms of training management and physical performance during menses[33].

Performance

The menstrual cycle is perceived to have a negative impact on footballing performance, where players are on average affected 28% of the time, stressing the necessity for intervention. Physical impact was greatest during menstruation, power (93%), fatigue (87%), reaction times (73%) and speed (53%), providing a target period for research. Physical demands have increased as football has become faster and more intense[34], and such negative impacts weigh heavily on player performance. Perhaps cycle monitoring could be used to predict peak player fitness. The goalkeeper reported reduced reaction times, crucial in goalkeeping, thus player specific intervention may be necessary. Objective evidence supports player perception: high intensity running is significantly greater in the luteal (late stage 4) vs follicular phase (stage 2)[35]. Recent research has, however, found no correlation between performance and menstruation in eumenorrheic women, suggesting that other factors may have more influence [35,36] Results so far are contradictory, and certainly more objective evidence is required. If there is no true correlation between menstrual cycle and performance, this should be used to educate players, decreasing negative connotations of menstruation, and increasing player confidence to play during menses.

In a sport that lacks psychological support[37], two thirds of players have worsened confidence, focus and reaction to criticism during the menstrual stage. This could be avoided using existing techniques: lack of awareness and self-management strategies rectified by basic education; irritability, altered mood and antisocial behaviour addressed with open dialogue, understanding and normalisation of menstrual-related issues between teammates and coaches. Player confidence is important to address and may involve a multidisciplinary approach including coaches and psychological input. Awareness of player cycle stage and the impact on their reaction to criticism should help staff and team-mates be more sensitive in communication during affected stages.

Recovery

Eight players reported increased recovery time and fatigue in the menstrual stage, yet only five players reported to alter their recovery strategy accordingly. Decreased post-match training load, structured recovery programmes and nutritional planning to aid recovery during menses may be effective, and group sessions incorporated into the recovery schedule at key cyclical stages could help to motivate and normalise menstrual related fatigue[28]. Five players report decreased post-match appetite, perhaps smaller meals with high nutritional value could be incorporated into dietary planning. Research into athlete nutrition and recovery is male dominated[27], despite women having cyclical variation in dietary requirements[38]; more research is required to understand cyclical nutritional needs and enable education for staff and players. Two players compared menstrual stage fatigue to a *"lack of sleep"*. Hailed the most efficient component of recovery[39], sleep hygiene advice would be useful in the menstrual stage.

Management

Despite impact on performance and related symptoms, only two players reported missing both training and matches respectively. This contrasts the general population, where females limit daily activity during menses[40]. One player missed matches due to cyclical migraines. She was told to 'deal with it' and offered no medical treatment, reflecting society's normalisation of menstrual suffering. Similar to the 'suck it up'[41] and pain principles[42] highlighted in elite male sport, you are expected to be tough when faced with pain. Athletes need strong willpower and resilience to succeed, and additional hardships of females excelling in a male dominated sport produces players conditioned to expect adversity[40]. Contact sports commonly produce pain from impact and exertion; perhaps players expect pain, hence dysmenorrhoea is tolerable. In 2008 Santer et al. reported that females do not see menses as an acceptable reason to adopt illness behaviour[40], and this attitude coupled with pressure to perform could contribute to elite athletes adopting an 'accept and adapt' mentality[16]. Medical advances mean that targeted treatment for hormonal headaches have become available[43], perhaps a multidisciplinary approach is required when treating footballers with complex menstrual symptoms. Education for players and staff is important to shift mentality, improving treatment, understanding, player wellbeing and ultimately, performance, mirroring findings by Findlay et al.[16]

Pain was the most reported menstrual symptom, with 13 players self-medicating as a result. Two players avoided medication, associated with dislike for *"taking pills"*, which could be attributed to lack of education or social attitudes, where women conceal symptoms[44]; menstruation is viewed as a non-justifiable medical issue[40]. Three players reported prophylactic painkiller use pre-match. A concept worth exploring, caution is advised; NSAIDs have a significant side-effect profile[45] and interfere with muscular hypertrophy[46], both NSAIDs and paracetamol have been suggested to cause reduction in anabolic response to acute exercise bouts[46], whilst opiate containing medication affects cognition[47]. Revision of

timing, education and use of painkillers would be prudent in reducing pain, targeting improved performance, whilst identification of other symptom prevention techniques could motivate future research and benefit players regardless of menstrual impact on competition.

Limitations

Population was limited to two clubs from the same large city; thus, results may not be reproducible on a national level. The inclusion of players from the two clubs was needed due to limited sample size within a single club due to: contraception use, players with restricted English language ability. However, to minimise impact, clubs were selected where no club education on the menstrual cycle was performed, thus it was deemed the baseline of knowledge was comparable across participants. Players volunteered to participate, allowing self-selection bias. Half of elite athletes use HC, often prescribed to reduce severe symptoms[15]. By excluding this population, we may have excluded the most affected players; future research into this group would be prudent. Self-report methods have limitations[48], and recall bias may have been affected by fluctuating perception throughout the menstrual cycle. Data was formed on player perception, and there still lacks quantitative research to confirm the perceived impacts discovered in this study.

Conclusion and future direction

This study marks the first exploration into the perceptions of elite female footballers on menstrual cycle impact on performance, eliciting a complex interplay of biopsychosocial effects. The impacts and anxiety associated with menstruating should be addressed and intervention is advisable immediately: education, cycle monitoring and altered training schedules. Further research is required to assess objectively, provide target for intervention, and decrease performance anxiety during menstruation. Normalisation of menstrual issues,

through raising awareness and opening conversation, is essential to end menstrual cycle stigma, targeting sex equality in elite football. Two players reported menstrual stages of <2 days. An abnormally short length, which, interestingly, was seen amongst the two youngest participants. This additional observation highlights the importance of monitoring and supporting athletes to prevent unhealthy side-effects of elite sports, e.g., relative energy deficiency in sports.[5] Finally, future research highlighting variations in the outcomes assessed by variations in personality types may be interesting to explore further.

Competing interest's statement:

None declared

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Data sharing:

Appendix 2 includes the full thematic analysis for transparency.

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Figure 1. Menstrual cycle chart applied during interviews